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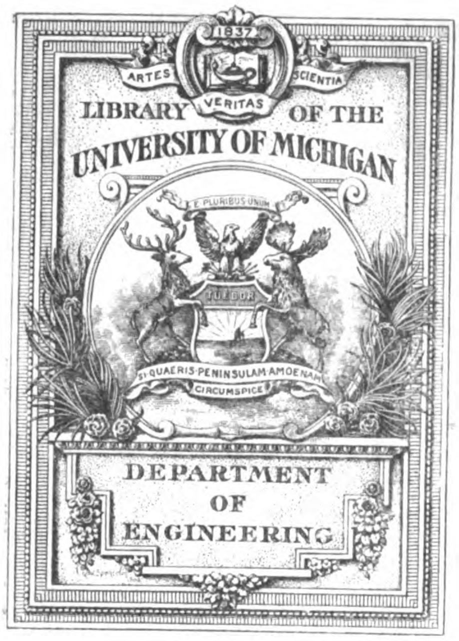
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N. E. L. A.—The next annual meeting of the National Electric Light Association will be held at Cleveland, O., February 19-21, 1895. Every concern interested in either lighting or railway work should be represented in the membership of this body, and should have at least one representative at the Cleveland meeting. The Secretary is Mr. Geo. F. Porter, 136 Liberty street, New York.

EDITORIAL NOTES.

Toronto Bribery Matters. The city of Toronto has set an example worthy of being followed by many other municipalities in making a thorough and judicial investigation of the charges of bribery and corruption brought against her Board of Aldermen. The investigation has covered several weeks, and the results have been tersely given in Judge MacDougall's reports to the Mayor.

The part of this report which we reproduce this week reads, in view of present prices and conditions in the electrical trade, like ancient history; yet it is only a little more than two years old. In that two years what changes have taken place!

The price of railway apparatus now is down to very near the figure which the G. E. Company was ready to pay then as a bribe to two Aldermen for each equipment sold. This drop in price is not a cause for rejoicing, but there is ample cause for it in the fact—and it is a fact—that the days of giving bribes to secure contracts are about over. There may occasionally be an isolated case, but the disease is practically eradicated.

The Thomson-Houston Company, the great exemplar of bribery and corruption, and its successor, the G. E. Company, conducted on similar lines, have come to grief. And the one fundamental cause for their failure was their dishonesty. Agents were instructed to give bribes; their expense accounts were passed by the president of the company, C. A. Coffin. It did not take these agents long to learn that bribery could be worked both ways, and they were soon accepting bribes to use their efforts to make unbusinesslike trades for their company. Once aware that their employer was fully cognizant of the roguery practised, they did not fear exposure in their own company. They knew they were safe—and they were. A special agent of the company has stated as a solemn fact, within a week, that in his long experience he never had reported that an agent was stealing from the company without seeing that agent not only retained but his salary raised within a month after the report.

The cause of the G. E. Company's failure is laid upon the district office plan. The plan itself was all right. But when every man in those offices knew that there was rottenness and corruption just above him, why should he hesitate to line his own pocket? What incentive was there to work for the best interests of his company?

If the policy of the company had been honest its failure would have been less marked and would have created more sympathy.

It is pleasant to know that this plan of business has been succeeded by something better, even if less money is made by the selling companies. True, the reminders of it have not yet passed out of sight. B. E. Sunny is still in charge of the Chicago office of the G. E. Company—an office where fights over the spoils among employees became matters of public knowledge. C. A. Coffin, the head of the entire system, without whose knowledge it could not have been carried on for one month, is still the president of the company.

ELECTRICITY does not desire to take to itself all the credit for the improved and more honorable conditions of trade; but we are proud that our share in the reform has been conspicuous and creditable. It was the knowledge that ELECTRICITY was ready to print the facts, more than anything else, that has led to the discontinuance of the policy of bribery as a means of selling goods.

* * *

THE Cataract General Electric Company are making another effort to secure the repeal of the law authorizing the Superintendent of Public Works to make further grants for transmission lines along canal lands. The grab which this company worked through rests already under something worse than suspicion, and we doubt if the present Legislature will care to be mixed up in the matter.

General Electric. There have been, so far as we know, no answers published to the questions propounded in these columns last week to the Board of Directors and officers of the G. E. Company, yet they all must be answered, and before many weeks.

Amid all the rubbish given out to the financial agencies and to the press, there occasionally appears something which sheds a little light on the intentions of the directors in regard to reorganization. ELECTRICITY does not need this information. Two or three weeks ago we stated their intentions as to the kind of report which will be issued in April. Last week Kiernan's Agency gave out the following:

> The committee of General Electric directors appointed at the last annual meeting to consider the advisability of reducing the capital stock of the company is expected to render its report at the annual meeting in April.
>
> It is understood the committee will report in favor of a reduction of $13,000,000 to $15,000,000 in the common stock.
>
> The company will close down its works the latter part of this month for a week or so to take inventory. Officials say the annual report will make a very good showing. It is even believed in some quarters that 8½ per cent. was earned on the common during the calendar year.

The first part of the above is only partially correct, the inference deducible from the latter part is totally incorrect.

And if any attempt is made this year to issue a false report of affairs, as was done in the two preceding reports, it will be a dangerous proceeding for the responsible parties. There are stockholders who feel that they have been humbugged long enough, and who propose this year to know the facts. The annual meeting in April next will not be a cut-and dried affair. There will be a lively time at best, and it will not be safe for the man who offers the report to say that he has come unprepared to answer questions. There will be many questions to answer, and they will either be answered at the annual meeting or in a court-room soon afterwards.

The General Electric Company has nearly run its course; it cannot exist much longer under present conditions and present management. Would it not be well for those directors who can prove the innocence of their connection with the scheme to come forward and make their excuses to the public for allowing their names to be used to humbug investors? The responsibility for all the deceit and misrepresentation rests somewhere. Where does it rest? Speak up, Mr. Coster, Mr. Twombly and Mr. Coolidge.

Can any one be expected to believe that the company has made any money this year? When the facts are clearly presented from the books, as they will be sooner or later, it will be shown that ELECTRICITY's statement was correct; that the reduction in assets for the year is greater than the debts paid and bonds retired, and that the cash has not increased. This fact cannot easily be explained away.

The ultimate total collapse of the organization is inevitable, and it will be welcomed by those having the best interests of the industry at heart. It means that bribery and general thieving have no place in the conduct of a commercial enterprise; that the public has placed the seal of emphatic disapproval on the methods adopted to sell goods, on the plan of financiering, and upon every important feature of the company's management.

The air will be clearer when every vestige of the present management has been eliminated.

* * *

The Welsbach Light. The *Progressive Age*, an advocate of the gas interest, has attempted to answer the arguments recently printed in ELECTRICITY against the Welsbach light. Our contemporary accuses ELECTRICITY of manufacturing testimony, and prints denials from Mr. E. P. Gleason and President Gawtry of the Consolidated Gas Company of the interviews ascribed to them in our article. We have manufactured neither interviews nor news.

When our Welsbach matter had been prepared by the editor, having no member of the staff at liberty to make a tour of the city for the purpose of securing interviews, we engaged Mr. G. Wilfred Pearce, a newspaper man of some experience, to do that work for us. His interviews were accepted as genuine and paid for by us at regular rates. If those of Messrs. Gleason and Gawtry were bogus, Pearce is convicted of the worst offence known among newspaper men, and is not likely to have an opportunity to swindle anyone else in like manner.

Our apology and this explanation is cheerfully made to these gentlemen, which we hope will be accepted in the spirit in which they are offered.

As to the *Progressive Age*, however, we have this to say, that it makes absolutely no reply to our arguments against the Welsbach light. It makes an exceedingly awkward and puerile attempt to evade the question by saying: "We lack both space and the incentive to *attempt* to set our contemporary straight; possibly we may entertain the thought that it prefers to continue in its present course, in keeping with the old saying 'None so blind as those that will not see!' Nor have we a desire to give to our friend *elementary instruction in chemistry*, therefore we *leave its minor criticisms* on that score to turn to more serious matters." (The emphasis is ours.) And then it devotes two columns of matter to calling our attention to the two fraudulent interviews above referred to. For this latter service and the opportunity to set ourselves right we are under great obligation to our contemporary. But let us look at its argument (?): It quotes the old saying that there are "none so blind as those that will not see." We quoted the report of the Municipal Council at Vienna (the birthplace of the Welsbach light) when considering the proposition to introduce the light into the schools as follows: ". . . that, besides, the glare and color of the light *attacked the retina* of the eye, especially at the commencement. . . .

"Conformably with this report, it was decided by the referendum to *decline to permit* the introduction of the Auer incandescent burner into the schools."

It would seem from this that our contemporary when discussing the Welsbach light would better have paraphrased the quotation somewhat and made it read "There are none so blind as those who have habitually used the Welsbach light."

As to teaching us elementary chemistry, the idea is almost as amusing as it was for the *Progressive Age* to print as arguments statements from three different authorities (?), one of whom flatly contradicted himself on a vital point, and then described his methods of arriving at unreliable results, another of whom disagreed with the first, and the third who bent his energies to prove that carbonic oxide gas was not poisonous anyway. The same energy expended in the same way to prove that arsenic or prussic acid are not poisonous would be quite as effective and certainly quite as appropriate, since the burden of the first two quotations was to prove that no carbonic oxide existed.

Such trifling facts as that the light tends to destroy the sight of those who use it, that its products of combustion tend to destroy the health of those who sit under it, that the cost of renewals exceeds that of any other artificial light known, and that the care required exceeds that required to keep a kerosene lamp in good order, are unworthy of the attention of our contemporary—so it says. We think the *Progressive Age* did the best it could do, however, in ignoring the facts and attempting to divert attention from them.

* * *

What is the Matter with New York? It is not too early for those who are anxious to secure the 1896 meeting of the National Electric Light Association for New York City to begin the work which will convince the members that this is the proper place for that year.

ELECTRICITY is confident that a majority of the members would look with favor upon New York if the arguments were properly presented. We can offer them all that can be had in any other city and a great deal more.

An entertainment fund could be raised large enough to distinguish New Yorkers as hosts; the Grand Central Palace could be secured for exhibition purposes, and no other building in the country could excel it for the purpose.

New York wants the meeting, and if she tries to get it she can win.

Thomson Regulator Patent Void

Suit Decided in Favor of Western Electric and Sperry Companies.

(Special to ELECTRICITY.)

CHICAGO, Jan. 14.—In the long-fought suit of the Thomson-Houston Company vs. Western Electric Company, for infringement of the Thomson Regulator patent, Judge Grosscup has decided the Regulator patent void on the ground of no invention in view of the admitted state of the art at the time the patent was issued, 1883. He decides that a higher degree of mechanical and inventive skill is expected and required in the electrical field than in other lines. The decision overrules that of Judge Colt in the Citizens' case at Boston.

This case had been in litigation for four years and is a decisive victory for the independent companies.

Followed by a favorable decision in the Bate case, the General Electric Company will be left without a leg to stand on.

ELECTRICITY extends congratulations to the defendant companies, who have fought quietly and persistently, and to Messrs. Barton & Brown, who have conducted their clients to victory.

Under the Searchlight.

Views and Opinions on Timely Topics.

Too Much Johnston.

Mr. W. J. Johnston, publisher of our padded contemporary, the *Electrical World*, who has done all in his power to degrade the profession of journalism, to bedevil not only the electrical newspaper business but the entire trade, has lately deluged advertisers with bushels of circular matter which it is difficult to believe could be prepared by a sane publisher.

He has been tolerated too long, and we submit that it is time for those who patronize his paper to give a little thought to the subject of the man and his methods.

For years he has carried along nearly all the bankrupt concerns in the business, depending upon his good-paying customers for enough profit to enable him to carry without returns all their dead-beat competitors. The pages of the *World* are full of these concerns, many of whom have not paid a dollar in a year. Once in a while, when one of them fails, we learn the facts beyond dispute. Not many months ago one of them offered to give Electricity an advertisement on the same terms as he got from the *World*--he said he had not paid a dollar in three years. He said, also, he had tried the *Electrical Review*, and they had not treated him fairly—they sued him for his account when long overdue.

Let any sound concern, in any line of business, scan the pages of the *World*, and see if most of its bankrupt competitors are not occupying equally desirable positions with its own advertisement.

Can any other publication be found offering such insults to legitimate advertisers ?

Puffed up with the idea that he has made the trade what it is, he now invites people to drop all other papers and give to the *World* ALL their patronage. Does he suppose that the trade can be made to forget that the other journals have all done important work in extending the scope of the business in spreading the knowledge of the art ?

Does he stop to think that he cannot find one successful advertiser in the world to subscribe to his theory that advertising should be done in one publication only ? The subject is scarcely worth ten lines of argument.

He has sent out volumes of lying statements, which grow bolder and more absurd every week.

His map showing circulation by States has not a correct figure in it. His statement of total circulation is a lie, and we challenge him to produce the names of 4,000 *paid subscribers*—people who have paid an annual subscription to the *Electrical World* within twelve months.

We will wager $200 that he cannot produce this list, the winner to pay the $400 into the treasuries of the A. I. E. E. and the N. E. L. A., evenly divided.

He has done nothing but insult the people who have made him what he is since the time when he sold out the telegraph operators, whose support had made the existence of the *Operator* possible.

Having received several orders to discontinue the advertisements of those who could no longer endure his insulting letters, he answers them that he is glad they quit, that it is just too sweet for anything to be rid of them : this to the largest and best paying advertisers in the trade.

It is time for a great many men to ask themselves the question, Can we continue to patronize the *Electrical World* and maintain our self-respect ?

An Electrician's Heinous Crime.

His Severe Sentence.

Judge.—You are an electrician, you say, and you have been convicted of stealing a copy of Electricity from your employer's desk before he had time to read it.

Prisoner.—True, your honor, I could not wait.

Judge.—The offence is a serious one and is occurring too often. You are sentenced to solitary confinement for six days and to read the editorial page of the *Electrical World* twice every day. And may God have mercy on your soul.

* * *

Can This Asset Be Marked Up ?

The books of the G. E. Company show that they hold $119,000 securities of the Ottawa (Ill.) Street Railway Company.

The company has lately taken in about $18 per day or about one-half to one-third of operating expenses. They have now served notice on the Mayor that they will cease running cars and their franchise will be surrendered. The equipment is worthless except for junk.

Can this asset be marked up towards correcting the $12,500,000 impairment of G. E. capital ?

* * *

The following has been received from an advertiser. The full page advertisement referred to appeared in a recent issue of the *Electrical World* :

To the Publisher of Electricity.

Dear Sir : Your favor of the 10th inst. received ; the matter of full-page advertisement to which you called our attention was not authorized.

* * *

A gentleman who has played a leading part in the development of the electrical business for fifteen years writes as follows :

My Dear Greene :

The last number of Electricity was a soaker. I wish you would send a copy to my office regularly. We will burn 'em up yet !

General Electric.

What is Said of It Nowadays.

Notes and Comments from Various Sources.

(From the Evening Advertiser, January 9.)

The stockholders of General Electric will do well to bear in mind several basic facts concerning their company which are in danger of being obscured. The first of these facts is that, while it is perfectly true that one-half of their stock represents nothing at all, except presumably some shadowy kind of item which might be described as "good will," nevertheless their stock is entitled to the reversion of the company's future earnings. If the company can earn in a bad year, such as the year ending December 31, something on the stock, it matters very little whether one-half of that stock represents practically nothing of book value, or whether it is represented by real assets. The stock of an industrial company is valuable only for its earning power.

This impairment of General Electric capital is by no means so vitally important as has been generally thought. It represents, no doubt, a dead and irrecoverable loss. No doubt the symmetry of the balance sheet would be much improved by the cutting in two of the company's capital stock, and elimination of the debit to profit and loss. How, nevertheless, can such an operation impair the earning power of the remaining half of the capital stock? What does it matter to the stockholder whether he receives, for example, 4 per cent. on $100 of stock or 8 per cent. on $50 of stock ? Would not the stock market estimate the $50 of stock at precisely the same value as the $100 in such a case ?

The facts of the case, as far as General Electric is concerned, the *Commercial Advertiser* believes to be as follows, and it has what it considers good authority for the statement. The electrical business in this country, partly by extreme and bitter competition, chiefly at the hands of an extremely well equipped company, viz., Westinghouse, has been brought to a state of minimum profits. This is especially true with regard to street railway equipments. Naturally, the General Electric Company has suffered the loss of considerable business, owing to its financial weakness at the critical moment, and has been obliged to take whatever business was left at very low prices. Notwithstanding this, however, the statement is made by an official of the company that the earnings during the year just closing would have been sufficient to pay something like 4 per cent. on the stock. If this is true, and there ought to be at least a fair chance of its being true, it is evident that, partially crippled as the concern was, it is still able to do business at a profit in bad times. If it is not true, it is to be presumed that the annual report will show what is the truth.

The object of these remarks, as already stated, is to advise stockholders to wait for the annual report before parting with their stock.

For some weeks past there has been a good deal of talk about a newspaper attack shortly to be made on the General Electric Company. Short sales of the company's stock have been made in the market, possibly in connection with this, the majority of these having been made three weeks ago. The murder is now out in the shape of a long criticism of the company's affairs in the trade paper known as Electricity.

It is unnecessary for present purposes to assume that the proprietors or the editor of Electricity have been personally concerned in the "bear" attack on the stock. As far as argument about the matter goes, it is assumed that the article in question is simply an honest endeavor to tell the public what Electricity considers to be the real facts of the case. With so much by way of premise, it seems advisable to say a few words of warning to the public in general and the stockholders of General Electric in particular. In a word, stockholders in the General Electric Company are hereby advised to disregard absolutely and entirely all information concerning their company that may be published between now and the date of publication of the company's annual report. There is sufficient doubt existing with regard to much of this alleged information to make it advisable that nobody should attach very great importance thereto. The last annual report of the company was, on the whole, fairly satisfactory in point of detail and completeness. There was no clear evidence of the facts having been covered up. There was very clear evidence that a leaf had been turned, as far as the company's methods of business were concerned. Since that time, of course, there has been a period of intense depression in the electrical manufacturing business, as indeed in all other manufacturing businesses.

The financial writer of the *Advertiser* concedes the independence of Electricity in its comments on the G. E.

We regret that we cannot extend to him the same courtesy. Either his knowledge of the subject is so limited that he has no business to write a line for any paper in regard to it, or, if knowing better, he has been persuaded by the company to print the veriest nonsense in the hope that its publication will prolong the opportunity for the insiders to manipulate the stock and get completely rid of their holdings in advance of the annual meeting in April.

Electricity merely gave last week and the week before advance news of what will be public matter after the annual meeting. We shall continue to give such advance news. We have been for over two years three months in advance of all competitors in reporting the actual condition of this company's affairs.

The *Advertiser* accepts the statement as correct that the company has earned some money this year.

Yet the statement is flatly false.

A record of the transactions for the year would show that the treasury assets sold and old accounts collected amount to far more than the bonds retired and debts paid, and that the cash on hand has not increased since January 31, 1894.

In addition to this there was a loss during the year of over $2,000,000 by the drawing out of the Ft. Wayne Company, the loss of the feeder and main patent, the expiration of the incandescent lamp patent. Where are the profits ?

The astute financial writer chatters about the difference between receiving 4 per cent. on $100 of stock and 8 per cent. on $50 of stock very like an up-country farmer discussing the Government currency problem.

He does not seem to know that the capital is impaired, that the marking up of present assets to cover this impairment would land the men who tried it in the penitentiary, and that no dividend of any kind can be paid while this impairment continues even if the company were earning money, which they are not. He should consult the New York State statutes.

The stockholders of G. E. will get no dividends in this century or the next without a scaling down of the stock.

This scaling down is already decided upon, and we suppose the average New York and Boston daily paper financial editor will learn it after the event by reading his Schenectady, Amsterdam or Podunk exchanges.

What daily paper will gather to itself honor and credit by first presenting the true story of G. E., its present condition and future prospects?

The Electropoise.

A Defender of the Humbug.

To the Editor of Electricity.

Dear Sir: This letter was written some time ago, but when you ceased agitation of what you were pleased to call "Electro-Medical Fraud," I thought it best to drop the matter; but since you have began anew by copying an extract from a foreign prejudiced paper I consider it my duty to enter my protest against your indecent articles headed "Electro-Medical Fraud," which I hope you will have the fairness to publish.

I would not be guilty of replying to your vile and venal articles in the spirit and tone in which they were written, nor would it be gentlemanly for me to seek to say through your own publication that the attack you made on the Electropoise and the Electrolibration Company exposes your ignorance and shows a lack of information as well as a lack of intelligence on the subject you fain would discuss; nor would it be in good taste to call you a fool because you happen to be an editor; nor would it be courteous to say that as an apprentice journalist you were seeking notoriety as a scientific writer in a slander suit in which you were incapable of losing anything, and perchance increase the circulation of your publication; but I will say that, in my judgment, you have shamefully abused the privileges of a free press in attacking in a scandalous and libelous manner honorable men and criticizing a subject which you have not tried to comprehend.

I wish to say that I am in no way connected with the Electrolibration Company, nor does this letter emanate from any suggestion of the company; so that what I may say reflects no opinion of the Electropoise people, nor are they responsible in any measure or in any way for the opinions of this letter.

There was a time when I did not only disbelieve in the therapeutic properties of the Electropoise, but regarded it as the rankest humbug. I looked on the credentials and recommendations published by the company as so many acts in a farce to humbug the credulous and draw dollars from the pockets of sick and afflicted people who were willing to try almost anything to restore health. I saw it advertised in the leading magazines and weekly publications and especially in the *Litery* (sic) *Digest*, and every time I saw the advertisement it added more and more to my disgust for the Electropoise, and when in this disgusted condition, when I was prejudiced almost beyond the power of conviction, my attention was called to its wonderful powers by a warm personal friend, and one in whom I had the greatest confidence, a gentleman at the very top of his business in knowledge and capability, Mr. John W. Rhines.

Then follows a long eulogy of Mr. Rhines, a description of his case, a first-rate puff for Funk & Wagnall's new dictionary, a good advertisement for Mr. Rhines's patent voting machine and a description of another so-called cure—in all about enough of matter to fill two of these columns.

The letter then proceeds:

Now, Mr. Editor, the two cases above cited are two effects that you will not deny, or dispute, whatever may be the case, and it is for you now as a scientist to show the cause apart from Electrolibration, but these are two cases which you cannot answer, as you did, or rather as you tamely tried to answer, the Brooklyn correspondent, for science will not accept such an answer. Ridicule and reason are not synonymous terms, and while you may have thought buffoonery was the best method to dismiss a subject which seemed to you ridiculous, because ignorant and unwilling to be convinced of its therapeutic qualities, it shows plainly either the lack of a scientific mind, or a determination not to investigate. You, posing as a writer on scientific matters, should have been the last one to use ridicule and sarcasm for reason in answering a gentleman who was, in all sincerity, inviting you to investigate a subject on the side of which there is the greatest preponderance of evidence as to its healing merits, and which was of vital importance to the general public as well as the scientific world.

Now, sir, if you are writing in the interest of electricity endeavoring to lead men to a knowledge of the truth along the avenues of science, seeking to enlighten the masses in the hidden and unseen forces of Nature, take up those two cases, and prove to the individuals themselves and to the satisfaction of their friends that Electrolibration had nothing to do with their healing, or else back down and say that your articles were the production of immature reflection—but, remember, when you take up those two cases, you have staring you in the face two effects which by no process of reasoning you can deny, and every effect must have a cause. Respectfully yours,

Thos. M. Smith.

28 Chestnut Avenue, Jersey City, Jan. 4, 1895.

Our correspondent is evidently not accustomed to writing for publication, but in his evident honesty and sincerity his verbosity and faulty style can be forgiven and overlooked. We will also undertake to say a few words in reply, even though his methods of expression are not those best calculated to draw them forth.

In the first place, we have never attempted to discredit the honesty or genuineness of the testimonials given in behalf of the Electropoise. Honest testimonials of this kind, for quite as worthless agencies, are as old as history. Hoodoos and incantations, amulets and charms, faith-cures and mental healing, have been potent in all ages, and a belief in them has in the past been incorporated in all religions. The effect of such things upon patients is well understood by the medical profession, and resort is often had to bread pills and such like remedies, with results that would be surprising to one who did not understand the effects of purely mental agencies in combating disease. While confidence in the physician and in his remedies is often a most important factor in the success of a treatment, it is not always essential, for we see patients daily recovering where confidence is entirely lacking in both. They often recover in spite both of the remedies and of the doctor. When a patient recovers after a treatment with bread pills, or teaspoonful doses of pure water, it is useless to argue with him that the recovery is not due to the treatment. A reasonable man may be convinced when you tell him that he has been taking something that he *knows* could have no effect whatever, but there are some who will not believe even then. This state of mind is well illustrated by the story told of a patient suffering with monomania. He was perfectly sound and rational in all respects but one, and that was that he had the hallucination that he was dead. No argument could convince him that he was not dead, and finally in desperation his physician said: "Now you will admit, won't you, that a dead body can't bleed?" "Yes," replied the patient, "I will admit that a dead body will not bleed." "Very well," said the doctor, taking out his scalpel and making a slight incision in the patient's arm, and pointing triumphantly to the flowing blood, "that proves conclusively that you are not dead." "No it doesn't," quickly replied the patient, "it only proves that I was mistaken, and that a dead body *can* bleed."

We have no desire to convince Mr. Rhines, or any one else, that he is not cured. If he has recovered and is now well, we are glad of it, and it matters not to him or to us whether the recovery was preceded by a dose of bread pills or the Electropoise, but it does matter to suffering humanity whether those bread pills cost a fraction of a cent or $25.

If there be virtue in the Electropoise, then its virtues should be made known throughout the land, and Electricity should be crowned as a benefactor to mankind for having given specific directions how the instrument can be made at home at a cost not to exceed half a dollar. If it be good, then its manufacture should be encouraged for the benefit of suffering humanity, and there is nothing now to prevent its manufacture and sale by anybody. It claims to be protected by U. S. patent. We have shown that the Electropoise as made and sold is not made according to that patent, and that this claim is therefore fraudulent.

It is claimed that the Electropoise polarizes the body when applied. We have shown that it does not and cannot polarize the body as claimed, and that therefore this claim is a fraud.

It is claimed that this polarization causes a concentration of the atmospheric oxygen upon the polarized surfaces. We have shown that no polarization of any kind, however strong, causes such concentration of oxygen. This claim is therefore fraudulent.

It is claimed that this concentrated oxygen, acting upon the surfaces of the body renews and revivifies the blood, etc. We have shown, according to the best knowledge of the day, that concentrated oxygen can have no perceptible effects when thus applied. This claim, therefore, has no foundation in fact.

It is claimed that its benign influences are all primarily due to "thermo electricity by induction." We have shown that there is no such thing known to science as "thermo-electricity by induction," any more than there is a white that is black. This foundation claim is therefore a fraud.

It was claimed by Du Bois that the Smithsonian Institution had given them a typewritten letter certifying to the high scientific value of the discovery of the Electropoise. We have shown that the Smithsonian Institution never gave any such indorsement, and Du Bois now admits, we understand, that he has no such letter. This claim is therefore a fraud.

In fact, the whole business of the Electropoise is fraudulent, and we credit Du Bois and those with whom he is associated with too much sense not to know that it is fraudulent.

It is probable that many if not most of the proprietary medicines sold on the market are compounded after recognized formulas that have merit in certain classes of disease. So far as they are sold and used for these diseases they are legitimate. But the moment they are sold as cure-alls, to alleviate all the ills that flesh is heir to, that moment the business becomes a fraud and all those engaged in it guilty of abetting a fraud. No one questions the merit of Jenner's discovery of the efficacy of inoculation against smallpox, but if anyone prescribed vaccination as a remedy for cholera, scarlet fever and deafness he would be guilty of malpractice.

The Electropoise has the same merit as the buttons on one's coat—no more. But granting that it has genuine merit, it is an insult to the intelligence of the nineteenth century to offer it as a cure for such diverse diseases as aphonia, yellow fever and physical deformity. The Electrolibration Company, like human vultures, are preying upon the credulity of the poor, the sick and the unfortunate, and are waxing rich through their necessities. Unfortunately for our boasted civilization, a large portion of the religious press is abetting this fraud for gain and bringing scandal upon the church. Funk & Wagnall's *Literary Digest* is abetting this fraud. *Harper's*, *Scribner's*, the *Cosmopolitan*, the *Review of Reviews* are all prostituting their columns to the propagation of this imposture. These may seem like strong words, but the editors of those papers are not fools, and nobody but a fool would believe all the claims made for the Electropoise genuine.

A London journal says that since the introduction of electric light public performers are able to preserve their voices in better condition, and are 50 per cent. more often in good voice. They are cooler, do not perspire, and are not husky while singing or acting. The atmosphere is better and the equal temperature of the whole building has greatly diminished the risk of taking cold. Their throats are not parched and their voices not injured so much as in houses where gaslight is used.

Popular Electrical Science.

VIII.

The Telephone—An Explanation of Its Modus Operandi—The Musical and Speaking Telephones and Their Essential Differences Described.

BY NELSON W. PERRY, E. M.

The telephone has been with us so long and come into such general use that we have ceased to marvel at its performances, and yet if we but consider for a moment the character of the service which it performs, and the extreme simplicity of the mechanism by which this service is rendered, we must stand in awe of this wonderful invention—wonderful not alone for the service it is able to render but also for the extreme simplicity by which extremely complex results are attained. The invention of the telephone, too, stands almost unique among inventions, in that it sprang into being almost full-fledged and complete. Almost all other important inventions in their perfected forms have been a growth, and have only reached their present perfection through many successive steps of improvement, to which many brains and hands have contributed. Not so with the telephone. The principles upon which the first instruments were made are rigorously adhered to in the best instruments of to-day, and although the modern instrument is better than that which was first given to the world, the improvement is due chiefly to better mechanical workmanship, a better knowledge of electro magnetic induction, and a better adaptation of the means to the desired ends.

The electrical transmission of simple sounds or musical notes was an accomplished fact long before the speaking telephone was known, and was accomplished in this way: If a diaphragm of iron were held before the poles of an electro-magnet, and the current turned on in the coils of the latter, it would attract the diaphragm to it and hold it in a concave position towards the magnet. If now the current were suddenly broken, the diaphragm no longer attracted because of the disappearance of the magnetism in the electro-magnet, would spring back, and this would give rise to an air impulse. If the making and breaking of the circuit were continued at regular and short intervals, these air impulses, due to the alternate attractions and flyings-back of the diaphragm, would follow each other with similar rapidity, and we would have at the further end a musical note of a given pitch. If the current with which we were operating were a strong one, so that the attraction and rebound of the diaphragm were strong, the note given out would be very loud. If the current used were a weak one, the note would be weak, but it would still remain the same note. If the interruption of the current were more rapid or slower, the effect would be simply to produce a higher or lower note; so that by varying the rapidity of the interruptions of the current, any note desired could be reproduced, and by using a stronger or weaker current these notes could be reproduced with greater or less intensity. Thus we had at hand before the discovery of the speaking telephone all the elements necessary for the electrical transmission of musical notes. But in the earlier musical telephones a vibrating diaphragm in front of an electro-magnet was not used. Page, an American, had discovered in 1837, that an iron bar when magnetized and demagnetized at short intervals emits a sound. This is due to the fact afterward discovered that an iron bar becomes slightly longer when magnetized, and resumes practically its original length again when demagnetized. The rapid changes of length due to magnetization and demagnetization, therefore, set up air vibrations just as would an iron diaphragm alternately attracted and recoiling, but since the changes in length of a bar under these conditions are exceedingly slight, the tone emitted is very faint. Those who have ever had their attention attracted to a transformer such as is used on alternating current lighting circuits, will have noticed a faint musical note emanating from it. This is due to the rapid changes of magnetism in the iron in the transformer, and is called after the discoverer's name, the Page effect. By the musical note thus given out we can tell exactly the number of alternations of current taking place on that circuit, for the transformer will give the same note exactly as a tuning fork, having the same number of vibrations per second as there are alternations of current in the circuit of the transformer.

Philip Reis, a German, by making use of the Page effect, constructed a musical telephone, the receiver of which consisted of a knitting needle, over which was wound a long coil of fine insulated wire. In order to magnify the sound, this was mounted upon a violin or other sounding box. The two ends of this coil were connected with a battery, and in order that the current might be interrupted in consonance with the sound waves to be transmitted, it was led through a transmitting instrument which was constructed as follows. He constructed a box over the top of which was stretched a membrane which would readily respond to sound waves. In the centre of this membrane was fastened a small metallic disk to which one of the circuit wires was led. An L-shaped piece of light metal rested at its two outer ends on the top of the box beyond the diaphragm, where they would not be subjected to the vibrations of the latter, while the third leg of the tripod, consisting of a small metallic point attached to the angle of the L, rested lightly in the center of the metallic disk where the vibration would be greatest. This L-shaped piece of metal was attached to the other end of the circuit wire, so that the current before reaching the knitting needle coils had to pass through the contact between the disk and the point. If now the membrane were set in vibration, as it would be by any sound in the vicinity of the instrument, it would cause the point to dance up and down on the disk, breaking the contact at each vibration, and thus alternately magnetize and demagnetize the knitting needle at the distant point for every sound wave that impinged upon the diaphragm. Thus the knitting needle, by reason of its alternating elongation and contraction would give out a similar note. Of course to make this instrument efficient it was necessary that the point and disk *should* break contact at every sound wave vibration, for if it failed to do so the knitting needle would not give out the same note. It would give out some other note, due to a less frequent vibration, and if this failure to break contact when it should occurred at irregular intervals, the reproduction would not be a musical note at all, but a noise. It speaks well for Reis's mechanical skill that his instrument did not fail of its proper functions; but, as we shall see in a future article, he has his excellent mechanical skill to blame for missing the discovery of the speaking telephone, for had his skill been less—had his instrument worked less perfectly—it would have been capable through accident of transmitting articulate speech, and as a matter of fact it is scarcely to be doubted that it did at times, through that perversity which often characterizes inanimate things, work so badly as to transmit spoken words. Reis called this instrument a "telephone," and very properly, for it was intended to and *did* transmit sounds to a distance. But it was not intended to transmit articulate speech, and could not when working as it was intended to work.

But words involve something more than sound. They may be, and often are, musical—that is to say, the musical tones may predominate and blend the one into the other. This is harmony, but it does not constitute speech. There is a certain *quality* in the human voice by which the voice of a friend is at once recognized; there is a peculiar modulation which is characteristic of the individual, and then above all is the articulation;—all of these must be reproduced if we are to transmit speech, and none of them are reproduced or capable of reproduction by a current that is alternately closed and broken. As on the ocean wave of large size there ride other smaller waves, and upon these still smaller ripples are superposed, so in the sound wave of the human voice—up on the fundamental wave, as it is called, which determines the loudness of the sound by the height of the wave, and the note by the frequency of these waves—it is to the small superposed wavelets upon this fundamental wave that are due the quality and characteristics of the voice. An interrupted current such as Reis used is totally inadequate to produce these small superposed waves, and therefore could not transmit speech. But Faraday, long before Reis's time, discovered that if a wire were vibrated in front of a magnet, electrical currents were generated in the magnet. It was the development of this discovery that led to the enormous dynamos of to-day, capable of giving out thousands of horse power on the one hand, and of the speaking telephone using infinitesimal currents by which whispers may be transmitted unblurred over hundreds of miles of wire. As a corollary to this discovery was the one that if a piece of iron is vibrated or moved in front of a magnet, the magnetism of the latter is disturbed; and still another, that if a coil of wire be wound around the end of a magnet, any disturbance of the magnetism of the latter would give rise to an electric current in that coil which would vary in strength as the amount of disturbance of the magnetism varied. It so happens that an iron diaphragm of circular section, which is supported at every point around its circumference but whose center is free to vibrate, is capable of taking up all air vibrations such as are produced by sound, even to the little superposed ripples which give character to peculiar sounds. Alexander Graham Bell conceived the idea that if such a diaphragm were placed in front of a magnet and caused to vibrate by the human voice, these very vibrations in all their minuteness and intricacy would be reproduced in the magnetism of the magnet before which the diaphragm was placed, and that if a coil of insulated wire were wound around the magnet, these magnetic disturbances would produce electrical currents in these coils which would correspond in frequency, intensity and all other respects with the sound waves which originally produced them. If this were so, then all that it would be necessary to do to transmit speech would be to carry these wires to the coil of another electro-magnet with a diaphragm in front of it. The oscillations in current in the coil of the first passing through the coil of the second would reproduce in it the exact magnetic disturbances of the first magnet, and these reproduced magnetic disturbances would set the second diaphragm into vibrations corresponding in every particular to the vibrations set up in the transmitting diaphragm by the words spoken to it, and the resulting sounds, except as to volume, would be perfect reproductions of the original ones. This is in fact Bell's method. It will be observed that the mechanism by which articulate speech is reproduced at a distant point is archaically simple and not easily disarranged—so simple in fact that any one may use it, and in fact any one with the slightest mechanical ingenuity can make it. Its make and use by unauthorized persons has, however, been prohibited for seventeen years by the U. S. patent laws. This prohibition has now ceased by the expiration of the full term of the patent, and the manufacture and use of the telephone is as free as the air we breathe. With the restrictions withdrawn, the telephone is likely to come into a vastly wider use than heretofore, and although one can now buy outright a set of instruments in the market at a very small fraction of the rentals formerly charged, there are doubtless many who would enjoy making a set for themselves. It is not to be supposed that much money can be saved by home manufacture, for the cost of making a single pair of instruments must be enormously greater than where they are turned out by the aid of machinery in large quantities, but the pride which one is apt to take in the use of instruments which are his own handiwork will doubtless impel many to undertake the task even though as great an expense is involved as in purchase. To assist those who would like to undertake the equipment of private lines, the next chapter or two will be devoted to instructions as to how to make the instruments at home and to install them, which it is thought will enable any one to equip his residence with instruments at small cost in a way to give entire satisfaction.

Peculiar Telephone Troubles Caused by Alternating Current Distribution.*

BY E. W. MIX.

The importance of the inductive influence of an alternating current distribution on telephone systems is well shown by some disturbances which developed at Odessa during last summer.

The telephone lines are all overhead, and the apparatus is of the American Bell telephone manufacture. The dynamos in the central station are of two types, one for 40 ~, and the other for 125 ~. The primary potentials of the circuits are 1,800 and 2,000 volts respectively. The 40 cycle machines alone had been used for the lighting of the municipal theater up to the time of the development of the disturbances. The secondary distribution of the theater was made at 60 volts, and the total energy consumption about 80 kilowatts. It had always been possible to detect a slight induction on the telephone lines passing near the theater when the 40-cycle dynamos were running, yet the influence was insignificant. When, however, the theater line was branched on the 125 cycle dynamos, the disturbances were quite important on certain lines running in the neighborhood of the theater.

It was at first thought that the source of the trouble would be found to be the induction produced by the overhead primary lines, but the telephone wires most influenced crossed these lines at right angles. The group of about twenty telephone wires most influenced passed from supports on the roof of one building to another about 20 meters high along the side of the theater, but about ten meters from the side walls, or fully 30 meters from the center of the theater, or, so to speak, center of gravity of the distribution. The distance between the telephone wires and the primary wires at the point where they cross is about seven meters. It being thought that the secondary circuits might alone be the cause of the troubles, a temporary load was made up for the secondary circuits in the transformer room by means of water rheostats. The load thus placed on the primary circuit was made even more than the normal; but, under these circumstances, all disturbances ceased to exist.

Investigation as to the arrangement of the secondaries led to the discovery that a great many circuits, and especially those for lighting the four galleries, were made on the loop system; i. e., where the current enters at one end of the circuit and leaves at the other, for the purpose of assuring an equal potential on all lamps in that circuit. In the gallery circuits, the current enters at one side of the theater and leaves at the other, so that the effect at a considerable distance from the circuit was the same as if a single conductor were placed around the gallery carrying a current equal to that of the circuit. This current was unusually large on account of the distribution being made at 60 volts only. These four circuits passing around the theater in this way produced a very strong magnetic field, the axis of which was practically coincident with the axis of the theater. This field embraced to a certain extent the group of telephone wires, and gave rise to the trouble.

In order to gain a more definite idea of the extent and distribution of the magnetic field so produced, an exploring coil was made up, consisting of about 100 meters of insulated wire wound up into a coil of about 1·20 meter in diameter, and the two terminals connected to a telephone receiver. By carrying this coil around inside and outside the theater, holding the receiver to the ear and turning the coil in different positions, it was very easy to determine the direction of the lines of force at any point, and the intensity of the noise in the telephone was a good measure of the strength of the field.

When all the circuits were on, the effect was very noticeable on the iron roof of the theater at a level a little above the group of telephone wires. On the ground outside the theater and immediately under the wires, the influence was also well marked. It is very likely that the iron roof added to the effects on the telephone wires in concentrating the lines of force which escaped from the edges of the roof and cut the wires near by. The iron roof acts somewhat as a pole piece to the magnetic field.

The same trouble developed at about the same time in another theater where the wiring of the gallery circuits had been made on the same loop system. Here it was easy to locate the trouble because the circuits were more distinctly separated. The influence was only exerted on two telephone wires which passed over the roof of the building. The instant these loop circuits were switched on, the noise in the telephone was noted. The intensity of the noise in each case had no relation to the load on any other than the loop circuits, so that it was plainly demonstrated that these circuits were the cause of the trouble in both theaters. The remedy in such cases is naturally the suppression of the loop system, and especially in cases where high frequency alternating currents are employed.

The importance of electrostatic induction effects on telephone lines was forcibly brought out by a condition which existed one day, and which was conclusively proven by experiments afterwards. It was found that a new disturbance was set up in a part of the city heretofore unaffected. Here there was a new branch of the primary line installed running parallel to a group of telephone lines for a distance of about 350 meters. The primary wires were on wooden poles about 7 meters from the ground, and the telephone wires also on wooden poles about 11 meters from the ground, but on the opposite side of the street, the distance between the two lines being at least 20 meters. There were as yet no transformers branched on this line. The effect was first noticed on a line which ran but about 30 meters parallel to the primary lines and then crossed them at right angles. It was supposed that both primary wires were connected to the line circuit, but investigation showed that one had been by an oversight left disconnected. When the connection was established the disturbance ceased. Here the effect was purely electrostatic. The insulation of the primary line was perfect, so that the disturbances could not be attributed to any leakage to ground.

To more fully determine the extent of the electrostatic influence, the experiment was tried of connecting one pole of the dynamo to a circuit leading out in one direction from the station and connecting the other pole to a circuit leading out in the opposite direction. By this combination no current was sent out on any of the lines, except that necessary to give them an electrostatic charge. The disturbance set up in almost all the telephone lines of the city was such as to almost completely prevent communication. So long as only one circuit was so connected to but one pole of the dynamo, the influence was just sufficient to enable one to determine that the dynamos were running; but, on connecting the two circuits as described above, immediately the disturbances were set up. The insulation of the lines with the transformers connected was in the neighborhood of 300,000 ohms. The length of double line of one circuit was about eight kilometers and that of the other five kilometers. No current could be detected flowing out on these lines by means of the amperemeters, which were fairly sensitive instruments, and where one ampere could have been quite easily noticed.

The conclusions are, therefore, that electrostatic induction is quite as, if not more, capable of creating telephonic disturbances as electromagnetic induction with high frequencies and potentials, and precautions should be taken to keep the two conductors near together, so that one may neutralize the other. In electrostatic induction the earth, and even buildings, serving as an intermediary conductor of large capacity, tend to increase the area of influence of the electric charges received by the primary wires.

A Helmholtz Commemoration.

On the 14th ult., a festival in memory of Prof. von Helmholtz took place in the rooms of the Berlin Singakademie in presence of the Emperor and Empress and the Empress Frederick, the festival being under the auspices of the scientific societies with headquarters in the German capital. The hall was tastefully decorated, a prominence being given to a fine bust of Helmholtz. The ceremony was opened with a song composed by von Schütz. Dr. Von Bezold then delivered an oration recalling the services rendered to science by the deceased. He warmly praised Helmholtz's personal qualities; although from the very first signalled out as one of the leading spirits of the age, and in spite of half a century of flattering testimonies from the entire scientific world, he ever remained free from pride, and that has enabled us to contemplate his picture without a single afterthought. Herr Joachim then gave Schumann's "Abendlied" on the violin, and Brahms's "Gedenksprüchen" for eight voices terminated the sad celebration. The Emperor William has contributed 10,000 marks to the fund for the erection of a monument to Helmholtz in the chestnut grove behind the Berlin University.

Another Self-Propelled Vehicle Competition.

Another competition for mechanically-propelled vehicles is mooted, and again Paris is the center at which it is proposed to hold the trials. The tests will be made for highest speed maintained for long periods of time. The minimum distance for the runs has been fixed at 620 miles. Paris will be the starting point and also the winning post. Vehicles operated by electricity, steam or oil are eligible. The trials are arranged to take place next summer.

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*The Electrician (London).

THE UTILIZATION OF OZONE.[*]

A Paper of interest, by Dr. O. Frölich, on the utilization of ozone, has recently been published in the Proceedings of the German Electro-Chemical Society. The statements which it contains are based upon observations made on a working scale in many cases, and refer in some instances to applications which are in actual operation. Certain of the methods of utilization put forward are admittedly only suggestions, but they are in all cases of a practical kind and worthy of attention. The apparatus used was one designed by Siemens & Halske, and is in principle identical with the Siemens ozone tube—now a classical laboratory instrument. A useful modification in detail consists in the substitution of mica for glass as a dielectric. Each unit of the apparatus is, therefore, composed of a metal tube with a mica sheath, enveloped in a mica tube with a metal sheath, the annular space between the two mica surfaces serving as a channel for the gas to be ozonized. The well-known modification of the Siemens tube, differing therefrom in that the coatings of the dielectric are water or dilute acid, is also useful, especially for small installations. It has the advantage of being transparent, and thus allowing the observation of the character of the discharge taking place between its opposing surfaces.

The two essentials for the successful formation of ozone are the use of an alternating current of high voltage and the production of a "silent" discharge. In modern practice the induction coil which has sufficed for laboratory experiments is replaced by a step-up transformer. It is not a matter of indifference in what manner the alternations occur. Should the curves representing the rise and fall of the current be unsuitable, a reduction in the output of ozone per unit of electrical energy is to be expected. The author states that the form of alternation found by experience to be most efficient has now been ascertained, but gives no details of the construction of the transformers designed for this particular end. When the right character of alternation has been arrived at the working of an ozonizing plant is simple, fair regularity of running being the chief requisite. The only measurement needed is that of the voltage at each ozonizer, which should be tolerably constant. It is noticeable that with an increased production of ozone a rise in the temperature of the ozonizers takes place, this being sufficiently great to need the circulation of water through the inner tube of the ozonizer. The uses to which ozone can be put may be conveniently dealt with under the following heads:

Chemical Processes.—Ozone, when used on account of its chemical activity, varies greatly in its effects according as it is used alone or in conjunction with other substances, e. g., chlorine. When ozone is blown through spirits of turpentine copious white fumes are evolved, the composition of which is at present unknown. The substance thus produced has strong bleaching properties, textile materials dipped in spirits of turpentine and then exposed to ozone being readily decolorized. A similar effect is produced when ammonia is substituted for turpentine, ammonium nitrite being a product. A considerable obstacle to the wide utilization of ozone is its comparatively high cost. Up to the present only 20 grammes of ozone per horse-power can be prepared, while 70 grammes of electrolytic oxygen can be obtained by the same expenditure. It follows, therefore, that the remunerative employment of ozone must be confined to cases where action upon the whole bulk of the material treated is not contemplated, but merely a removal of impurities, or improvement in quality of a tolerably high-priced commodity is aimed at.

Sterilization.—Ozone acts rapidly upon micro-organisms, and a special investigation has been made by Dr. Ohlmüller to ascertain how far this action can be utilized. The chief conclusion arrived at is that when oxidizable matter as well as bacilli is present in the liquid to be treated, the former is attacked first and the latter are killed only after this initial oxidation. The destruction of the bacilli when once begun is rapid, pathogenic organisms being killed almost instantaneously. It appears, therefore, that the use of ozone for sterilizing water is only advantageous when the water is fairly pure and free from much oxidizable organic matter. The author suggests that the town supply in Berlin, which is nearly free from organic matter, should be ozonized before being sent into the mains.

Ventilation.—The action of ozone upon micro-organisms on the walls and in the air of living rooms is not great; moreover, the smell of pure ozone—as distinct from the products associated with hydrogen peroxide, which characterize the air of pine forests, and are vulgarly termed "ozone"—is unpleasant, and if the gas be present in notable amount it has a strongly irritating action on the throat and lungs, resembling chlorine in this respect. It follows that any utilization of ozone for furthering ventilation must depend upon the conjoint use of substances—e. g., ethereal oils, capable of modifying the effects of the pure gas.

Improving Articles of Consumption.—The effect of ozone upon spirits has long been known to resemble that which results on keeping. Apparatus has been devised for treating the contents of casks in a cellar or store individually. It has been found that the improvement is more marked with strong, sweet wines, spirits and liqueurs, than with alcohol liquids light or acid in character. The ozonizing is best applied moderately but repeatedly. The method has been in use by one cognac maker for several years, good results having been obtained. The flavor of tobacco and coffee is also improved by ozonizing. A crucial test of this alteration has been afforded by the action of ozone upon the so-called "stink-beans" sometimes found in coffee. These are isolated beans, which, during storage and transport, have suffered a fermentative change sufficient to cause them to contaminate the whole consignment with their own offensive taste and smell. One circumstance constitutes a drawback to the treatment of coffee with ozone, viz., that the broker has a strong prejudice in favor of a particular gloss and color, which properties are deteriorated by ozonizing, although the flavor is improved.

The applications about to be described have either actually been found of technical value, or are fairly certain of being adopted commercially. René, a piano maker of Stettin, has used ozone since 1881 to remove the resonant properties of the wood used in making the instruments which he constructs. The wood is placed in a warm, well-closed chamber, and ozonized air is passed through for 12–24 hours. The wood is thus uniformly hardened and made less sensitive to fluctuations of temperature; the alteration is probably due to the oxidation of the resin contained in the wood.

The customary method of oxidizing linseed oil for the manufacture of linoleum, by hanging strips of fabric (termed "scrim") saturated with the oil in an airy loft, occupies several months. By the use of ozone the oxidation is completed in a few days.

The author, in conjunction with Herr Keferstein, a bleacher having a factory at Griffenberg, has worked out the details of the application of ozone to the bleaching of linen, with the result that grass bleaching is now given up. The ozone installation has been running for a year. Its capacity is 500 kilogrammes of linen per day. It is impracticable to use the ozone per se, both on account of its high cost and its excessive "tendering" action on the fiber. The linen is therefore subjected to the usual preliminary treatment with acid, alkali and chloride of lime, precisely as is often done in the case of grass-bleaching, the only point of distinction being the substitution of the ozone bleaching for the last-named stage of the process. Favorable results were also obtained by steeping the linen, previous to exposure to ozone, in weak solutions of hydrochloric acid, spirits of turpentine and ammonia. The treatment with ozone is carried out in a closed chamber, and continued for six to seven hours, whereby the decolorization is carried to about three-quarters the extent ultimately reached. The completion of the process is effected by alternate treatments with ozone and chloride of lime. The saving of time and the independence of weather attained by the use of ozone are the chief advantages of the system.

Bleaching by ozone can also be applied to beeswax, which is still sometimes sun-bleached. A whole series of starch products have also been prepared with the aid of ozone, the work having been carried out by the author in association with Herr Hellfrisch. The usual methods for preparing such substances as soluble starch, dextrin, etc., from raw starch, often yield products of dark color and bad smell, which diminish their commercial value. The bleaching action of ozone in conjunction with chlorine is found to give materials of this kind a lighter color and better odor and flavor.

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[*] "The Electrician" (London).

The Inventiveness of Outsiders.

It is remarkable, says the *Iron and Coal Trades Review*, how very many of the greatest inventions and discoveries of modern times have been achieved by men who were not themselves trained to the business or profession in which they acquired distinction. Neither Bessemer nor Siemens was trained as a metallurgist, and yet they have been acclaimed as the most epoch-making inventors in the history of the iron trade. Sir William Armstrong was not trained as an engineer, but as a solicitor, and yet he has revolutionized the art of gunnery and the manufacture of hydraulics. And so with many other modern instances. The so called practical men are too often incapable of looking all round a subject, and are so wedded to usages and established rules as to look with serious disfavor upon any really novel ideas however meritorious.

One of the most useful and ingeniously contrived electrical inventions of to-day is an electric fire alarm system which received the highest award at the World's Columbian Exposition, and it is an interesting fact, says the Rockland (Me.) *Courier-Gazette*, "that this wonderful apparatus was invented in Rockland by L. H. Des Isles. Mr. Des Isles, who is a native of Lamoine, came to Rockland to attend the Commercial College, and afterward obtained a position in the engine room of the steamer Mt. Desert. After several seasons on the Mt. Desert he accepted the position of engineer on the tug Frederick L. Wilson, and while on this boat he originated an electric heat alarm, which was the basis of the system now in use. A hot journal, which required almost constant attention, was a great deal of trouble to Mr. Des Isles, and in order to overcome this he arranged an electrical contrivance which rang an alarm when the bearing became overheated. From this small beginning the present system was perfected. Mr. Des Isles is now foreman of the company's works and is a large stockholder in the concern."

EXPERIMENTS IN CABLE SIGNALING.*

BY PATRICK B. DELANY.

Within the past few months I have made some experiments in signaling over the Direct United States cable and the cables of the Anglo-American Company, the results of which may be of interest. The trials were mainly with a specially designed system of automatic transmission. Over the direct cable—Ballinskelligs, Ireland, to Halifax—the entire traffic was transmitted for three weeks under very unfavorable conditions, owing to the almost unprecedentedly severe electric disturbances which prevailed at the time (February last); but the trials demonstrated very clearly, nevertheless, the great superiority of machine working over hand transmission.

In order to get at exact results, on February 27, during the busiest part of the day, 274 messages sent consecutively were carefully timed, showing the following speeds:

Number of messages.	Letters per minute.	Number of messages.	Letters per minute.
3	88	32	85
22	91	16	88
12	95	30	87
10	86	29	88
2	91	26	87
4	84	—	
88	87	274	

Average, 88 letters per minute approximately.

On the morning of March 2, when the cable was comparatively clear of earth currents, 84 messages were transmitted consecutively as follows:

Number of messages.	Letters per minute.
7	100
5	98
17	95
5	89

Average speed 95½ letters per minute, and without an "R. Q."

The foregoing results were with *regular traffic*, code messages, and under duplex conditions of cable.

Experimentally, code messages sent at 103 letters per minute were repeated back promptly from the recorder slip, while newspaper matter transmitted at speeds ranging from 110 to 120 letters per minute was readily repeated back correctly. I specify two instances of official and careful timing.

February 14: 268 letters from a newspaper paragraph, comprising figures and fractions of stock market reports, were transmitted at the speed of 111 letters per minute, and immediately repeated back from the strip at Halifax without an error.

On February 14, 190 letters were transmitted at the rate of 120 letters per minute, and repeated back promptly and correctly with exception of one word of two letters.

While speeds with actual traffic are the real tests of both cables and systems, it is but fair to assume that these experimental speeds would soon be reached with regular traffic, for experience has proven that after a few months' familiarity with automatic signals, operators read them at a speed 20 per cent. above the speed considered safe at the beginning.

During the month of September experiments were made with the same system over the four cables of the Anglo-American Company—Valentia, Ireland, to Halifax:

Highest Speed of Regular Traffic.

	Letters per minute.
1873 cable	153
1874 "	158
1880 "	133
1894 "	249

These figures require some explanation, however. Instead of translating signals into manuscript the Anglo-American Company cuts the recorder slip into short sections and pastes them on a blank, so that repunching or retransmission by key is done directly from the received record. In order to facilitate this cutting, *three* spaces are made between words in the punching. In arriving at the foregoing results two extra spaces are allowed for every word of five letters, which is the average for ordinary telegrams, and these extra spaces were computed on the basis of 3.7 impulses to the letter, which is the average shown by the analysis of 10,000 words made a few years ago in France. As a matter of fact, however, *cable* words average about *seven* letters to the word; therefore, extra spaces should be reckoned accordingly. This would modify the foregoing figures as follows:

	Letters per minute.
1878 cable	149
1874 "	149
1880 "	129
1894 "	248

which was the *actual* speed of transmission with regular traffic code messages, carefully timed by officials of the company at the station.

It is customary to reckon speeds by counting revolutions of the wheel of the transmitter—in which case, of course, all spaces are included; but, unless a stop watch in experienced hands is employed, the count is apt to be inaccurate. A count of the actual letters transmitted during a trial of several hours leaves no room for doubt as to exact results, and as re-transmission from the received strip requires signals which may be read by the average operator without studying, absence of complaint from the receiving station is the best evidence of their legibility. During these experiments at Valentia all signals were judged by the "good for traffic" standard, and the strictness with which this rule was followed was proven by the fact that, except in the case of the '80 cable, none of the speeds reached with regular traffic were exceeded in the experimental transmissions. On several occasions 141 letters per minute, over '80 cable, were reported "good for traffic," and 146 "fair for traffic"; but after a lapse of a day or two, when traffic was carried, the speed did not rise above 129 letters. The decline might easily be attributed to some change in the adjustments at the receiving station.

Working from London to Heart's Content Direct.

An experiment was made with a repeating system arranged by the writer which, judging from the results obtained, foreshadows, it is believed, important changes in cable working in the near future.

Regular traffic was punched in London and transmitted direct to Heart's Content over the '94 cable as follows:

September 25—Twenty-four messages regular traffic, speed 178 letters per minute.

September 26—Fourteen messages regular traffic, speed 160 letters per minute. No "R.Q's."

These experiments were hurriedly prepared, but were sufficient to show beyond a shadow of doubt that transmission may be effected from long land lines into ocean cables at the same speed as the cables are worked from their landing places. London may transmit to Heart's Content and New York may send direct to Valentia, thus saving repunching, retransmission and considerable time. So far as transmission is concerned cables may, in effect, be thus extended directly to the great inland centers where the bulk of the cable traffic originates, and this, too, without any of the dangerous drawbacks of bad coasts, shore ends, etc., and without any sacrifice in speed by the practical extension.

Working by Sounder Across the Atlantic.

For several years the writer has been engaged in devising a system for working long cables by key and sounder, and hoped for a successful demonstration while at Valentia; but, unfortunately, the key-controlled transmitting apparatus sent from London to Heart's Content failed to arrive in time. With an ordinary Morse key at Heart's Content, however, and a special receiving relay at Valentia, on September 30 Valentia received over the '94 cable on an ordinary Morse sounder 66 letters per minute, and these were automatically repeated to London, who pronounced the signals good. With the special transmitter designed for the experiment I think a speed of 100 letters per minute would have been reached, and I am quite satisfied that this speed can be accomplished between New York and London through automatic repeaters. I am strongly of the opinion, however, that in the near future all long cables will be operated by the automatic machine system of transmission.

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* From *The Electrician* (London).

Prize for an Improved Incandescent Lamp.

The French Societe Technique offers the following prizes to persons of any nationality: £409 for a markedly better incandescent gas lamp, to be sent in before April 1, 1895, the council to decide whether the time may not be extended to May 1, 1896; £320 in various prizes for essays on any subjects affecting the gas industry, particularly on mechanical handling of coal, coke, etc., on water, gas or revivification, or on the substitution of hydrocarbons for cannel; £80 between those who have made the greatest progress in apparatus for making or using gas. Papers to be in French, and unpublished; motto, with name in envelope, and a declaration inside that the paper is unpublished, and that the author will not publish otherwise for a year. To be sent to the Societe, 65 Rue Provence, Paris, by the end of April next. Also prizes of £10 to the authors of the best papers at the annual meeting, provided in this case that they are members of the Societe; and the usual prizes of £8 each to deserving workmen long under the same company, or in the same gasworks, without a break.

The Magnetic Properties of Iridium.

In a Paper communicated to the *Physical Review*, Mr. S. H. Brackett gives an account of some experiments he has made of the magnetic properties of iridium. The samples used contained 98 per cent. iridium, with some platinum, and a trace of phosphorous, but no iron. A bar of the metal 13·3 mm. long, 3·2 mm. wide, and 0·9 mm. thick, when brought into the field of an electro-magnet, set itself at right angles to the lines of force and became permanently magnetized in a transverse direction, and when suspended freely set itself east and west. The permeability of a larger bar was tested and was found to be unity, and, although the specimen was sharply struck while in the magnetizing coil, no induced magnetization was produced.

The Intrinsic Brilliancy of Artificial Lights.

According to the *Gas World* the intrinsic brilliancy per unit of area of the filament of an incandescent lamp is 133 times greater than that of the gaseous rival which has appropriated the first half of its name. It seems probable that in this estimate the meshes of the gauze in the latter lamp have been taken as if solid.

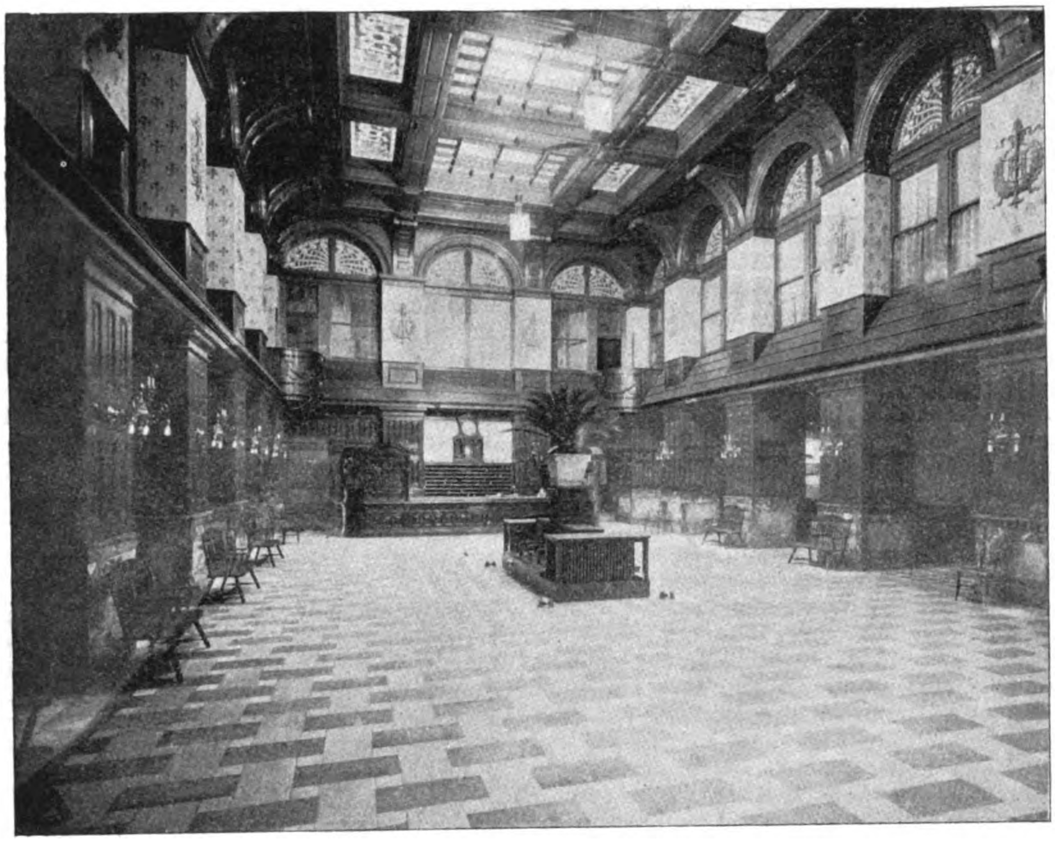
Mr. G. W. C. Lomb, of Alabama, an electrical engineer and inventor, seems to be about as prolific in the production of electrical devices as the inventor of the kinetograph himself. Among Mr. Lomb's latest inventions are the electric fire engine, complete system for the propulsion of canal boats by electricity, complete overhead system of street railroads, new and novel electric lamp, electric fire kindler, new steamboat wheel, marine and steamboat condenser, safety compensating trolley for electric railroads, electric return circuit for street railroads, complete surface trolley system for the same, and an underground system for street railroads. Mr. Lomb, we are sorry to learn, was at last accounts, sick in Cincinnati with acute indigestion.

THE CLEVELAND CONVENTION.

Mr. George F. Porter, secretary of the N. E. L. A., has issued the following bulletin :

The indications are that the attendance at the Cleveland meeting will be very large, and a number of the delegates intend taking their wives.

Hotel accommodations should be secured early to insure comfortable quarters. The headquarters will be at the Hollenden Hotel, the rates being : American plan, $3 to $5 per day; European plan, $1 to $3 per day. Other hotels in close proximity to the Hollenden are the Weddell, $3 to $5 per day; the Stillman, $3 to $5 per day; Forest City, $2 to $3 per day; Kennard, $2 to $3 per day; American, $2 per day.



THE HOLLENDEN.

The Hollenden Hotel, the headquarters of the Association, is one of the best appointed hotels in the country. The service can scarcely be excelled, the rooms are large and well furnished, and the lobby is roomy and well fitted for Convention purposes. Mr. Frank Probst, the manager, is a hotel man of wide experience, and the proprietor, Congressman Holden, is also on hand a great deal of the time looking after the interests of the house.

Those who attended the Railway Convention in 1892 at Cleveland do not need to be told that they will have an enjoyable week there in 1895.

A writer in the N. Y. *Sun* states that passengers riding on the electric railway between West Farms and Mount Vernon have the privilege of listening to an acoustic manifestation that in a remarkable manner illustrates some of the earlier experiments in developing the telephone. The track is a single one and the potential of the current is high; its amperage is also considerable. As a result, when a car is waiting on a switch for one coming in an opposite direction, the approach of the latter is audible at the distance of a mile to the passengers in the waiting car. The sound vibrations are carried along the wire, through the trolley, to the wooden roof of the car. This acts as a diaphragm, which faithfully reproduces the rumble of the approaching car. A mile away the noise of the wheels is distinctly audible, and at the distance of 1.000 feet the sound becomes a loud roar. Outside the car, however, practically nothing is heard until the moving car is within a few hundred feet of the switch.

TORONTO BRIBERY MATTERS.

How Motors were Sold in 1891-2.

(From Judge MacDougall's Official Report to the Mayor.)

In September, 1891, very important questions began to be discussed in the Council as to the kind of electric motive power which should be adopted by the new contractors; some were in favor of the trolley or overhead system. The Edison General Electric Company, a very wealthy electric manufacturing company, were anxious that the trolley system should be adopted, as they thought that in that event they might secure from the Kiely-Everett people the contract for supplying the motors for their cars. Early in September they made inquiries from a Mr. Johnson as to the name of an alderman who might be of use to them in promoting the adoption of the trolley system, and also who might have local influence with the Kiely-Everett people. Johnson introduced Alderman Hewitt to the Edison manager, Barr. Hewitt intimated that if Barr could secure Alderman Hall's support, too, he thought Alderman Hall and himself not only could assist in securing the adoption of the trolley system by the Council, but they could also ensure the Edison people getting the contract from Kiely, Everett & Co. for supplying the motors necessary to equip their rolling stock. Hewitt introduced Barr to Hall, and suggested that as Hall was a lawyer the best and safest way to secure his support was to give him a handsome retainer. Barr accordingly arranged with Hall to pay him $1,000 as a retainer. Hall had never acted for the Edison Company as solicitor; never did any legal work for them before or after the retainer; the payment was made on the 22d September, 1891. A little later in the year Hewitt intimated that in order to make certain that he and Hall would exert themselves actively in the direction required by the Edison Company, it would be necessary to have an understanding with the Edison Company as to a commission to be paid them (Hewitt and Hall) in the event of the Edison Company getting the contract for supplying motors to Kiely, Everett & Co. Barr swears that an arrangement was finally made with Hall and Hewitt to the effect that they were to be allowed a commission equal to the amount which the contract price, when awarded, should be in excess of $2,100 per car. It was thought, looking to the then current prices for car equipment, that a reasonable rate to be expected would be $2,300 or $2,400 per car; it was understood that the company would require about 200 cars fitted out: so that this commission, it was estimated, would amount to between $40,000 and $50,000. The next thing that happened was that Barr began to have doubts as to Hewitt and Hall having any influence with Mr. Everett. Johnson swears that after a consultation with Barr he was instructed to tell, and did tell, Hall to telegraph Everett and bring him here from Cleveland to have an interview with John Muir, the manager of the Edison Company, who came from New York for the purpose, and if he were able to accomplish this he would in some measure demonstrate the fact that he possessed influence with Everett. This was done. Everett came here, and an interview was held between Muir, Everett, Hewitt and Hall in Hall's office. Notwithstanding this supposed proof of the existence of influence, the Edison Company still declined to advance more money until the contract was actually secured. At the municipal election of 1892 Hall and Hewitt were both defeated, but they nevertheless continued to urge to Barr that they still possessed as much influence out of the Council as in it. They finally agreed after much negotiation that if they got a cash advance of $4,000 they would abandon their claim to the contemplated commission, and enter into a fresh written agreement or contract for their services and influence. On the 6th day of February the document was duly signed and delivered, and the $4,000 paid over to Hall and Hewitt. The agreement is here transcribed, that it may not appear that I have attached undue importance to the character of the document, or to its incriminating nature :

"In consideration of Messrs. Hall and Hewitt obtaining for the Edison Company's tender, should they make one to the Toronto street railway syndicates, the preference and acceptance (all things being equal in equipment and price), we, the said Edison Company, hereby advance to them as commission the sum of $4,000. Should the said Hewitt and Hall not obtain the preference and acceptance for such tender of the Edison Company, such sum to be returned by the said Hall and Hewitt in equal shares. After the first tenders are opened we undertake to give the figures of all the tenders lower than the Edison Company's tender to Mr. Barr before the acceptance of any tender; and that an opportunity will be given, if necessary, to Mr. Barr to make another tender on behalf of the Edison Company.

"We further agree not to advocate any system save the Edison system in Toronto at any time.

"Dated at Toronto, this 6th day of February, 1892.

"WILLIAM M. HALL.
"EDWARD HEWITT.
"M. D. BARR.

"Witness, A. T. JOHNSON."

The Edison Company subsequently got the contract from the Kiely-Everett syndicate, and, Barr says, made an enormous profit out of the same. Hall says that he only got part of the $1,000 (ostensibly paid as a retainer) and that Hewitt got the rest.

Upon this evidence and the admissions of Hall, I find that William and Edward Hewitt, who were aldermen in 1891, corruptly received the sum of $1,000 from the Edison Electric Company to improperly influence them as aldermen and to induce them to support in the City Council a resolution for the adoption of the trolley system of applying electricity in the street car rolling stock. And that after they had ceased to be aldermen, in February, 1892, they received the further sum of $4,000 in cash in lieu of and in substitution of a previous corrupt bargain and agreement which they had made with the Edison Company while they were aldermen of the city of Toronto, whereby they were to receive a large commission for procuring a contract for the Edison Company with the Kiely-Everett syndicate, which commission, it was agreed, was to be payable upon the contingency of their inducing the City Council to adopt the trolley system.

Some light is thrown on the number of visitors to Niagara Falls by the returns of the electric road running along the Canadian bank from Queenstown to Chippewa, through Victoria Park. It appears that the travel for the season up to November reached about 467,000 passengers. This road skirts the river all the way within a few feet of the edge of the bluff, and is operated by the water power of the Horse Shoe Fall, the generators being driven by turbines which receive water through a canal just above the fall and discharge under the veil of tumbling foam and spray. The plant is of 3,000 H. P. It was the first large utilization of the energy of Niagara, and it is now proposed to parallel the road with another on the American shore, which shall have the peculiar attractiveness of running out on brackets at the foot of the cliff, and will thus put the tourist right over the boiling waves of the Whirlpool Rapids.

BOOK REVIEW.

Central Station Bookkeeping and Suggested Forms, with an Appendix for Street Railways. By Horatio A. Foster, Mem. Am. Inst. E. E. Cloth, 8vo. 139 pp. Price, $2.75. New York: The W. J. Johnston Company, Limited.

It is seldom that an author brings to his subject such well developed and mature faculties, both natural and acquired, as Mr. Foster has to this subject of central station bookkeeping.

Mr. Foster has a natural mental bent toward statistics which he has cultivated to a further degree. With this he has combined a wide experience as an electrical expert, and the United States Government was glad to avail itself of his services in collecting and arranging electrical statistics for the United States Census Report, and the fulness of those portions which Mr. Foster had immediately in charge has fully justified the selection.

In this way the author has had unusual opportunities of familiarizing himself with the methods of accounts most in vogue in electrical supply stations, and being himself an expert accountant has brought a ripe judgment to bear in sifting that which was good and adequate from that which in the light of present development can be regarded as little better than mere makeshift. To this he has added many suggestions of his own which every business man will recognize as additions in the right direction.

In making these additions he has happily avoided anything of purely tentative value and has not departed in any case, so far as we have been able to detect, from the recognized lines of sound bookkeeping and business policy. He has thus given us suggestions, with forms and diagrams, for the organization of the staff of electrical central stations, the classification of accounts and reports, which will enable the management to determine at any moment, with the least expenditure of energy, the condition of business, and particularly the unit cost of generation and distribution of current. Of these forms and diagrams there are seventy-five in all, and many of them are of full size so as to form exact models for the getting up of a set of books. Recognizing the fact that all stations are not alike nor operated under identical conditions, and that no one set of books can meet equally well all conditions, alternative methods are suggested as types from which books to meet special requirements may be gotten up, and doubtless the author would be willing to give his personal assistance in special cases to designing of systems to meet unusual requirements.

In an appendix is furnished a classification of accounts of electric street railways, together with instructions, forms of books, etc., necessary to carry it out.

In the electrical supply business this question of proper bookkeeping, whereby accurate and reliable data concerning the business should be rendered available, has to a very large extent been a desideratum that has remained unsatisfied. This has been rendered conspicuously evident whenever the attempt has been made to collect data. The meagerness of the information attainable has been due more often to the fact that the managers of stations did not possess it themselves than to any unwillingness on their part to be accommodating. The consequence has been that we do not know to day what may be regarded as average practice in this country. No one appreciates this more than the manager himself, for he would not only like to know what he himself is doing but also how his work compares with that of others in the same line. We regard any effort to change the situation for the better, as a distinct gain to both the public at large and to the manager, and feel sure that this very intelligent attempt on the part of Mr. Foster will meet the hearty commendation that it so richly deserves.

Northwestern Electrical Association.

The third annual meeting of the Northwestern Electrical Association occurs at the Hotel Pfister, Milwaukee, this week. This young organization has had a phenomenal growth since its inception and is continually gaining in strength. At the last meeting in St. Paul there were over 100 members present. An interesting and profitable programme has been prepared and practical subjects will be discussed by thoroughgoing men.

F. P. Little.

Mr. F. P. Little, the leading member of the Electrical Construction and Supply Company in Buffalo bearing his name, died a few days ago, after an illness of several weeks.

Mr. Little was one of the leading men in the profession in his city and well known throughout the East. He was a splendid companion, a whole-souled, genial man, and will be sadly missed by a wide circle of friends.

Personal.

Mr. W. D. Packard, of the Packard Electric Company, Warren, O., was in New York for a few days last week. He reports his company as in excellent condition and looking for big business as soon as the Supreme Court clears up the lamp situation finally.

Mr. Frank Parsons has resigned from the Davidson Fan Motor Co., of Boston. He will continue in the electrical line, in which he has made rapid headway toward the front.

Mr. Charles D. Shain's poetic New Year's greeting to his friends has created considerable comment, all of a favorable nature. It is said that he contemplates retiring from active business and devoting his attention to verse.

Mr. A. T. Moore, Jr., will open an office in Buffalo next week. He will have control of Walker apparatus in that territory and will also handle several other lines.

Col. S. G. Booker, of St. Louis, is expected in New York in a few days. He reports the Phœnix Carbon Company as in good condition, fully equipped, and very well satisfied up to date.

An International Exhibition of Patents and Inventions.

There has been announced an exhibit with the above official title, to be held at the Grand Central Palace in this city during the month of March.

The prospectus is before us, containing a long list of names of eminent gentlemen said to be connected with the enterprise. Notwithstanding these names, however, this prospectus is not calculated to create any high expectations for the Exhibition. The English language is maltreated in the first sentence, and in nearly every other sentence. It is stated that "the Exhibition will be divided in three departments: (1) Patents, (2) Patent Medicines, (3) Photographs, Photographers' Apparatus and Supplies."

Rather a strange combination. What have patents to do with patent medicines? The promoters tell us:

> (2) The second department of this Exhibition will be devoted to the Exhibit of Patent Medicines. Possessors or Inventors of Patent Medicines will thus be brought in the *direct contact* with the public be it through *selling* or *giving* samples thereof. When one considers the exorbitant expenses incurred by general advertising—which is actually the only way by which Patent Medicines can attract the attention of the public—*a more efficacious, and cheaper advertisement* which can be aided by the distribution of descriptive pamphlets can hardly be found.

The scheme does not commend itself to us. The Grand Central Palace is worthy of better things.

SOCIETY NEWS.

American Institute of Electrical Engineers.

The 93d meeting of the Institute will be held at 12 West 31st street, New York City, on Wednesday, January 16, at 8 P. M.

A paper will be presented by Prof. Alexander MacFarlane, of Ithaca, N. Y., "On the Units of Light and Radiation." The author expects to be present. A paper will also be presented by Mr. Alton D. Adams, of Boston, entitled "The Best Metal for Field Magnet Frames."

A meeting of Western members will be held the same evening, Wednesday, January 16, 8 P. M., at Armour Institute, 33d street and Armour avenue, Chicago, where, in addition to the above papers, Prof. Stine will present an illustrated historical sketch of the first three-wire Edison plant at Sunbury, Pa. If time permits, this matter will also be taken up at the New York meeting.

Applications have been received from the following candidates for associate membership, and will be acted upon by Council at its meeting, February 20, 1895: Robert C. MacCulloch, New York; B. C. Paddock, Jr., Boston, Mass.; Bernard Victor Swenson, Champaign, Ill.; Franklin Robert Anson, Salem, Oregon; Maxwell M. Mayer, New York; Joseph Nisbet LeConte, Berkeley, Cal.; Herman Loewenherz, Hoboken, N. J.; George A. Redman, Rochester, N. Y.; Arthur B. Cumner, Boston, Mass.; J. Lloyd Prince, Flatbush, L. I.; J. T. Nyhan, Macon, Ga.

LEGAL NOTES.

Mr. Muir's Railroad.

The Schenectady Street Railroad property has been sold at receiver's sale. The sale was made by P. C. J. De Angeles as special master appointed in the action of the Central Trust Company of New York. Under the judgment of the court the property could not be sold for less than $100,000, and it was required that a deposit of $10,000 be made by the bidder. The property was bid in by William H. White, Charles Batcheller and another. The price is said to have been $100,000.

The Western Electric Company; which represents the American Bell Company in the West, has begun an injunction suit in Chicago against the Harrison International Telephone Company for infringement of patents covering the telephone call box. There are three important suits covering the call boxes owned and controlled by the American Bell Company and its agencies and correlated companies. The first is the Thomas A. Watson patent of the switch in the call box; the second, the Elisha Gray patent telephone call box with magneto bell, and third, the Charles E. Scribner patent of the automatic crank switch for the call box. In the bill for injunction filed by the Western Electric Company the patents named are reviewed and their ownership by the plaintiff averred and the charge made that the Harrison Telephone Company "since April 1, 1893, have made, used and sold telephone call boxes which contained the devices named, and are causing to be made, sold and used such boxes."

The Seattle Consolidated Street Railway Company, the successor of the Seattle Electric Railway and Power Company, operating the Second street line and its branches in Seattle, Wash., has been sued in the United States Circuit Court under foreclosure proceedings brought by the Illinois Trust and Savings Bank of Chicago, trustee, on a mortgage for $400,000, covering an issue of bonds, March 15, 1890. Default in the payment of coupons under the trust deed was made April 1, 1894, and the bank now asks that the mortgaged property, covering all the holdings of the company, be sold as an entirety and without the right of redemption, to satisfy the sum due upon the bonds.

On the 8th inst., the Electric Railway Company of Savannah went into the hands of John R. Young as receiver under appointment by the United States Court on the petition of H. A. Pevear, of Lynn, Mass. The petition charges that over $1,000,000 worth of stock has been issued by those controlling the company, and parcelled out without any fair valuation being received in return. It is charged that certain parties interested in the company have run it to build up the value of lands, regardless as to whether it was solvent or not. Coupon bonds to a large amount are said to have been issued to stockholders without proper compensation. The value of property in the receiver's hands is placed at a half million of dollars.

THE LA ROCHE ELECTRICAL WORKS ASSIGN.

News is received as we go to press that the La Roche Electrical Works of Philadelphia have made an assignment. Details are not yet obtainable.

General News.

What is Going on in the Electrical World.

Norwalk, O.—An electric road between here and Bucyrus will be built as soon as the franchises can be secured.

Fergus Falls, Minn.—Clint J. Nichols, of Wahpeton, has been granted an electric light franchise and will put in a plant.

East Orange, N. J.—The township committee will petition the Legislature for permission to establish an electric light plant for the town's use.

Hull, Mass.—The Nantasket Electric Street Railway Company has been granted a franchise to construct and operate an electric railway in this town.

Bryan, Tex.—A receiver has been appointed for the Bryan Water, Ice and Electric Light Company, which was started in 1889 with a capital of $50,000.

Chicago.—Since the application of electricity to intramural transit nearly $1,000,000 have been expended in this city in the construction of power houses alone.

Charlottesville, Va.—A telephone exchange is to be established here. The 'phone made by the Fitzsimmons Telephone Company of Cincinnati, has been adopted.

Kokomo, Ind.—The Mowery Electric Light Company has made an assignment of its property. The assets of the company are estimated at $20,000; liabilities, $10,000.

Palestine, Tex.—The Palestine Electric Light Company's plant has been sold by the receiver to John R. Hearne. This was the first incandescent electric light plant put up in Texas.

Dickinson, N. D.—E. Hughes, of Bismarck, and Senator McGillivray, of this place, have nearly completed a deal for putting in an electric plant here to be run with lignite coal.

Schenectady, N. Y.—A test was made here a few days ago of the pulling power of an electric locomotive and a six wheel steam locomotive, with the result in favor of the electric machine.

Cleveland, O.—Arrangements have been made by the postal authorities with the Cleveland Electric Railway Company by which mail matter is to be carried to and from sub-stations along its various lines.

Gloversville, N. Y.—Subscriptions are being solicited for an electric railway proposed to be built between Gloversville and Broadalbin. Dr. M. F. Drury, of Broadalbin, heads the subscriptions committee.

Bismarck, N. D.—An ordinance has been passed by the council, and awaits the approval of the mayor, granting a twenty years' franchise to operate an electric lighting plant in this city to E. A. Hughes.

Decatur, Ill.—Representatives of a syndicate of Chicago capitalists have been here looking over the books and plant of the Decatur Electric Street Railway Company as a preliminary move toward purchasing the property.

Greensburg, Pa.—Judge Sadler, of Carlisle, who has been here in the interest of the Greensburg, Turtle Creek and Pittsburg electric railway, says that if the right of way is secured through Jeannette the road will be commenced at once.

New Haven, Conn.—The receiver of the Ansonia Electric Company has been granted legal permission to sell the company's works at Ansonia. Sealed bids for the plant will be received by Charles S. Mersick, the receiver, until the first Monday of February.

Logansport, Ind.—This city has its own electric light plant, consisting of 152 arc lamps. The new system was built by the Standard Company of Chicago at a cost of $50,000. The old Jenney plant will continue to furnish incandescent light and heat to private consumers.

Lima, O.—A company of Lima and Ft. Wayne capitalists has been organized in this city to construct an electric railroad which will connect five of the surrounding towns with Lima. The right of way has already been secured from Lima to St. Mary's and to Wapakoneta, a distance of 44 miles.

Seneca Falls, N. Y.—The highway commissioners have granted a franchise to the Waterloo, Seneca Falls and Cayuga Lake Railroad Company for the use of the new boulevard from the Easton farm to Cayuga Lake Park and the lake road north to Orchard Beach for the construction of a surface railway.

Media, Pa.—The Philadelphia and Rosemont Passenger Railway Company propose at an early day to build an electric road of the trolley system from Philadelphia to Rosemont on the Haverford road, and along the county line road between Delaware and Montgomery counties, and afterward extend the line from Rosemont to Bridgeport.

New York.—The New York and New Haven Railroad Company, it is said, is seriously considering the question of using electricity as a motive-power on its "short lines"—the lines which branch off from the main route and extend short distances to the minor summer resorts on the waters of the Sound and in the New England States.

Monticello, N. Y.—An electric railway connecting Monticello, Fallsburg, Woodbourne and Neversink will, it is thought, be built and in operation before the end of next summer. Mr. Van Cleft, of Newburg, is the promoter of the enterprise. Over $65,000 of the capital stock has, it is said, been subscribed.

Chatham, N. Y.—The Spengler Electric Light Company is using the water power of Chatham Centre in operating an electric light plant which is intended to furnish Chatham, Vatalie and Kinderhook with electric light. All the apparatus of the plant has been supplied and set up by the Standard Electric Company of Chicago.

Lancaster, Pa.—Edwin L. Reinhold and H. Burd Cassel, manager and treasurer of the Marietta Manufacturing Company, have purchased the plant of D. H. Kulp, who for some years has been an extensive manufacturer of electrical fans, and will carry on the business in the future. The plant will be operated here until preparations can be made for removal to Marietta.

Utica, N. Y.—At a meeting of the stockholders of the Utica Electric Light Company, held last week, these directors were elected: H. D. Pixley, M. Jesse Brayton, W. E. Lewis, R. T. McDonald (Fort Wayne, Ind.); T. Solomon Griffiths, Jos. Fox (New York); H. M. Scheuch. The directors elected the following officers: President, H. D. Pixley; first vice-president, R. T. McDonald; second vice-president, W. E. Lewis; secretary and treasurer, M. Jesse Brayton.

Boston.—The Lighthouse Board are making arrangements for the erection of range lights at South Boston, and are considering the use of electricity as an illuminating agent for these lights. Electricity has not been used hitherto for beacon purposes in Boston harbor.—The Boston Electric Light Company has sold $210,000 bonds to a New Haven party. This is a part of the issue recently authorized by the gas and electric light commissioners.

Concord, N. H.—The Railroad Commission reports to the Legislature that New Hampshire has now five street railways, of which three—the Manchester, Nashua and Laconia—are operated by horse power, and the other two—the Concord and Dover—by electricity. Arrangements are being made to convert the Manchester and Nashua roads into electrics. These roads, the report states, have passed from the ownership of the many people who furnished their original capital into the control of financiers.

Stockton, Cal.—The directors of the Electric Street Railroad Company are considering the advisability of establishing an electric plant of their own to furnish power for propelling the street cars, instead of renting the power from the Gas, Light and Heat Company.—A. J. Larson, of Lodi, who is working up the project for running an electric railroad from this city to Lodi, reports that the right of way and ten acres for each quarter section have been obtained for seven miles, or about half the distance between the two towns.

Denver, Col.—The claim is made in this city that it uses twice as much electric light as any other city of its size in the United States. The capacity of the two stations owned by the Denver Consolidated Electric Light Company is: Boiler capacity, 5,080 H. P.; engine capacity, 6,910 H. P.; illuminating capacity, 80,000 16-C. P. incandescent lights; 18,000 25-C. P. municipal incandescent lights; 2,240 2,000 C. P. arc lights, and motor services to the amount of 400 H. P. The officers of the company, recently elected, are E. W. Rollins, president; W. G. Fisher, vice-president; John H. Poole, general manager; W. W. Borst, superintendent, and A. E. Grier, secretary and treasurer.

Keokuk, Iowa.—J. C. Hubinger has made a proposition to the city council to the effect that if the city will grant him a contract to light Keokuk with electricity for twenty years he will agree to build a high bridge to extend from Fourth street in that city to the Illinois bluff at Hamilton, over a mile distant, the bridge to cost $400,000. He will, if properly encouraged, put a railroad track under the wagon track on this bridge, and also run an electric line across it, extending the lines to Carthage, Warsaw, Elvaston and Nauvoo, thus giving those towns freight, mail and passenger service, and supplying them with heat and light.

Niagara Falls.—A movement is on foot among several business men, providing there is another cold snap, to get up an electric ice carnival here. Some merchants have already promised to subscribe toward such a project, and say that while the short winter season here would not admit the building of an ice palace, the beautiful natural scenery about the Falls and parks could be gloriously illuminated with electric lights and present a picture that would never be equaled elsewhere. Some of the enthusiastic ones say electric cables of lights of various colors could be strung in front of the great Falls, also across the gorge and through the parks. The scenery, so beautiful in the day, would be intensified at night and thousands would be attracted here to see it.

Los Angeles, Cal.—There is in Los Angeles something over 100 miles of street railroad tracks, comprising electric, cable and horse car routes. These roads have carried about 9,000,000 people during the year that has just closed. The cable system has about twenty miles of tracks and originally cost $2,000,000. Its whole system is double tracked. The electric system has about fifty-five miles of track, the greater portion of which has been double-tracked. During the present year it is the intention to change nearly all of the cable lines into electric systems, which will necessitate great improvements in the power houses and also the purchasing of a large amount of electrical material. The Westinghouse works in Pittsburg, Pa., have already contracted to supply the latter.

Tacoma, Wash.—The Pierce County Power and Telegraph Company have applied for permission to build and operate an electric power plant in Tacoma for manufacturing, railway and other purposes. They propose to put a dam across the Nisqually in order to get a fall of water to run the dynamos, and will put in a large amount of expensive machinery.—A new company has been formed here growing out of the purchase and combination of the Tacoma Light and Water Company with the Commercial Electric Light and Power Company. The reputed purchasers are Seymour, Barto & Co., C. B. Hurley, and some Eastern men who make a specialty of the gas business. Mr. Hurley has become manager of the consolidated plants.

Trade Note.

The Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, have recently been making some changes in their store and have put in some new counters and shelving, thus adding to its attractiveness and furnishing better facilities for the display of their increased line of goods.

The Partridge Carbon Company.

The prospects of the Partridge Carbon Company of Sandusky, O., for the coming year are very bright. Railroad companies have not been slow to recognize that quality counts more than original cost as a factor of economy in carbon brushes. The factory is running overtime, working chiefly on the "Partridge S. L. Brush."

INCORPORATIONS.

The Foreign Electric Traction Company, Alexandria, Va.—to manufacture electric apparatus. Capital stock, $1,000,000. Promoters: W. M. Stewart, P. B. Thompson, G. Y. Atlee, W. M. Wheelis, Washington, D. C.

The Kings County Electric Light and Power Company, Jersey City, N. J.—to manufacture and use electricity for producing light, heat and power. Capital stock, $1,000,000. Promoters: Edwin C. Low, Brooklyn, N. Y.; Henry R. Burr, Amityville, N. Y.; Hugo G. Adam, Montclair Heights, N. J.

The Farquhar Electric Company (incorporated in West Va.), Suffolk, Mass.—to manufacture and lease electrical machinery and appliances, etc. Capital stock, $1,000,000. Promoters: Donald H. Farquhar, Chas. H. Whitcomb, Frank L. Whitcomb, Boston, Mass.

The Southern Ohio Telephone and Telegraph Company, Hamilton, Ohio—to erect and operate a system of communication by electricity, telephone or telegraph instruments. Capital stock, $35,000. Promoters: Wm H. Pfau, Frank P. Richter, F. W. Clements, C. C. Morey, H. H. Haines.

The Mt. Clemens and Lakeside Electric Street Railway and Dock Company, Lakeside, Mich.—to build and run a general electric railway. Capital stock, $25,000. Promoters: B. B. Conisin, Mt. Clemens, Mich.; Evan Jones, Geo. L. Fl[illegible]cher, W. C. Cunderfinger, Pittsburg, Pa.

Colorado Electric Placer Mining Company. Capital stock, $[illegible]00,000. Incorporators: Erastus S. Bennett, Geo. W. Van Norwick and Frank E. Badger.

The Farnsworth Propeller Company, Chicago, Ill.—to manufacture or sell steam or electric propellers for water navigation, under patents issued by the U. S. Patent Department; own real estate and buildings necessary for the shipbuilding business. Capital stock, $2,000,000. Promoters: Addison Bybee, P. Malden, Frederick J. Patterson.

The Trenton Traction Company, Trenton, N. J.—to buy, acquire, lease and operate street or surface railways. Capital stock, $500,000. Promoters: E. J. Moore, Philadelphia, Pa.; Thos. C. Barr, East Orange, N. J.; Francis M. Eppley, West Orange, N. J.; Geo. B. Jenkinson, Newark, N. J.

The Cartersville Light and Power Company (incorporated in W. Va.), Cartersville, Ga.—to manufacture, distribute and sell illuminating or fuel gas or electric light and power, etc. Capital stock, $100,000. Promoters: Peter W. French, Weymouth, Mass.; T. Putnam Symonds, Salem, Mass.; Wm. E. Merill, Haverhill, Mass.

The Loop Construction Company, Chicago, Ill.—to build and construct elevated and electric railroads; furnish materials and appliances for same. Capital stock, $1,000,000. Promoters: Douglas Hotchkiss, Geo. E. Newlin, Wm. M. Johnson.

The Rushville Electric Light Company, Rushville, Ill. Capital stock, $12,500. Incorporators: C. W. Weinman, John Foote, H. Wells and John S. Little.

The Elyria, Oberlin and Wellington Electric Railroad Company, at Toledo, Ohio—to construct and operate an electric railway eighteen miles long. Capital stock, $100,000. Incorporators: A. R. Webber, W. A. Braman, R. J. Reefy, W. B. Bedortha, Charles A. Metcalf, J. W. Steele, A. H. Johnson and Parks Foster.

The Tri-Village Telephone Company—to connect Fort Edward, Sandy Hill, Glens Falls and South Glens Falls, N. Y. Capital stock, $2,500. Directors: Marcus C. Allen, J. E. Howland, of Sandy Hill; Joseph E. King, F. B. Davis and G. C. Beverly, of Fort Edward, J. W. Hunting and J. I. Dunn, of Glens Falls.

The Cushman Electric Company, Saco, Me.—to manufacture electrical apparatus. Capital stock, $300,000. President, B. A. Kimball, of Concord; treasurer, Ambrose Eastman, of Boston.

The Maine Electric Company, Portland, Me.—to manufacture and deal in all kinds of machinery and electrical supplies. Capital stock, $10,000. President, Wm. M. Lamb, Cumberland Mills; treasurer, O. Warren Neal, Westbrook.

$1,000,000. Promoters: T. J. Ryan, Geo. W. Walts, F. Milton Johnson, G. W. Fleming, Harvey W. Snow, San Francisco.

The Knoeller Car Improvement Company, Jersey City, N. J.—to acquire by purchase patent and patent rights for improvements for use in electric, cable and street cars, etc. Capital stock, $5,000. Promoters: Jas. Ridley, Patrick A. Kilroy, Daniel Y. Lewis, Geo. B Fielder, Jersey City.

The World's Flash Company, Chicago, Ill.—to manufacture, buy and sell electrical appliances of all kinds and electrical machinery. Capital stock, $90,000. Promoters: Leroy D. Thoman, Fred. W. Harnwell, Walter S. Holden.

The Gerson Electrical Manufacturing Company, Philadelphia, Pa.—to manufacture iron and steel, etc. Capital stock, $50,000. Promoters: Chas. Hermitage, Louis J. Gerson, Philadelphia; F. C. Rice, Brooklyn, N. Y.

The Pacific Mineral Reduction Company, San Francisco, Cal.—to prosecute mining and milling; deal in water rights and construct ditches, electric light plants, and supply power for manufacturing purposes. Capital stock,

Watseka Automatic Telephone Company, Chicago Capital stock, $10,000. Incorporators: W. H. Harry, H. Darlington and E. E. Wood.

The Tillamook Electric Railway, Power and Light Company, Tillamook, Oregon—to build, own and operate an electric railway. Capital stock, $500,000. Promoters: W. H. H. Cary, Davis Hess, Wm. Squires, Tillamook.

The Electric Bell and Resistance Company, Newark, N J.—to manufacture and deal in electrical devices and electrical supplies. Capital stock, $10,000. Promoters: Geo. F. Atwood, Isaac M. Williams, Orange, N. J.; Jas. P. McKenna, Newark.

The Ceramic City Light Company, Chicago, Ill.—to generate electricity for use in furnishing light, heat and power, and distribute and sell the same. Capital stock, $50,000. Promoters; Philip M. Smith, Chas. M. McKeehan, Wm. E. Smith, Alex. R. Wells A. Curtis Vandyke.

Woven Wire Brushes.

The Belknap Motor Company of Portland, Me., are the patentees and manufacturers of the best Woven Wire Brush on the market.—[*Adv.*

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JANUARY 1-8, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

531,664. Closed Conduit for Electric Railways. Robert J. Turnbull, St. Paul, Minn., assignor of one-half to Augustus F. Priest, same place. Filed Jan. 19, 1894.

531,837. Trolley. Theodore Cooper, Providence, R. I. Filed Sept. 17, 1894.

531,873. Electric Railway. Abraham A. Shobe and William Embley, Jerseyville, Ill. Filed July 24, 1894.

531,980. Electric Rail-Bond. George E. Somers, Bridgeport, Conn. Filed May 7, 1894.

532,031. Self-Adjusting Trolley. John Corcoran, Harrisburg, Pa., assignor of one-half to Alfred T. Black, same place. Filed Aug. 29, 1894.

532,057. Motor Suspension for Electric Street Cars. Samuel Harris, Cleveland, O. Filed May 19, 1894.

532,113. Converter System for Electric Railways. George W. Swartz, Florence, Ala. Filed Oct. 12, 1893.

532,126. Supply System for Electric Railways. Albert G. Wheeler, Chicago, Ill., assignor to the Love Electric Traction Company, same place. Filed Jan. 21, 1893.

532,133. Trolley-Wire Clip. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Anderson, same place. Filed July 9, 1894.

532,157. Underground-Trolley Arm. Paul C. Just, Chicago, Ill., assignor to Albert G. Wheeler, same place. Filed Jan. 4, 1894.

532,163. Conduit Tramway. John C. Love, Philadelphia, Pa., assignor to the Love Traction Company, Chicago, Ill. Filed Sept. 5, 1893.

532,165. Conduit for Electric Railways. John C. Love, Chicago, Ill., assignor, by direct and mesne assignments, to the Love Electric Traction Company, same place. Filed May 9, 1894.

532,167. Electric-Railway Trolley. John C. Love, Chicago, Ill., assignor, by direct and mesne assignments, to the Love Traction Company, same place. Filed May 9, 1894.

532,168. Trolley-Wire Clamp. John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Company, Chicago, Ill. Filed July 11, 1892. Renewed Oct. 13, 1894.

532,185. Conductor-Bond for Meeting Ends of Rails of Electric Railways. Peter Rieth, Chicago, Ill., assignor of two-thirds to John McGeean and James McGeean. Filed June 14, 1894.

532,195. Trolley-Support. Lucius T. Gibbs, Milwaukee, Wis. Filed July 28, 1893.

532,200. Trolley for Electric Railways. John C. Henry, Westfield, N. J. Original application filed Sept. 27, 1889. Divided and this application filed March 8, 1893.

532,261. Conduit Electric Railway. Albert M. Burgher, Clay City, Ky. Filed April 17, 1894.

532,302. Closed Conduit for Electric Railways. Frank Windle, Philadelphia, Pa. Filed March 8, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

531,663. Base for Incandescent Electric Lamps. George C. Thomas, South Framingham, Mass. Filed Nov. 28, 1893.

531,698. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed April 5, 1894.

531,729. Adjustable Hanger for Incandescent Lamps, Gas Fixtures, etc. Harry W. Lawrence, Denver, Colo., assignor to the Electrical Specialty Company, same place. Filed Dec. 1, 1893.

531,751. Electric-Arc Lamp. Albert Schweitzer, Allegheny, Pa., assignor of two-thirds to Frederick Goellner, same place, and Conrad Weber, Shaler, Pa. Filed June 22, 1894.

531,840. Adjusting Mechanism for Arc-Light Carbons. Elie F. G. H. Faure, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, same place. Filed Aug. 22, 1894.

531,978. Electric Arc Lamp. Chas. E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 7, 1891. Renewed May 9, 1893.

532,095. Electric Arc Lamp. Amos W. Richardson, Patricroft, England. Filed March 2, 1894.

532,103. Electric Lamp Support. Frank Schefold and James Nortney, New Albany, Ind. Filed March 1, 1894.

DYNAMOS, MOTORS, ETC.

531,623. Armature for Dynamo-Electric Machines or Motors. Ward Decker, Owego, N. Y. Filed Nov. 17, 1892.

531,657. Transmuter for Electrical Currents. William J. Still, Toronto, Canada assignor of one-half to Randolph MacDonald, trustee, same place. Filed April 5, 1893.

531,707. Brush for Dynamo-Electric Machines. John B. Wallace, Ansonia, Conn., assignor to the Wallace Electric Company, of Illinois. Filed April 30, 1894.

531,790. Method of Operating or Controlling Electric Motors or Dynamos. Rudolf Eickemeyer, Yonkers, N. Y. Filed Nov. 2, 1891.

531,821. Constant-Current Dynamo. James J. Wood, Fort Wayne, Ind. Filed July 3, 1894.

531,996. Electric Converter. Robert H. Hassler, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed April 30, 1894.

BATTERIES.

532,128. Storage Battery. Theodore A. Willard, Norwalk, Ohio. Filed Jan. 5, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

531,650. Telephone Indicating Apparatus. John I. Sabin and William Hampton, San Francisco, Cal. Filed July 25, 1894.

531,677. Printing-Telegraph. Samuel V. Essick, Yonkers, N. Y. Filed April 20, 1893.

531,854. Telegraphic Transmitter. John J. O'Neill, New York, N. Y. Filed Feb. 23, 1894.

531,913. Telephone-Switch. Augustus G. Davis, Baltimore, Md. Filed Nov. 23, 1893.

MEASURING INSTRUMENTS.

531,866. Method of and Means for Measuring Energy of Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Filed Sept. 19, 1894.

531,867. Method of and Means for Measuring Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Filed Sept. 19, 1894.

531,868. Indicating Watt Meter for Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Filed Sept. 19, 1894.

531,869. Watt Meter for Multiphase Alternating Electric Currents. Oliver B. Shallenberger, Rochester, Pa. Original application filed Sept. 19, 1894. Divided and this application filed Nov. 24, 1894.

531,870. Alternating-Current Measuring Instrument. Oliver B. Shallenberger, Rochester, Pa. Filed Nov. 24, 1894.

531,970. Electrostatic Voltmeter. Henry A. Rowland, Baltimore, Md. Filed Feb. 24, 1894.

SIGNALS AND SIGNALING APPARATUS.

531,651. Electric Block-Signal. Charles H. Sallada, Pittsburg, Pa. Filed April 9, 1894.

531,669. Indicator for Electric Currents. Edward Weston Newark, N. J. Filed Feb. 21, 1894.

531,708. Electric Signal. William J. Wessenberg and Horatio F. Wilbur, Meriden, Conn. Filed Aug. 12, 1893.

531,919. Electric Railway-Signal. Jake Frank, New York, N. Y. Filed Nov. 27, 1893.

532,008. Electric Signaling Apparatus. George E. Miller, Saugus, Mass., assignor to the American Electric Train and Switch Signal Company, Portland, Me. Filed Jan. 24, 1894.

532,009. Electric Semaphore-Setting Device. Homer A. Parrish, Jackson, Mich. Filed Feb. 10, 1894.

532,122. Railway Signal. James Wayland, Newark, N. J. Filed Jan. 24, 1894.

532,291. Electric Burglar Alarm. Horace M. Scholes and George M. Meyers, Kansas City, Mo. Filed April 17, 1894.

MISCELLANEOUS.

531,635. Electric Wire Holder or Insulator. Albert Iske, Lancaster, Pa. Filed May 29, 1894.

531,690. Phonograph. Stewart D. McKelvey, Canton, Ohio, assignor of one-third to Joseph A. Linville, same place. Filed March 31, 1892.

531,702. Cleat for Electric Wiring. Joseph H. Swift and William F. Maintien, Plainville, Mass. Filed March 17, 1894.

531,709. Electro-Magnet. William J. Wessenberg and Horatio F. Wilbur, Meriden, Conn. Filed Sept. 27, 1894.

531,764. Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed May 8, 1894.

531,765. Circuit-Regulating Device in Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed May 28, 1894.

531,849. Electric Steam-Engine Governor. Chester B. Melott, Rondout, N. Y. Filed July 21, 1894.

531,890. Coin-Controlled Electrical Musical Instrument. Philip Wuest, Jr., Philadelphia, Pa. Filed Sept. 12, 1893.

531,929. Safety Device for Electric Circuits. Thomas Harden, London, England. Filed April 27, 1894.

531,961. Circuit-Controller. Thomas Parker, John H. Woodward, and Edmund S. G. Rees, Wolverhampton, England. Filed Feb. 24, 1892.

531,962. Distribution of Electricity. Thomas Parker, John H. Woodward and Edmund S. G. Rees, Wolverhampton, England. Filed Feb. 24, 1892.

532,016. Electrically-propelled Vehicle. Henry C. Baker and John R. Elberg, Kansas City, Mo. Filed April 6. 1894.

532,101. Insulator for Electric Wires. Daniel M. Rothenberger, Lancaster, Pa., assignor of one-half to Chas. A. Inglis, same place. Filed April 4. 1894.

532,160. Insulator. Myron D. Law, Washington, D. C., assignor to Albert G. Wheeler, Chicago, Ill. Filed Aug. 29, 1893.

532,161. Conductor. Myron D. Law, Washington, D. C., assignor to Albert G. Wheeler, Chicago, Ill. Filed Sept. 28, 1894.

532,164. Conductor Support. John C. Love, Chicago, Ill., assignor, by direct and mesne assignments, to the Love Electric Traction Company, same place. Filed May 9, 1894.

532,166. Tension Device for Electric Conductors. John C. Love, Chicago, Ill., assignor, by direct and mesne assignments, to the Love Electric Traction Company, same place. Filed May 9, 1894.

532,188. Electric Hair Clipping Machine. Peter Shannon, Chicago, Ill. Filed April 27, 1894.

532,260. Cross-Arm for Support of Electric Wires. Edward J. Bullock, Wallingford, Conn. Filed Nov. 19, 1894.

532,353. Lightning Arrester. Alexander Wurts, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 28, 1894.

532,354. Lightning Arrester. Alexander J. Wurts, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Aug. 3, 1894.

ELECTRICITY.

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N. E. L. A.—The next annual meeting of the National Electric Light Association will be held at Cleveland, O., February 19-21, 1895. Every concern interested in either lighting or railway work should be represented in the membership of this body, and should have at least one representative at the Cleveland meeting. The Secretary is Mr. Geo. F. Porter, 136 Liberty street, New York.

EDITORIAL NOTES.

The Brooklyn Trolley Strike.

At last we are confronted with a strike of large proportions on the trolley roads, and as we go to press it is announced that the situation has become so serious in Brooklyn as to necessitate, in the opinion of the authorities, the calling out of the New-York troops. Under such circumstances it is customary for the editor to moralize and indulge in platitudes, but these resorts avail nothing. We are sorry that recourse to the usual strike methods has found its place among electrical workers. Granted that both parties to the controversy are partly right and partly wrong, the striker starts out with the sympathy of the public. So far he has an immense advantage over the corporation for which he works, but he loses that advantage so soon as he resorts to strike methods. He nullifies the effect of his own arguments by resorting to the very methods with which he is finding fault. The company, he says, is overbearing, autocratic,—and then in trying to fight this company the striker becomes ten times more overbearing and autocratic. He says he will not work for such wages or for such hours as are required, and he has a perfect right to say this, but then he goes further and says no one else shall work under these conditions, and the company shall not conduct its business unless it conducts it according to his ideas.

The laboring man or mechanic must understand that the company for which he works is as much a creature of circumstances as he himself is. It must cater to the public—to its customers—if it would live. There is no corporation so strong that it may say with impunity, "The public be damned." Only in so far as it successfully caters to its patrons' wants can it succeed. Only in so far as it conducts its business successfully can it pay wages. The poorer we are the more necessity do we find for curtailing expenses. This applies less to the wealthy than to the poor, but the law is inflexible. If a corporation is wealthy it can afford to pay better wages—whether it does so or not is a different matter—but in so far as its capacity for earning money is crippled just so far will its *ability* to pay good wages be lessened—and that is the method into which all strikes sooner or later degenerate, viz., in trying to force higher compensation by crippling the capacity of capital to pay anything. The whole thing is illogical and a repetition of the mistaken policy of killing the goose that lays the golden eggs. Resort to legislation has been proposed and tried, both to regulate the price of labor and to regulate the price of other commodities, but it has in all cases failed, and must in all cases fail. It is no more possible to regulate the price of a commodity by law—and labor, whether it be skilled or menial, is a commodity—than it is to regulate in the same way the ebb and flow of the tides. The price of any commodity is regulated by the law of supply and demand, which is quite as inflexible as the other natural laws which control the movements of the heavenly bodies and of the tides.

Each individual, however, can do something to increase the wages he will get, and that something is to increase the actual value of his services by becoming more expert in that which he undertakes to do. A skilled mechanic need fear no competition from workmen of an inferior grade. The more selfish the corporation that comes into the labor market the stronger will be the position of the skilled artisan, for the simple reason that he can make more money for his employer with less expenditure of labor. No legislation, however severe, can place upon a par two things which are not intrinsically equal. The law cannot make two dollars equal to three dollars of the same money, nor can it make inferior services equal to those that are superior. The unions, too, can do much. They can elevate the character and quality of the material of which they are composed. It should be their province to have laws passed making membership in their organizations contingent upon real merit. Then to wear the badge of the union would be to wear the badge of merit, and capital would come to the union for its labor, not because of threatened disaster if it went elsewhere, but because of its very cupidity, that it could thereby make more money. They should agitate the passage of State laws requiring that electrical workers, say, should be up in their business before they are qualified to enter the trade. They should be required to pass an examination before some competent tribunal and receive a certificate of proficiency before they are permitted to enter the ranks. Just how high this standard of proficiency should be is a matter that should probably be left to the unions to decide. Probably it would be best to have several standards from which the novice might pass by successive stages as his proficiency entitled him to advance. There would be no competition between these different grades, because there can be none between merit and demerit, but there would be a competition in skill between the members of the same grade with the laudable incentive to step higher up to a position where their services would command more consideration by reason of their greater intrinsic value. But this would be solely a competition of merit wherein the men themselves would be the sole judges.

The employer, too, has not less to learn than the employed. So long as he conducts himself so as to give ground to the suspicion that he will take unfair advantage of his employees—that he is seeking opportunities to grind them down—so long will the employee rebel, whether he be skilled or unskilled. His first duty is to dispel this idea of unfairness, and if it requires greater sacrifices on his part to accomplish this, still he must do it, or that potent influence called "public opinion" will be arrayed against him. Each side must be absolutely fair to the other, and above all let the employee be fair to himself. Let him not attempt to foist upon the employer as an equal one whom he knows is his inferior. It is unfair to himself, unfair to the union and unfair to the employer.

* * *

The Fixture Trust. Of all the attempts at forming Trusts none had fewer chances of success than the so called Fixture Trust, none flattened out so quickly and so completely, none was so ridiculously managed. One by one all Trusts are dissolving, and a few years more will see the last of these attempts, in this generation, to overturn the law of supply and demand, the law of competition, and all other sound business laws upon which the world's commerce has been built up.

Mr. Clement M. Biddle, the originator of the Fixture combination, had made money in one or two other similar trades and had grown too confident. In order to bring recalcitrant concerns into line he offered to buy them outright, offering any price, even twice their value, but always in-notes with little cash. All but one or two were gathered in, the firm of Horn, Brannen & Forsyth being the most conspicuous one to remain outside.

The Trust was scarcely completed when disaster began to pile up thick around its various branches and disintegration was forced.

The patents of Mr. Luther Steiring, owned by Mailland of Detroit, were relied on to bring in a large revenue, and they did so for a year or two until defeated in the courts by the Gibsons of Philadelphia. Nearly every house in the trade had agreed to pay a 3 per cent. royalty on their gross business; but this arrangement was short-lived and the field was open again.

Some of the pillars of the combination, Archer Pancoast, Oxley Giddings and others, were forced into bankruptcy and large losses sustained by both stockholders and creditors.

The General Fixture Company shared in the disaster, and it is now rumored that an appraisement is to be made and the property sold. The Northwestern Hardware Company (the name the Trust was to work under) had paid on account of the purchase of this company about $200,000 and given $400,000 in notes. They now claim the condition of the concern was misrepresented and are suing to recover the money paid and to cancel the remaining notes. Meantime the company has been a financial charge upon its parent, the General Electric Company.

The business of every concern which went into the combine was badly injured and some were ruined completely. The promoters themselves have lost large amounts of money, and there has been nothing but disaster from start to finish.

With the wrecks of 75 per cent. of all Trusts formed in the past ten years before us, is any further argument necessary to prove that the fundamental idea of Trusts was wrong, is wrong, and always will be wrong?

* * *

A Sound Idea. The Hartford (Conn.) Board of Fire Underwriters have taken steps to compel electric wiremen to pass an examination before being allowed to work at their trade in that city. Charles E. Chase, president of the board, has been instructed to appoint a committee to present the facts to the Court of Common Council and ask that no wiring of houses be permitted by any except licensed electricians. The passage of such an ordinance in any city would insure the work being done by competent men, and in a way to reduce the danger of fires, etc., to a minimum.

In many cities steam engineers are compelled to undergo examinations and to work under licenses. There are many reasons why those in control of electrical plants, and wiremen also, should be under similar official regulation.

True, the danger of explosions is not present in electrical apparatus, but there are other dangers equally serious. Such a plan would work to the advantage of competent men, and would at once produce a higher standard of service. In the wiring branch alone there is urgent necessity for its adoption, and if properly enforced its benefits to the public and to the better class of workmen would be manifest.

This is one of the few questions which are almost beyond argument. No sound objections could be offered by any one. Hartford is on the right track, and we hope other cities will take up the subject at once.

* * *

Falling into Line. For some time the New York, New Haven and Hartford Railway Company have suffered from the competition of the trolley systems which parallel and cross their lines at scores of points through New England. Their last two annual reports have commented on the bad effects of this competition on the system, and the railway company have made several attempts to hamper intended trolley competitors by bringing annoying suits to prevent the latter from crossing the tracks of the former.

Now it is announced that the New York, New Haven and Hartford Railway Company have decided to equip two of their branches with electrical motive power. One of these is the Nantasket Beach line, which conveys passengers to that resort chiefly in summer. The other is the line from Providence to Fall River, conducted in connection with the Sound steamers. The latter road is about forty miles long. One of the officers of the road has called attention to the fact that the four-track system between New York City and New Haven, about seventy miles long, is in such a condition and is so constructed as to permit the use of electricity as soon as it is made clear that a change of this magnitude is warranted.

Whether electricity as a motive power will ever displace steam on trunk lines is still an undecided question. But that it may be adopted on innumerable branches of steam roads with profit and satisfaction there is scarcely a doubt. We are glad that the leading railway system of New England, where the influence of the trolley cars has been most felt, have given up fighting the march of progress and decided to join in the procession.

It is also announced that the Brooklyn elevated railroads, alarmed at the inroads the trolley cars have made on their receipts, are about ready to adopt electricity and to add an elevator service to each of their stations.

Thus the public are placed under obligations to the promoters of the trolley system, who are forcing the adoption of better and more enjoyable rapid transit facilities than were dreamed of ten years ago. And whatever plans may be adopted by its competitors the trolley will maintain its position.

* * *

The Cleveland Convention. There is every indication that the Cleveland meeting of the National Electric Light Association will be a thorough success. The programme arranged so far is an excellent one, and gives promise of a series of vigorous discussions.

There is sure to be a large attendance. ELECTRICITY has in preparation a special issue for this meeting which will be fully worthy of the occasion. It is not our custom to get out a special issue every second week, and when we announce one we do so in the full assurance that we can offer advertisers a *special* opportunity of being represented in a paper which will be thoroughly read for its interesting matter and then preserved as a work of art. Orders should be placed at once.

Under the Searchlight.

Views and Opinions on Timely Topics.

In an early issue we will publish a complete list of the stocks and bonds carried on the G. E. books as assets, also those sold to the Securities Company, the Electric Corporation, and the Street Railway and Illuminating Properties, with the total capitalization of each of the local companies. It should be preserved for reference.

* * *

Last year the G. E Company had $8,000,000 of patent assets—so they said. The only patents of value have now either expired or been declared invalid, and the patent account, we fear, will soon be in debt to "shop cost" or to profit and loss account.

* * *

The Offer is Still Open.

Electricity offers to put up $200 with any party to be agreed on, the *Electrical World* to put up an equal amount, the sum to be divided between the A. I. E. E. and the N. E. L. A., to prove whether the *Electrical World* has or has not 4,000 paid subscribers. Decision to be rendered by a committee of three, each side to choose one, the two to choose the third.

Step up to the captain's desk, Mr. Johnston.

* * *

The Cause a Mystery.

(From the Elmira Gazette.)

Patrons of the Elmira and Horseheads Street Railroad must have noticed that at times recently the current would desert the trolley and the car would stop. Many of them will be surprised to learn that the cause of this is a mystery. Superintendent Cheney of the electric light station is a great electrician, but he has failed to discover the cause. Many others have looked for it, but they, too, have been unsuccessful.

A few years ago, before the service of the New York Steam Company had reached its present state of perfection, there were several leaks in Mail street from the company's pipes—veritable geysers rising high in air. They remained there for days, and when the reporters sought the manager, Mr. F. H. Prentiss, he told them he had been unable to find the cause. The New York *Times* suggested that Mr. Prentiss be compelled to sit on one of the geysers until he discovered the cause. Perhaps Superintendent Cheney better be compelled to ride the trolley until he finds out why the current persists in deserting.

* * *

Speaking of bribery, how would some of the expense sheets of the old "special agents" look in cold type?

* * *

Maps and Their Uses.

We have received several copies of a map of a great portion of the world, upon which have been engraved a large number of figures, purporting to show the circulation of the *Electrical World* in various States and countries, which leads us to consider the question of maps.

Not many years ago when Richard Croker, "Awful" Gardner, Owney Geoghegan, Judge Norton, Fatty Walsh and other prominent men were shining ornaments of the prize ring, when prize fighting was as common as meetings of good government clubs are nowadays, and when the reports of scrapping matches formed a leading feature of the regular news of the day, the New York *Herald* managed to beat its contemporaries regularly in obtaining reports of the fights. They had so many scoops that the city editors of many other papers were in danger of losing their jobs.

Finally a reporter on the Brooklyn *Eagle* conceived a brilliant idea. He bought a real estate map of the city of Brooklyn and started in on his own hook to report prize fights from his room in a boarding house. Night after night he located and described in detail bloody mills, first in one section of the city, then in another, on vacant lots. He beat the *Herald* so often that they sent an army of reporters to Brooklyn, until every second man on the street was a *Herald* reporter looking industriously for a prize fight. At last, by mistake, a fight was located on premises which were directly under the windows of a station-house. The police officers investigated the source of the *Eagle's* news, and the bright reporter was compelled to throw away his map and again devote himself to reporting events which had taken place.

The circulation story told by the map of the *Electrical World* is about as truthful as the stories of fights told by the *Eagle* reporter and his now famous map.

* * *

Street Railway and Illuminating Properties.

The trustees of Street Railway and Illuminating Properties have retired 939 additional shares of preferred stock, paying an average price of 110⅛ flat. This makes a total of 28,500 shares purchased to date and leaves outstanding 21,500 shares.

The profits of this syndicate will be more than enough to have paid a 5 per cent. dividend on the G. E. common stock for two years.

* * *

Buffalo and the Falls Power Scheme.

Buffalo has been in a turmoil for some weeks over the question of granting to the Niagara Falls Power Company a franchise enabling it to get the Niagara power into the city.

It is now made known that the Buffalo General Electric Company's franchise is sufficient for all the needs of the Power Company.

The deal between the General Electric Company and the Niagara Falls Power Company's interests, mentioned in Electricity some weeks ago, is in a fair way to be uncovered.

* * *

Boston men were blamed for the over-valuations in the first report of G. E. Who will be blamed for the over-valuations in No. 2? Let us wait and see.

* * *

They do strange things in Philadelphia. A recent illustration in the *Inquirer* of that city showed an attaché of the Electrical Bureau in the City Hall engaged in the diversion of killing rats by electricity. It was stated that the rats are first caught in ordinary traps.

* * *

Electricity confidently expects such a thorough reorganization of the G. E. Company this year as will allow us conscientiously to extend the right hand of fellowship and welcome it back to the ranks of honest companies minding their own business and not interfering with the rights of others.

* * *

The Electrical Trust was not a funny term in 1892, but in 1895 it sounds like a joke.

* * *

The *Wall Street News* states that the Thomson Regulator patent was carried on the G. E. books at $2,000,000.

The National Electric Light Convention.

The Trunk Line Association have granted a rate of a fare and a third for the round trip, on the certificate plan, for members and delegates attending the Eighteenth Convention, to be held at Cleveland, February 19, 20 and 21. Negotiations are now pending for a special train from New York to Cleveland, notice of which will be given as soon as route is selected and schedule arranged.

Truth is Stronger than Fiction.

"Electricity" Makes No Statements Which Are Not Easily Verified by Others.

(From Electricity, Jan. 2.)

But admitting that the debts are paid, that bonds have been retired, how has it been done? From profits in the business? Certainly not. They (the G. E. Co.) have sold during the year a large amount of local securities, have cleaned up a number of bad accounts, and with the proceeds from these two sources they have reduced their debts and retired some bonds.

(Inspired Financial Paragraph, Jan. 3.)

The allegation that the $1,000,000 bonds retired last year were not paid out of earnings is declared to be untrue, as the company now depends upon its earnings rather than new capital for all its expenditures. This has been true ever since the St. R. and Ill. Properties issue.

A TRUTHFUL DIRECTOR.

What Do Messrs. J. P. Morgan & Co. Say to This?

(From the Lynn (Mass.) Item, Jan. 12, 1895.)

A General Electric director says the only indorsement likely to be outstanding at the end of the fiscal year will be $2,800, which cannot be got at. Present indorsements are only $35,000.

He further said that the company was not applying net revenues to the purchase of the company's bonds but the proceeds of assets sold. He thought that considerably over $1,000,000 of the bonds had been bought for the treasury. **CURRENT REVENUES WERE USED IN THE BUSINESS.**

The "profits" are all needed in the business. Electricity said this three weeks ago, and we never make a mistake.

The statement mentioned above as to the retirement of bonds not out of profits but out of assets sold was made to the financial editor of the Boston *Herald* by a director of the G. E. Company who knows what he is talking about, two weeks after Electricity published the fact.

Where Will the Proceeds Go?

To Retire Bonds, We Guess.

It is reported in our news columns this week that Messrs. Tucker, Anthony & Co., of Boston, have purchased of the General Electric Company the Macon Consolidated Street Railway system.

This is one of the properties grouped together in the last G. E. report, par value, $3,860,338.33, carried at $4,766.75.

(From the Boston News-Bureau.)

The General Electric has bought in another $100,000 of its bonds and has now on hand between $1,100,000 and $1,200,000 of its own bonds.

From whom does the company buy these bonds?

Who are the brokers?

How much regular commission do they get?

What do the brokers pay?

How large are their shavings?

Why are bids not invited in regular and legal manner?

(From the Commercial Advertiser.)

The statement is made by an official of the company that the earnings during the year just closing would have been sufficient to pay something like 4 per cent on the stock.

Four per cent. of $34,711,600.00 is $1,388,464.00. If this has been earned, where is it? It is not in the treasury. There was only $744,000 of floating debt January 31, 1894. Where have the proceeds of notes collected disappeared to?

VANISHING ASSETS.

The Thomson Regulator patent, declared void last week by Judge Grosscup in Chicago, was carried on the G. E. books as worth $2,000,000 of the $8,000,000 of patent assets which they claimed in April.

The feeder and main patent was valued at about the same figure, and this was declared void in the U. S. Circuit Court at Philadelphia some months ago.

The lamp patent, $3,000,000 more, expired in November.

There now remains only the three-wire patent, which no one needs to use.

What are the patent assets carried at now ?

Is Mr. Ord scratching his head while pondering on this subject ?

The Electropoise.

An Honest Religious Journal.

The "Christian Advocate's" Position Clearly Stated.

(From the Christian Advocate, Jan. 17.)

REFUSED—AND WHY.

Electricity, of this city, is carrying on with vigor and every appearance of thoroughness the exposure of what it calls "a fraud,' "an outrageous humbug," "a swindling scheme," "a nefarious enterprise," "a worthless device," "an arrant fraud," "a cheat," "worse than the Louisiana Lottery." It publishes an analysis of it, and specifies what it declares to be five fraudulent claims.

Its proceedings would not have demanded notice from us if among its list of religious papers condemned for advertising it we had not seen the *Sunday School Times* and the *Christian Advocate*. As we should have been greatly ashamed if the charge had been true, and, knowing it to be false, we delayed for a week or two to see whether Electricity would retract it.

In the next number it published a card from Dr. Trumbull containing this sentence :

> The *Sunday School Times* rejected the advertisement of the [here the name of the trap is given] before the members of the electrical profession seemed to be aware of its unsavory nature.

Electricity humbly apologized for the error and accounted for it by stating that

> when we prepared our article we were informed by the editor of the *Christian Nation* that he had accepted the advertisement because it had been investigated and accepted by the *Sunday School Times* and that their acceptance of it was sufficient warrant for him.

Meanwhile we had written a note to the editor:

> We hereby inform you that the *Christian Advocate* did not publish that advertisement. It was offered to the paper, but when shown by the advertising agent to the editor it was rejected on the ground that it was a transparent humbug.

Electricity published the note, and accounted for supposing that it was advertised in the *Christian Advocate* by the fact that a person connected with this paper had signed an extravagant recommendation of the thing, and then says :

> It thus seems that there is a wicked partner in the joys and sorrows of the *Christian Advocate* editorial staff. The wicked partner indorses most fully [here the name of the trap is given] over his own name, etc.

There is but one authority who decides what advertisements shall be admitted to the *Christian Advocate*, namely, the editor. Because any person who gives the whole or a part of his time to editorial work on the *Christian Advocate* happens to recommend an unworthy article, to assert without investigation that the same was advertised in the *Christian Advocate*, is a carelessness which a paper engaged in exposures should be above.

At the same time Electricity has honorably given the retraction due publicity.

We do not employ persons because of their opinions upon outside matters. A man may be an allopath, homeopath, hydropath, an eclectic, a vegetarian, be deluded by one or many forms of quackery, or certify that a horse chestnut carried in his pocket cured him of rheumatism; he may be a Prohibitionist, a Republican or a Democrat in politics; he may favor woman suffrage or oppose it; if he is of good character, and does his work satisfactorily, it is all that is required of him.

[We are only too glad to give publicity to this statement of the *Christian Advocate's* position, for it goes a long way toward setting it right before the public. What the editor says as regards his indifference to the tenets of his employees is all right so long as those tenets are not given the appearance of authority by the use of the paper's name in connection with the holders of those beliefs. As it is, Dr. DePuy's name is not mentioned in connection with the Electropoise except as the editor or assistant editor of the *Advocate*. In this way a scandal has been brought upon the good name of the paper, and while the *Christian Advocate* need not concern itself, perhaps, with the personal opinions of its employees, it seems to us that it should be a matter of great concern if those opinions are hawked abroad in such close connection with the paper's name as to seemingly identify the individual and the paper. However great an offence against good taste (to use a very mild expression) it is for Dr. DePuy to seek notoriety in the way he is doing, it would be a matter simply between himself and his conscience if he appeared as an individual only. But when the initials D. D. are used in connection with his name it creates in the minds of the unreasoning a scandal upon the church, and when "assistant editor of the *Christian Advocate*" is also added it implies a responsibility that a paper jealous of its good name can ill-afford to shoulder. We have always believed and are glad to believe that the *Advocate's* skirts are entirely clean, but its name is constantly being used in a way to bring discredit not only upon itself but upon the cause it so ably espouses.—Ed.]

LEGAL NOTES.

In the suit between the Homestead Street Railway Company and the Pittsburg and Homestead Railway Company, Judge Green, of the Pennsylvania Supreme Court, has rendered a decision adverse to the former company, holding that under the law for the incorporation of street railways there can be but one street railway franchise over the same highway. The Pittsburg and Homestead Railway Company, having had a prior charter and right of way granted, has the sole right over the road in question, and the grant to the Homestead Company was a void act.

Suits have been filed in the U. S. District Court at Knoxville, Tenn., against the Knoxville Electric Street Railway by the Union Trust Company of New York and the Thomson-Houston Company of Massachusetts. The plaintiffs seek to foreclose the mortgages and have the road sold. The road has been in the hands of a receiver for nearly three years.

Judgment Against G. E.

The General Electric Company has been assessed $5,000 damages by a jury in the Supreme Court, New York City, before Judge Beach. The plaintiff was George R. Burke, suing as administrator of the estate of his son, Carl Burke.

Carl Burke was in the employ of the Ringler Brewery several years ago. The Edison General Electric Company was putting a plant in the brewery. While the company's employees were rolling an engine into the place one of the rollers slipped from under a plank and fell down into the basement. It struck Burke, who happened to be passing, and caused his death.

Popular Electrical Science.

IX.

The Magneto Telephone—Plain Directions How to Construct at Small Expense a Most Serviceable Instrument for the Residence or Office—The Days of Speaking Tubes are Past.

BY NELSON W. PERRY, E.M.

Thus far I have described only the magneto-telephone whereby the magnetic and electrical oscillations or waves are caused solely by the vibration of an iron armature in front of a permanent magnet around the pole or poles of which are wound coils of insulated wire forming part of the transmission circuit. With this no battery is required, and for short distances it is superior to the battery telephone (to be described later) on account of its greater simplicity and the almost impossible contingency of its getting out of order. The magneto instrument, therefore, is peculiarly adaptable for house use and for connecting together the different parts or departments of a large manufacturing establishment. It may also be used to good advantage over greater distances if specially wound for such service. In fact conversation has been carried on successfully by means of magneto instruments between New York and Cleveland, and circuits 15 to 20 miles long were at one time not uncommon. The first telephone exchange in Boston was for several years operated entirely with these instruments, and for some time after the first introduction of the telephone the magneto instrument was the only one in use anywhere. The battery telephone has some advantages which will be referred to later, but the magneto, by reason of its all but indestructibility, is pre eminently the private line instrument.

To enable any of my readers to construct a serviceable instrument of this kind I append the following instructions :

Buy of some optician or electrical supply house a small permanent horseshoe magnet about 2½ inches long. This should cost at retail not over 10 cents. Have two holes bored clear through both of the poles, leaving enough metal around them so that the steel will not be materially weakened. In having these holes drilled do not permit the steel to be heated for the purpose of facilitating the drilling, for if the temper be drawn the magnetism of the magnet will be destroyed and the usefulness of the magnet for the purpose greatly impaired. Next cut off two pieces of soft iron wire—the softer the better—about $\frac{3}{16}$ inch in diameter, and $\frac{7}{16}$ inch long. Turn down one end of each of these pieces so as to make a tight fit into the holes drilled in the magnet (*A B*, Fig. 1), and drive them home as shown in Fig. 2.

The reason for making these pole pieces (*A B*, Figs. 1 and 2) of soft iron is that the latter is much more sensitive to changing magnetizing influences than hardened steel, and it has been pointed out that the operation of the telephone is dependent upon these rapid changes for its efficacy. When these soft iron pole pieces are inserted they will be found to be strongly magnetized by their contact with the permanent magnet.

Next buy a spool of cotton-insulated copper wire of No. 32 gauge or smaller. An eight-ounce spool, which will contain enough wire to wind telephones for the whole neighborhood, can be had at retail for 60 cents or less.

This may be wound directly on the cores *A* and *B*, but it will be found more convenient to wind the coils on shallow spools first and then slip these over, as shown in Fig. 3. These spools may be conveniently prepared and wound as follows: Whittle down a pine stick to about the diameter of the cores *A B* or a trifle larger and wrap on this two or three turns of dry manilla paper cut into a strip, say about an inch wide. Cut out of pasteboard four disks, and, perforating their centers, force two of them on to the paper-covered stick, leaving a space between them of about quarter of an inch to hold the wire. Now, after slitting the portions of the paper cylinder which extend on either side beyond these washers, turn up the paper and paste it to the outside surfaces of the disks or washers, and one spool is complete. The other two washers will be used for the second spool.

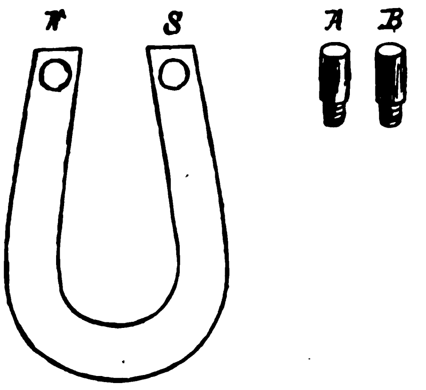

FIG. 1.

Before removing the spool from the stick it will be best to wind it full of wire. To start the coil, bore a small hole in the side of the spool and draw through this two or three inches of the wire to facilitate connections, and then wind on as evenly and tightly as possible, say 300 turns of wire, and end it off as it was begun, by pulling through another perforation three or four inches of the wire. It matters not in which direction the winding is done, but to avoid confusion and for convenience we will assume that while holding the stick in the left hand we have wound the wire from beneath over the spool or in the direction of the motion of the hands of a clock. Mark the side of the spool next to the left hand *a* and that nearest to the right hand *b*, for convenience of reference. The spool with its coil may now be transferred from the stick to the core *A*. Prepare and wind the second spool in an exactly similar manner and with the same number of turns of wire, and mark the side next the left hand *c* and the opposite side *d*. Now a little care must be observed in slipping this second spool onto its core to have it right, for if it is put on the wrong way it will not work. Let us suppose that in putting the first spool on core *A* the side *a* came next to the magnet, then in placing the second spool on *B* the side *d* must come next the magnet. Connect the *last* end of coil *A* to the *beginning* of coil *B* by removing an inch of the insulation and twisting the two tightly together.

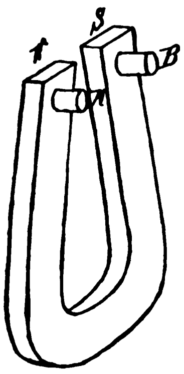

FIG. 2.

The next step will be to go to a wood turner and have the boxes made to receive this apparatus. The boxes should be cylindrical in form and about $2\frac{1}{4}$ inches in diameter. They should be made of some highly seasoned, close-grained hard wood, such as ash or maple or boxwood, or preferably of guttapercha. The box will be in two parts—a body *M* and a cover *L*, as shown in section in Fig. 4 and in perspective in Fig. 5. The face of the body should be turned down to a true plane first and then recessed $\frac{1}{16}$ inch deeper through a circular area of $1\frac{3}{4}$ inches, leaving an annular seat for the diaphragm and the cover. The center of the block should then be gonged out, as shown, to make room for the bobbins or spools *C C′*. The back of the body will then be cut or recessed so that the magnet without the spools may be introduced and fastened in position so that the pole pieces *A B* will come as near the center as possible. The face of the pole pieces should be just far enough below the face of the box so that the metal diaphragm when placed in position will just clear it. In order that the distance between the pole pieces and the diaphragm may be adjustable it may be well before putting the magnet in its seat to place therein a strip of indiarubber as a cushion which will hold the pole pieces normally a little too far away from the diaphragm; then by means of a set screw in the back of the box, as shown in Fig. 6, the adjustment may be readily made.

After the magnet has been placed in position, the spaces cut away to permit of its introduction should be filled in by tightly fitting pieces of wood coming flush with the surface, and then, for the sake of appearances as well as to make the box tight, it should be neatly covered with paper.

The lid should be of the same diameter as the box, having a hole about $\frac{3}{8}$ inch in diameter cut through its center and the space around it cut away so as to form a bell or trumpet-shaped section for the concentration of the sound waves. On the under side the cover should be cut away $\frac{1}{16}$ inch except around the edges, as shown in Fig. 4, so that when the diaphragm is in place and the lid fastened on, the diaphragm will be tightly gripped around its circumference but will be free to vibrate in other parts.

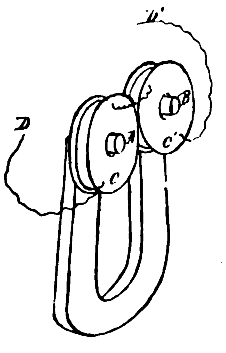

FIG. 3.

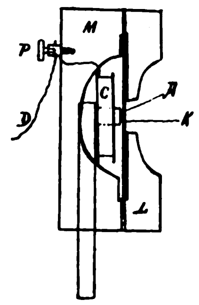

FIG. 4.

For the diaphragm, buy a sheet of ferrotype plate of any photographic supply dealer. This is the material upon which ferrotypes are taken and will cost five or ten cents. One plate will be sufficient for a dozen and a half or more diaphragms.

With a pair of compasses strike out a circle 2 inches in diameter on cardboard; cut this out and using it as a template scratch out similar circles on the ferrotype plate with a pinpoint and cut these out with a pair of scissors. It is best not to strike these circles directly on the ferrotype plate with the compasses for fear of indenting it, but it may be done with care.

Place the diaphragm centrally on the body of the box and then screw the cover down upon it lightly, taking care that the screws do not touch the diaphragm.

But previous to this place the spools upon the magnet pole pieces—bore two small holes through the back of the box through which the ends of the coils may be carried. Screw in a couple of small binding posts and attach each wire to one of these, as shown in Fig 4.

This instrument may be used equally well either as a transmitter or as a receiver, and it will be found a great convenience to make two of them for each station so that one can be held continuously to the ear while the other is used as a transmitter.

The method of connecting up two instruments is shown in diagram, Fig. 7, and the method of connecting up four—in case there are two instruments at each station, one to be used as a receiver and the other as a transmitter—is shown in Fig. 8. The binding posts *A* and *B* are those connected with the coils on pole pieces *A* and *B*. It will be observed that in all cases an *A* binding post is connected with a *B* binding post, and this rule will hold good however many instruments there may be in circuit. Nor does it matter, in Fig. 8, which one of the two instruments is used as a transmitter and which as a receiver, for these instruments are perfectly reversible.

In Fig. 6 are given two views of the instrument—the one to the left being a section through the axis and the one to the right a rear view, showing the parts cut away for the admission of the magnet, similar parts being numbered alike in both. *C* is the set screw for adjusting the position of the magnet with reference to the diaphragm. *D* is a bar of brass or other non-magnetic material laid across the magnet upon which the point of the set screw rests. The solid black portions shown most plainly in the left hand figure are pieces of rubber or elastic cushions intended to permit of a motion of the magnet towards or away from the diaphragm as the set screw *C* is screwed in or out.

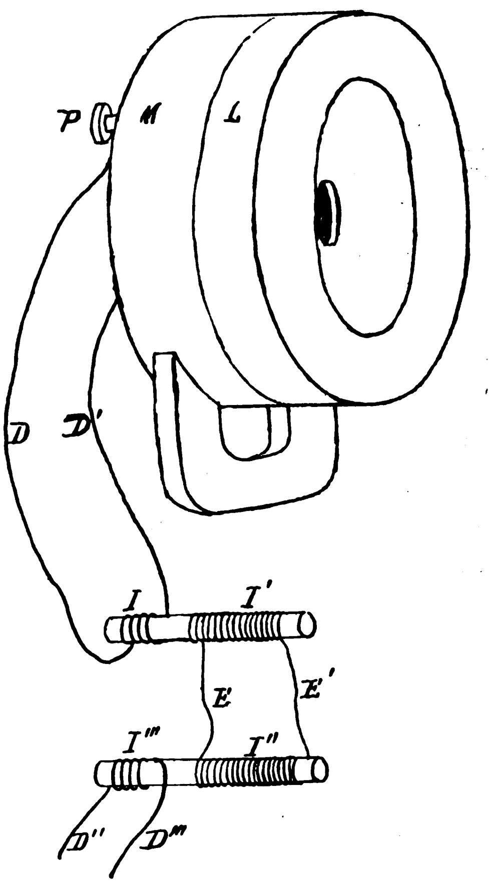

FIG. 5.

In Fig. 5, at the lower portion, I have illustrated two induction coils, such as are frequently used in long distance telephone service. They are not much used with magneto instruments and do not necessarily concern us just now, but may just as well be explained here as elsewhere.

THE TELEPHONE INDUCTION COIL.

I have already explained in a previous article how an alternating or variable current in a wire sends out etheric waves in all directions, which in turn set up similar alternating currents in other conductors with which they come in contact. I have also stated that the ether resident in iron propagates these waves with enormously greater facility than does the ether in other substances, and pointed out that when we want to transmit energy from one coil to another by means of these ethereal undulations by far the best method is to place both coils on a core of iron. Such an arrangement is the ordinary induction coil.

Now, electrical energy is composed of two distinct factors, just as is the energy of running water.

We have not defined a waterfall when we have stated that it is 100 feet high or that 1,000 gallons of water per minute is flowing. When we state, however, that a given stream pours 1,000 gallons of water per minute in a fall of 100 feet the rate of expenditure of energy in that waterfall has been clearly defined—it will be equal to the weight of the water flowing in 1 minute multiplied by the height of the fall. Assuming that a gallon of water weighs 8 pounds, 1,000 gallons will weigh 8,000 pounds, and if this weight of water falls 100 feet, it will develop 100 × 8.000 = 800,000 foot pounds of energy. If this amount of energy is developed in 1 minute, then the horse-power developed will be $\frac{800000}{33000} = 24\frac{8}{33}$ horse-power. The same energy would be developed if half the amount of water fell double the distance or double the amount fell half the distance.

In electricity the situation is very analogous. An electrical energy is not defined when we say that it flows under a pressure of a given number of volts, nor when we say it delivers so many amperes. But when we say, for instance, that in a given circuit the pressure is 100 volts and the current delivered is 10 amperes, the amount of energy or its capacity to do work is clearly defined and is equal to 100 × 10 = 1,000 watts; 746 watts equal a horse-power, so that by dividing 1,000 by 746 we get the value of that current in horse-power. But it is clearly the same so far as the energy of the current is concerned if we have 100 amperes flowing at 10 volts, 1,000 amperes at 1 volt or 1 ampere at 1,000 volts, provided the product of the amperes and volts remains as before, 1,000. It does make a good deal of difference, however, when we come to transmit this energy, whether it is 1 ampere at 1,000 volts or 1,000 amperes at 1 volt—it being very far preferable in all cases of transmission to have the voltage factor large and the ampere factor small than the reverse. The induction coil gives us a very simple means of changing a current of low voltage to an equivalent one of high voltage, and vice versa. Thus if the circuit from our telephone is wrapped say four times around an iron bar, and there be another circuit wrapped the same number of times around the same bar, there will be induced in that second circuit a current having the same number of amperes and at the same number of volts as the first. If the number of turns in the second coil be twice as many as those in the first or primary coil, the current induced in the second will be only half as great, but its voltage will be twice as high, so for transmission purposes we may by means of the induction coil transform our energy up to any voltage desired by simply putting on enough turns of wire in the secondary. The amperes will of course be correspondingly reduced. This operation is perfectly reversible, so that if the transmitted high voltage current be made to pass through a coil of many turns at the further end, it may be transformed down again to any voltage desired. Now; as before intimated, high voltage currents are preferable for transmission purposes; so where long distances are concerned it is usual, especially in battery telephones, to employ induction coils for the purpose of raising the voltage of the telephone currents. In Fig. 5 the method of doing this is diagrammatically shown. The current from the telephone is connected to a few turns of comparatively large wire *I* on a soft iron bar or core. *I'* is a coil of many turns of fine wire on the same bar. Usually one of these coils is wound directly over the other. The comparatively low potential currents in *I* induce equivalent currents of high potential in *I'*. At the distant point is another induction coil, *I'' I'''*. The high potential currents induced in I' in passing through the many convolutions of *I''* induce in *I'''* equivalent currents of low potential, and in this latter circuit is placed the receiver of the distant station.

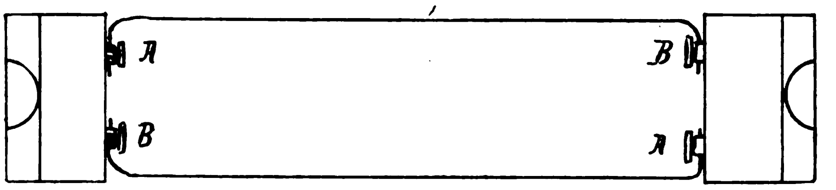

FIG. 7.

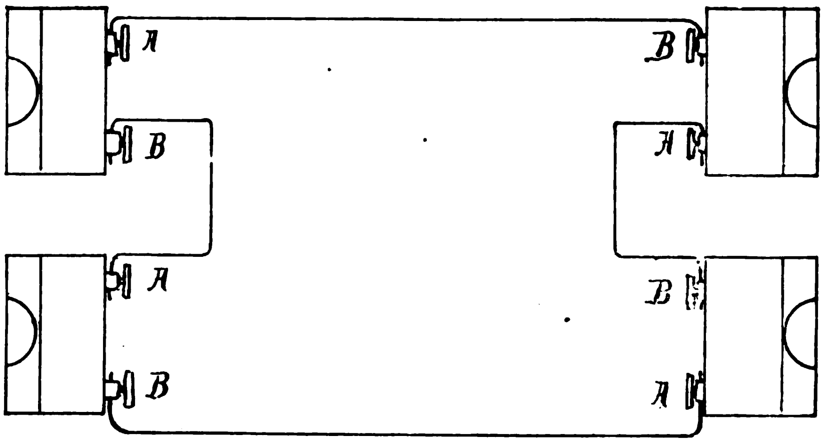

FIG. 8.

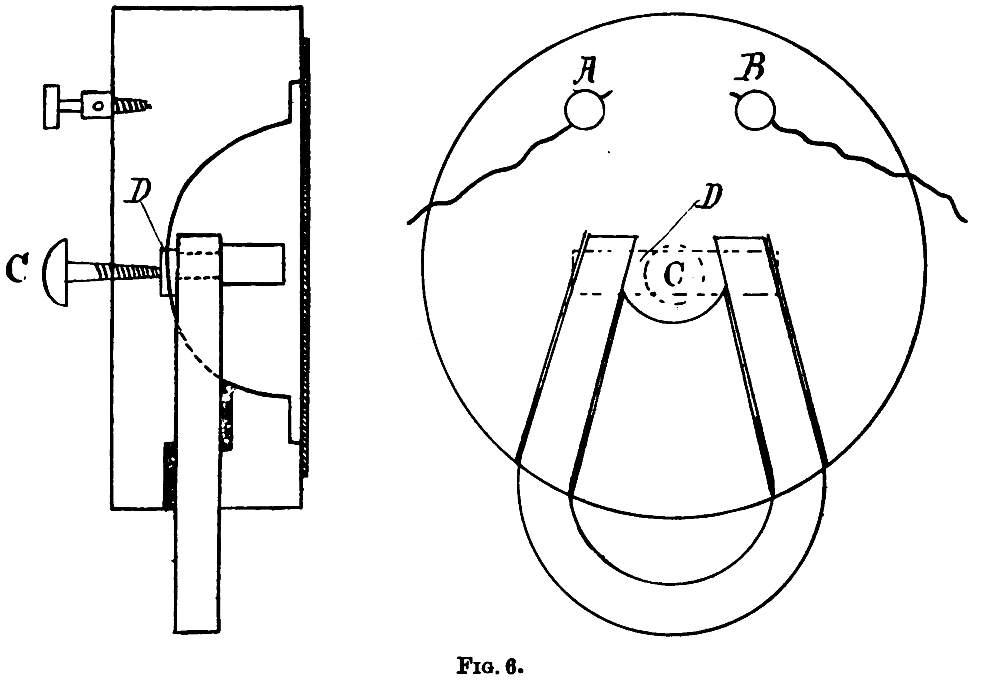

FIG. 6.

In my next article I propose to describe the microphone and battery transmitters.

Messrs. T. D. F. Andrews & Co., of London, England, have made some experiments upon the inductance of sheathed cables. The results show that, whether the sheath or outer concentric covering be of iron or copper, the inductance is practically the same; and if an ordinary copper concentric cable be used in place of the iron armored cable of the same cross section, the results are the same in every case. This is interesting so far as it goes, but a little information regarding the periodicity at which the tests were made would add to the value of these observations.

A remarkable experiment has just been made near Orange, N. J., on the Eagle Rock line of the Suburban Traction Company with some magnetic sand from the ore-separating works of Thomas A. Edison at Ogden. Mr. Edison had the idea that the sand would have more effect in preventing slipping of the wheels than the ordinary sand. The experiment was tried during the snow storm on the Eagle Rock line, where the grades are excessive and the difficulties of operating in the snow are enormous. The experiment proved a complete success, the sand making a perfect electrical connection with the rails and no slip being noted.

One of the most elevated telegraph lines in the world is that reported from India. On the Gilgit line two passes have to be crossed, one 11,600 ft. high and the other 13,500. The snow often lies at a depth of from 10 to 18 ft., and the poles used are 30 ft. long. The poles are planted close together. Offices of observation are close by, in each of which two Europeans are stationed, leading a life in comparison with which that spent at submarine cable stations is riotous and crowded. Many months the passes are cut off from mankind by the snow blockade.

The first sailing vessel to be lighted by electricity is said to have been the Spanish bark La Vigusea, a bulk-oil and general cargo carrier. She is fitted throughout with incandescent lights, the power for the dynamo being furnished by a small oil engine, which also furnishes power to pump her oil cargo when she is loading or unloading.

PRE-SCIENTIFIC ELECTRICITY.*

BY HORACE HAYDEN, JR.

The electricity of to-day and that of the future have been the subject-matter of many recent articles. In fact, the general reader should now be well acquainted with what has been accomplished in this science during a period of less than three hundred years, and must readily apprehend that more wonderful things will yet be achieved. Why all this has not been effected earlier is a problem which we shall attempt to solve, and which may prove to be interesting to those that care to accompany us over the period when this wonderful force played a part in the life of man in strong contrast to its obedient servility of the present day.

Classical scholars are familiar with the superstitious reverence the Greeks had for amber, and the tendency among them to use the word *electron* (*ἤλεχτρον*)—which is the Greek word for amber—just as the word *adamant* was frequently used as designating some ideal, some imperfectly known substance, possessed of almost miraculous properties. The Greeks even thought that the yellow semi-pellucid substance lived and had a soul, for, when excited, it seemed to become animated in its attraction for small particles that came within its influence. The name itself appears to have been derived from this physical myth, *Elector* (*Ηλέχτωρ*) being one of the names of the sun-god.

In the twilight of legendary Greece, we find that familiar and beautiful myth of Phaethon, son of Phœbus Apollo, who rashly undertook to drive the solar chariot through the heavens. We all remember how the chariot approached so near the earth that the mountains began to blaze, and rivers and fountains dried up, and that Zeus, enraged, hurled his thunderbolt, thereby precipitating the charioteer into the River Eridanus. There he was found by his sisters, the Heliades, who, lamenting long and bitterly, were at last changed by the gods into ever-sighing poplars, and their tears, which continued to flow, became translucent amber as they dropped into the stream.

The Greeks, even at this remote period, thus revealed their knowledge of the origin of amber. The tears of the ever-sighing poplars, becoming amber as they dropped into the stream, is but a poetic way of expressing the fact that amber is the resinous exudation of trees that becomes fossilized by the action of the water.

Without much effort of imagination it is possible to trace this chain of analogies a step farther. The myth of Zeus's thunderbolt—which we know to be synonymous with the lightning stroke—seems related to the properties of amber. By exciting amber it is possible to produce miniature lightning, and it is more than probable that the Greeks made this comparison. If the *Electra* (*Ηλέχτρα*) of these legends—who, we will remember, was the goddess of brightness—is, as has been pointed out, the personification of lightning, the comparison would then seem almost certain, for the resemblance between the names *Electra* and *electron* cannot be accidental.

Amber was highly prized by the Greeks as an amulet, and was precious as an article of jewelry. This we perceive in the Odyssey, when the Phœnician traders offer to the Queen of Syra "a gold necklace hung with amber." And thus, being constantly worn, the friction of garments would often excite sufficient electricity to cause it to attract, as Pliny remarks, "the fine threads of fringe" and other small particles, a remarkable fact which was very likely to be noticed by the wearer.

Thales was the earliest philosopher that made direct mention of this property of amber, and is, therefore, too often credited with the original discovery. He appears to have regarded the entire world in the light of a living being, gradually maturing and forming itself from water, the imperfect seed-state. This view endues the universe with vitality, and considers the world as a mere spontaneous development of a pre-existing germ of life. Thus he is said to have looked upon the apparently dead as animated and ensouled; and, hence, taught that amber and the magnet possess a living soul, from which their power of attraction is derived.

The adamant or magnet—to which the Greeks compare amber, although they knew it to differ from the latter in its attractive properties being inherent and only exercised upon iron—was originally found near the town of Magnesia, in Lydia, and from this circumstance was called *magnes* (*μάγνης*), from which the present name is derived. Plato tells us, in the "Ion," that it received this name from Euripides, but by the people was called the Heraclea stone. He adds, "for not only does this stone possess the power of attracting iron rings, but it can communicate to them the power of attracting other rings; so that you may see sometimes a long chain of rings and other iron substances, attached and suspended one to the other by this influence."

Here we clearly see that he had observed the power of the magnet to impart its magnetism to other pieces of iron; but, without better authority than we have, it would be imprudent confidently to assert, as others have recklessly done, that the ancients had any definite conception of the polarity of electricity or of magnetism.

Their deficiency in positive experimental knowledge, however, was abundantly replaced by prolific powers of imagination. They have told us that the magnet would attract both wood and flesh; that by holding a magnet in the hand we might find relief from both gout and convulsions; that its effect on the brain causes melancholy; that it acts as a love philter; that its power is lost after being rubbed with garlic, but may be restored by a treatment with goat's blood; and that it has no power in the presence of the diamond. All which assertions, and many more, were eagerly grasped by the wonder-loving writers of the Middle Ages.

It seems impossible to determine whether the Europeans themselves discovered that a suspended magnet will lie in the direction of the magnetic medium, or whether they received this knowledge through the Arabs, who, in turn, received it from the Chinese; for the latter claim as early as the sixty-fourth year of the reign of Ho-ang ti (2634 B. C.) to have been acquainted with this property of the magnet. After this fact became known in Europe, the magnet evidently took the name of lodestone (leading-stone), a name used by early writers; although we find no record of the mariner's compass until some centuries later.

If, now, we follow the Greeks into Egypt, our attention is attracted by the singular proposal of Dinocrates, the great architect and designer of Alexandria, to construct the arched roof of the temple of Arsinoë entirely of magnetic material, so that the iron statue of the princess might float unsuspended within the temple. But before the work was finished he died, as did Ptolemy Philadelphus, who had ordered the temple to be built in honor of Arsinoë, his sister and queen.

We have considered at some length the knowledge which the Greeks possessed of the electrical property of amber and the attractive power of the magnet, and must now pass rapidly over their acquaintance with the more familiar phenomena of atmospheric electricity.

The electricity of the earth usually concentrates itself in sharp mountain peaks, the natural dischargers of the planet, but sometimes will flow from smaller objects resting on the earth and projecting into the air. Some years ago Dr. Werner von Siemens, the noted physicist, while on the top of the pyramid of Cheops, at Gizeh, during a storm, perceived that a flow of electricity escaped from his finger when extended toward the heavens. The current manifested itself powerfully enough to cause a loud hissing noise, and from the metallic button of his gourd he obtained electric sparks.

Scholars have told us that the word *pyramid* is derived from the Greek root *pyr* (*πυρ*), which means fire; and add, that this name was chosen to indicate that pyramids terminate in a point, in the shape of a flame. If this be the correct derivation of the word, it seems more logical to agree with Fonvielle, that at some time in the many centuries during which the pyramids stood before the Christian era these mountains of stone had been seen crowned with flame—illuminated by the energies of the earth; but this is mere conjecture, and the most recent authorities maintain that the word *pyramid* is a derivative from the Egyptian word *pir-em us*, which means perpendicular height.

The manifestation of this form of atmospheric electricity is usually in the shape of a brush or a star of light. The records of the display of these lambent flames have accumulated with years, and are found in the literature of all languages, and of every age and country.

Among the ancients they were distinguished as Castor and Pollux, the favorite sons of Jove, who watched over the games, and also over travelers, especially those following the sea. The Dioscuri are represented on ancient coins as equestrians with a star floating over the helmet of each, and between them a zigzag line that Prof. Schweigger deems a representation of an electrical spark.

In modern times, around the Mediterranean, these electrical displays have been hailed as the light of St. Clair, St. Nicolas, St. Helena; elsewhere they have had the appellation St. Barbe and St. Elmo. The Portuguese call them Corpo Santo and the English, Comazants. Even at the present day of enlightenment, sailors attach a certain importance to these signs; for they suppose that the apparition of one of these natural lights portends that the severest part of the storm has yet to come, while two of them at once indicate a cessation of the tempest. In all of this we trace an inheritance from antiquity; Pliny, in fact, telling us that these lights are dangerous and unlucky when coming alone, but when two come together they bring comfort and foretell a prosperous voyage and chase away that "dreadful, cursed, and threatening meteor, Hellena." Thereupon, men at sea invocated the gods Castor and Pollux.

In the conception of Castor and Pollux we at once see the evidence of a predominant facility to seize the passing event, and a sensibility wonderingly alive to all the phenomena of nature. Thus, the ancient historians, with this characteristic facility, never omit to mention, with minute care, the phenomena arising from this natural electricity.

Seneca relates, as a strangely significant warning to Gylippus, that a star came and hovered over the shield of that general as he was sailing to Syracuse.

Plutarch, after speaking of the great victory of Lysander—which finished in one hour a war that had been protracted in its continuance—records: "Some, therefore, looked upon the result as a divine intervention, and there were certain who affirmed that the stars Castor and Pollux were seen on each side of Lysander's ship, when he first set sail from the haven toward his enemies, shining about the helm; and some say the stone which fell down was a sign of the great slaughter."

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* The *New Science Review.*

"The foremost man of all the world," intellectually distinguished by extraordinary genius in diversified pursuits, we must acknowledge to have been a strong-minded man, yet Cæsar does not neglect to inform us that the spears of the fifth legion appeared on fire during the African campaign; Castor and Pollux thus announcing that he would soon disperse the remainder of the Pompeian party. Another instance was the fire seen around the head of Ascanius.

We now turn our attention to that other form of atmospheric electricity, dignified by the ancients as the thunderbolt of Jupiter. Some of our modern authors, and others more zealous than wise, would have us believe that if Franklin did not actually appropriate the idea of others, his experiment was, in fact, anticipated by the ancients thousands of years before.

Herodotus, one of their authorities for this assumption, says: "The Thracians, when it lightnings and thunders, let fly their arrows toward the heavens, uttering threats against the god, for they do not believe there is any god but their own." It is quite evident that the Father of History does not intend to have us understand that they thus shot their arrows for the purpose of withdrawing the electricity from the clouds, as these energetic authors would interpret.

The Etruscans, renowned in antiquity for their knowledge on this subject, are said to have been able to direct the lightning, but this was done by exorcisms and conjurations. Among the Romans, Numa, instructed by the nymph Egeria, succeeded in intoxicating Faunus and Picus—whose names in this place probably denote only the priests of these Etruscan divinities—and learned from them the secret of making, without danger, the thundering Jupiter descend upon earth, and immediately put it into execution. From that time Jupiter had the surname Elicius, or Jupiter who is made to descend, and was adored in Rome.

Tullus Hostilius, it seems, was less fortunate. "It is related," says Livy, "that this prince, in searching the memoirs left by Numa, found among them some instructions relative to the secret sacrifices offered to Jupiter Elicius. He attempted to repeat them, but in the preparation or celebration he deviated from the sacred rite. Exposed to the anger of Jupiter—evoked by a defective ceremony—he was struck by the lightning and burned, together with his palace."

Then there is the story of a medal whereon appears the temple of Juno, the roof of which is supplied with many pointed stakes, that some would have us believe to be lightning-rods. Another medal, described and engraved by Pellerin, shows the god Jupiter in a cloud, with the lightning in his hand, and below a man guiding a kite. But the authenticity of this medal is suspected.

Artaxerxes believed that two swords, planted in the ground, dispersed the thunder-clouds. In the time of Charlemagne, poles were used for the same purpose, but, unfortunately for those that would deprive Franklin of scientific renown, they were not supposed to have any efficacy until bits of magical paper had been stuck upon them.

The ancients also believed that lightning never fell except by the immediate interposition of the gods; and whatever thing or place it struck was ever after deemed sacred—consecrated by the Deity himself. The Greeks placed an urn over the spot where the lightning entered the earth, and the Romans had a similar observance. Herodotus tells us that when Scyles, who had studied the language and sciences of Greece, ascended the Scythian throne, it was his desire to be initiated into the mysteries of Bacchus, which was against the wish of his people; and as he was about to take some of the sacred utensils in his hands, his palace in the city of Borysthenites was totally demolished by a thunderbolt.

To imitate thunder and lightning was considered a sacrilege by all religions. We remember the exciting passage of Virgil, wherein the poet describes the infernal regions and the fate of Salmoneus. This prince, according the legend, wished to be called a god, and to receive divine honors from his subjects. Therefore, to imitate thunder, he used to drive his chariot over a brazen bridge; and to counterfeit lightning, he darted torches on every side. This impiety provoked Jupiter. Salmoneus was struck by a thunderbolt, and placed in the infernal regions near his brother Sisyphus.

Tacitus, the philosophic historian of the declining glories of Rome, addressed one of his most fearful reproaches to the Emperor Caligula for attempting to manufacture the lightning and thunder of the sovereign of men and gods. Not content with deafening his subjects by compelling them to listen to his artificial thunder, this refined tyrant—more ambitious still than Salmoneus—had constructed a machine calculated to reply to the gods, by throwing a heavy stone toward the sky whenever the lightning happened to strike the earth.

These few references, selected from the many accounts left us, will give an adequate idea of the superstitious respect entertained by the ancients for thunder and lightning. These superstitions may appear extremely ridiculous to us, but we should not overlook the fact that but a century ago Franklin found numerous opponents who agreed that it was as impious to erect rods to ward off Heaven's lightnings as for a child to ward off the chastening rod of its father.

Pliny leaves us the following remarkable explanation of why lightnings are attributed to Jupiter:

"Most men are ignorant of that secret, which, by close observation of the heavens, deep scholars and principal men of learning have found out, namely, that they are the fires of the uppermost planets which, falling to the earth, are called lightning; but those especially which are seated in the middle, that is about Jupiter, perhaps because participating in the excessive cold and moisture from the upper circle of Saturn, and the immoderate heat from Mars, that is next beneath, by this means he dischargeth the superfluity, and therefore it is commonly said, 'That Jupiter shooteth and darteth lightning.' Therefore, like as out of a burning piece of wood a coal flies forth with a crack, even so from a star is spit out, as it were, and voided forth this celestial fire, carrying with it presages of future things; so the heavens showeth divine operations, even in these parcels and portions which are rejected and cast away as superfluous. And this most commonly happens when the air is troubled, either because of the moisture that is gathered moves and stirs forward that abundance to fall, or else that it is disquieted with the birth, as it were, proceeding from a great bellied star, and therefore would be discharged of such excrements."

Nothing needs to be said about the state of science which this far from luminous exposition reflects.

The ancients were also acquainted with the torpedo, or fish of Jupiter, which is found in the Mediterranean, and has the faculty of accumulating, to a remarkable degree, animal electricity, with which it can give a powerful electric shock, whence the names of *Narce* (*νάρχη*—numbness) and *Torpedo* (*torpeo* quasi torpor) were given to it.

Professor Thompson has called attention to the interesting fact that the Arabian name for the torpedo, *ra-ad*, signifies lightning. Aristotle was acquainted with the fact that its benumbing power could be sent by the fish some distance through the water. Scribonius, Largus, Galen and Dioscorides speak of the local application of a living torpedo in headache and gout; and, as an article of food and medicine, the torpedo seems to have enjoyed considerable reputation among ancient epicures.

We take this opportunity to consider for a moment the Vestal Fire, inasmuch as Professor Schweigger has said that he believed it was electric, and has been quoted by others that appear to have made no research themselves. Yet to agree with Professor Schweigger we would have to deny the authenticity of many of the ancient writers, among them Livy and Plutarch. The latter, in his life of Numa—to whom is ascribed the introduction of the worship of Vesta in Rome—has gone into much detail, and informs us that it was provided that if at any time the Vestal Virgins should allow the sacred fire to go out they were to be severely punished, and the fire rekindled from the sun's rays brought to a focus by a concave mirror made of polished metal. Neither this nor the earlier method of obtaining the fire by means of the friction of dry sticks appears to have anything to do with electricity.

Lucretius, in his celebrated poem *De Rerum Natura*, takes up the subject of magnetism, and, after he has spoken of the chain of rings already mentioned by Plato, attempts to solve the mystery of this phenomenon. He imagines the magnet to radiate innumerable atoms in streams that rarefy the space between it and the attracted iron, into which space the iron is forced by the pressure of air from behind. And as the metal is compact in its elements, the particles thus streaming into the void drag with them the entire chain. The magnet does not attract other substances, for the reason that some are held fast by weight, as the ponderous gold; and some are of such attenuate consistency that they lend its waves no hold.

However remote from being correct, this is at least an attempt at a theory. And a century later Pliny records the fact, that rubbing the blade of a knife—which we suppose was hardened steel—with the lodestone would make of it a permanent magnet.

Amber was in such repute in Rome at this period that Pliny sarcastically remarks that the price of a small figure in it, however diminutive, exceeds that of a healthy slave or warrior.

"True it is," he goes on to say, "a collar of amber beads worn about the necks of young infants is a singular preservative to them against secret poisoning, and a counter-charm for witchcraft and sorceries." This superstition we have inherited, although the custom as now in vogue is not as a defence against witchcraft and sorceries, but as an amulet or prophylactic.

If we stop to reflect for a moment, we will see that these men—philosophers whose genius sounded the depths of the microcosm, and discovered moral truths by a sublime intuition—knew natural and physical truths more as matters of fact and observation than as determined by law. Pliny himself says: "Of all these things there is no certain reason to be given, but secret they must be, hidden within the majesty of nature, and reserved within her cabinet." Their knowledge could not be called a science, in the modern sense, unless indeed an occult science. The only attempt they appear to have made to generate electricity was the accidental discovery that amber, when rubbed, would attract small particles, and here the extent of their knowledge seems to have terminated. They have left no evidence of even an endeavor to learn the true cause of this phenomenon, which hence remained one of the "awful mysteries of nature."

So we pass into and through that long and sad intellectual darkness of the Middle Ages. The only step of importance in electrical science which we find recorded is the use of the mariner's compass in Europe, the earliest of which were made by floating a magnetic needle on a chip of wood in a basin of water.

During this long period, the human mind was undergoing an intellectual revolution. Christianity—a religion of love—had succeeded the ancient religion of superstitious fear of gods and of nature.

In the latter part of the Middle Ages—in that period styled the "Revival of Learning"—a taste for ancient classic literature arose, and was necessarily and promptly followed by the introduction of the "art preservative of all arts," that of printing. Like a second awakening, we find, in the sixteenth century, an intellectual condition that produced works which made immortal the names of Michel Angelo, Raphael, Titian, Albert Dürer, Holbein, Edmund Spencer, Shakespeare, Cervantes, Rabelais, Montaigne, Ariosto, Tasso, Copernicus, Galileo and others.

At the very end of that century, in the year 1600, Dr. William Gilbert, surgeon to Queen Elizabeth, and the most distinguished scientist in England, found this little seed of human knowledge in the archives where it had been buried for fifteen hundred years. He straightway planted it in rich loam when he published his famous book, *De Magnete*, in which he made known that the attractive property of amber when rubbed was not inherent in that substance alone, but that it also existed in some twenty other bodies, in which are included the precious stones, glass, sulphur, sealing-wax and resin. Inasmuch as all these substances acted like amber, Gilbert called them *electrics*, and called the phenomenon itself *electricity*; terms which he derived from *electron*.

The publication of Dr. Gilbert's work marks the true commencement of electrical science, its immediate effect everywhere having incited philosophers to efforts to extend his list of electrics.

The propagation of that little seed, though slow at first, has steadily advanced, until now we are reaping a rich and golden harvest. And for the foundation of it all we are indebted to Dr. William Gilbert, whose name should be immortalized as the Father of the Science of Electricity.

American Institute of Electrical Engineers.

The 93d meeting of the Institute was held at 12 West 31st street, New York, Wednesday evening, January 16, President Houston in the chair.

Prof. Macfarlane, of Ithaca, N. Y., read his paper "On the Units of Light and Radiation," which was discussed by Messrs. Kennelly, Wolcott and Burnett.

It was voted subsequently that the paper be referred to Committee on Units and Standards for consideration.

The paper by Mr. Alton D. Adams, of Boston, was read by the author and discussed by Messrs. Crocker, Richard Fleming, Sheldon, Ashley, Burke, Waldo, W. L. Bliss and Gano S. Dunn.

At the Council meeting in the afternoon the following associate members were elected: Henry S. Anderson, H. W. Buck, Edmund V. Cox, Sylvester P. Denison, Arthur J. Farnsworth, Burton S. Lanphear, Edward A. Leslie, William B. Lester John Clifford Rennard, Henry W. Fisher, Henry Leslie Friedenberg, Edward B. Gallaher and J. Henry Klinck.

The following associate members were transferred to membership: Peter Wright, Arthur V. Abbott, Louis B. Marks, Edward V. Baillard and Francis Broadnax.

Change of Offices.

The New York offices of the Electric Storage Battery Company of Philadelphia have been moved from 45 Broadway to the Manhattan Life Insurance Company's Building, 66 Broadway. The change was made to meet the increase of business of the company.

THE T.-H. REGULATOR PATENT.

Abstract of Judge Grosscup's Decision.

This is a suit for infringement of patent No. 238,315, granted to Elihu Thomson and Edwin J. Houston, March 1, 1881, for "current regulator for dynamo electric machines."

The claims of the patentees are for a combination and are expressed in the following terms:

"1. In a current regulator for a dynamo electric machine, the combination of a device responding to changes in the main or generated current, a shifting commutator for said machine, and mechanism controlled by said responsive device to shift the commutator to those positions where the current taken up by said commutator shall be constant.

"2. In a current regulator for a dynamo electric machine, an electro-magnetic device acted upon by variations in the main or generated current, an adjustable or shifting commutator for the machine, and mechanism controlled by said electro-magnetic device to adjust the commutator to those positions where the main or generated current taken up by said commutator shall be constant."

The principal defence is that, in view of the prior state of the art, and especially of the invention patented by Thomson and Houston, January 20, 1880, No. 223,659, this so-called invention has been anticipated, and the patent, therefore, is invalid. So far as I have been able to ascertain, all knowledge of electricity is, so far, purely empirical; and mere speculations, therefore, however acute and plausible as to the ways and methods of this force, are likely to be erroneous, and therefore valueless. In the view of the case to which my judgment has come, it is unnecessary to enter these regions of speculation, or attempt to decide between the respective contentions so earnestly put forth and learnedly maintained.

Patent 223,659 discloses a device almost identical with that of the patent in dispute. Whatever may be the cause of the sparking, it was then discovered or known by the patentees that a proper shifting of the brushes upon the commutator would bring about a condition of minimum sparking. But the position of the brushes upon the commutator to prevent sparking was not necessarily uniform. It depended upon the speed of the revolutions, which, in turn, was dependent upon the uniformity of power, not so easily obtainable then as now. It depended also upon the accidental or purposed introduction or withdrawal of resistance from the circuit. It is apparent that a shifting by hand to meet these varying conditions would be both cumbersome and unsatisfactory, and the invention subsequently patented as 223,659 was to meet these electrical difficulties.

The object here, as in the subsequent patent of Thomson and Houston, was to obtain a device that would move the brushes backward and forward responsively to the electrical condition that such movements were intended to meet. For this purpose, the patentees employed a mechanical device, in every substantial respect like that described in the patent in suit, except that the electro-magnet was put in the short circuit beginning with the forward member of one of the brushes and ending in the main circuit at the rear of the other member of the brush, instead of having been put in the main circuit, as in the patent in suit.

It may be admitted that the anti-sparking device is, in some respects, different from the one in suit. The question is, whether the difference is one of principle and conception or only such difference in use as leaves the uses, nevertheless, analogous.

The complainants' anti-sparking patent revealed to the public a device by which the brush on the commutator could be automatically changed forward and backward responsively to a change in the current of electricity. The device, it may be admitted, was only used to prevent sparking, and was only acted upon by a small portion of the current, but it disclosed clearly and for all purposes a mechanism that would rock the brushes responsively to changes in the current, irrespective of whether such currents were the main or only accessory ones. The problem sought to be solved by the patent in suit was a somewhat different one in its ultimate ends, but the object of both patents was reached by the application of any principle, and the use of any device, that would automatically maintain constancy of current, notwithstanding changes of motive power or of resistance. The fact that one may be intended to prevent destructive effects upon the machine itself, and the other to adapt the machine to the circumstances of changing resistance, will not make both devices patentable if they employ substantially the same principles and the same mechanism. The immediate objects in view were thus analogous, and the ultimate uses into which they were diverged do not make them less so.

It must be remembered that it was then well known to electricians that the shifting of the brushes forward and backward upon the commutator increased and diminished the volume of the current, and thus equalized it against the tendencies of a changed resistance. This is what the anti-sparking invention accomplished automatically within narrow limits. It is what the so-called invention in suit accomplished automatically through a wider scope. There was required simply experimentation to determine its adaptability to the new purpose. Doubtless, such experimentation was difficult and delicate, and called into exercise a multitude of different adjustments of the brushes. But, it was all done in the light and along the lines of the earlier device and of electrical principles well known to the public. It was in my mind adjustment purely, and not a new conception of either a principle of electricity or a mechanism to carry it out. If there is any mistake in this judgment it is, I think, in putting a higher estimate upon mechanical skill in electrical fields than is applied to other fields, but I do not see how this can or ought to be avoided. No new distinct conception or discovery ought practically to go unrewarded. But it certainly would if its readaptations by experiment or adjustment to the thousand uses the field of electricity discloses were to be regarded as patentable improvements. I differ from Judge Colt in this case with reluctance, for I defer to his superior experience and wisdom in the patent field, but I cannot follow him in this case without violating my own sense of judicial responsibility.

The bill will be dismissed.

Phœnix Telephone Co. in Indianapolis.

The agents of the Phœnix Telephone Company report as a result of their canvass of the city of Indianapolis that 1,500 subscribers have been secured and that only 300 more names will have to be listed before the company applies for a franchise and establishes an exchange. The new company's rates for service are placed at $36 for business telephones and $25 for residences, and this rate will remain unchangeable between all points within the city limits. The charges of the old company are $48 for business telephones and $36 for telephones in residences.

Herrick & Burke.

The above is the title of a newly founded copartnership located at 203 Broadway as consulting and supervising engineers. Mr. A. B. Herrick and Mr. James Burke are the members, and are both well known.

COMMUNICATION.

The La Roche Assignment.

To the Editor of ELECTRICITY.

DEAR SIR: You have no doubt received notice from J. Franklin Stevens, who has been appointed assignee of La Roche Electric Works, Incor., that it was deemed expedient for our company to liquidate as a corporation while still solvent, the primary reasons for this step being the extreme difficulty in making collections and the closeness of the money market.

The officers and directors of the company have at different times advanced money to the company, but as you will note by the assignment report, no preferences were given even to ourselves. As stated in this report, there are ample assets in hand to satisfy every one concerned.

The writer has associated with himself certain gentlemen of financial means and proposes to continue the manufacture of the well-known La Roche apparatus with increased facilities. He will in all probability, when an appraisement is made, purchase the entire equipment of the La Roche Electric Works, and for the present continue manufacturing in the same building until more commodious quarters can be obtained.

Thanking you for any courtesies you may extend to the firm, I remain very truly yours,

F. A. LA ROCHE.

Philadelphia, January 19, 1895.

It was with considerable regret that we learned of the difficulties of the La Roche Company. In the new venture which is planned Mr. La Roche and his associates will have the best wishes of ELECTRICITY and of the entire trade.

Personal.

J. S. Crider, Secretary of the Washington Carbon Company, Pittsburg, Pa., is in New York this week in the interest of his company. He reports a very large demand for their "Helios" cored carbons and also an increased trade in regular carbons, motor brushes and battery plates.

General News.

What is Going on in the Electrical World.

Savannah, Ga.—John R. Young has been appointed receiver of the Electric Railway.

Delaware, O.—The Electric Light Company, controlled by John H. Howison, B. L. Watkins and others, has assigned.

Staunton, Ill.—The city council at the February meeting will receive propositions for a franchise for an electric light plant.

Jackson, Tenn.—Prominent citizens here are urging the authorities to put in an electric light plant to be owned and run by the city.

Lima, O.—The storage barns of the Lima Electric Street Railway Company, together with ten cars, were destroyed by fire on the 12th inst.

Trenton, N. J.—C. F. Adam, manager of the Electrical Construction Company, has purchased the entire stock of the concern and will continue the business.

Boston.—The West End Railway's car house and thirty-five trolley cars were destroyed by fire on the night of the 15th inst. The loss is about $100,000.

Ottawa, Ill.—The city council has passed an ordinance granting the Thomas Electric Light and Power Company the right to establish a plant for lighting purposes.

New Castle, Pa.—The city councils have been investigating the subject of electric lighting with a view to the purchasing and operation of a plant under city ownership.

Norway, Me.—A preliminary survey has been made of the route of the projected Norway and South Paris electric railway; construction work will begin early in the spring.

Adrian, Mich.—Receiver Snow of the Adrian Electric Belt Railway Company has received permission from the Circuit Court to borrow $9,000 with which to re-equip the road.

Macon, Ga.—Tucker, Anthony & Co., of Boston, have purchased from the General Electric Company the Macon Consolidated Street Railway. Wm. A. Tucker will be the new treasurer of the road.

Richmond, Va.—There is every probability of the Broad street railway line being changed to an electric system. The company are willing to make the change as soon as they get the council's permission to do so.

Rome, Ga.—Eastern capitalists have recently purchased the larger part of the stock of the Electric Street Car Line and the Electric Light Company, and these concerns will hereafter be conducted under new management.

Flint, Mich.—The council has passed an ordinance granting a franchise to the Harrison Telephone Company to establish and maintain an exchange in this city, one of the conditions being that the company give the city free use of five telephones.

Orlando, Fla.—The Young Men's Business League have instructed their committee to examine into the matter of establishing an electric light plant, and if a favorable report is made will urge the council to pass an ordinance to that effect.

Tallahassee, Fla.—The council has granted permission to the Bell Telephone and Telegraph Company to establish a telephone exchange in this city. W. B. Rice has secured the requisite number of subscribers and forwarded the papers to the company.

Dallas, Tex.—C. L. Wakefield promises, in case this city gives him a franchise, to put in a thorough modern electric light plant, to cost from $40,000 to $60,000, the object being to furnish power and light in competition with the present company.

York, Me.—Hon. Edward S. Marshall intends to construct an electric light plant upon his land near the York Harbor and Beach Railroad station, and has petitioned the selectmen for permission to erect poles and string wires on the highway.

Herkimer, N. Y.—J. Ledlie Hess of Fonda and R. Townsend McKeever of Gloversville have acquired the three horse railroads which connect the villages of Herkimer, Mohawk, Ilion and Frankfort, in Herkimer county. The roads will be consolidated and operated by electricity.

Red Bank, N. J.—The Red Bank Electric Light Company's bondholders have agreed to surrender their securities for percentages of their face value to P. N. Jackson, who pays 90 per cent. for the first mortgage bonds, 50 per cent. for the second series, and 4¼ per cent. for the third series.

Newark, O.—Superintendent J. E. Young of the Newark electric light plant shows that the expense of operating the plant for the past six months was $640.38 less than that for lighting the city by gas. This takes into consideration $1,110.44 interest paid on $40,000 bonds for that period.

Helena, Mont.—The city clerk has been directed by a resolution of council to take such steps as shall be necessary to submit the question of bonding the city of Helena for the purpose of owning and operating its own system of water works and electric light to a vote of the taxpayers.

Bloomfield, Ind.—There is a movement on foot among the business men of Bloomfield, Worthington and Linton to put in an electric light plant at Switz City with force enough to supply the three towns. Switz City is a small town about six miles distant from each of the three towns named.

Hartford, Conn.—A bill has passed the House by a vive voce vote and been transmitted to the Senate, in which it is provided that no steam railroad in the State shall be crossed on grade by an electric, cable or horse railroad, nor shall any steam railroad cross any cable, electric or horse railway at grade.

Petersburg, Va.—Several of our prominent business men are in correspondence with an electric company of New York City with a view of securing cheaper telephone service for this city. It is understood the company is willing to establish a service here provided it is guaranteed 100 members and is granted a franchise.

Salt Lake City, Utah.—A contract has been entered into between the Salt Lake and Ogden Gas and Electric Light Company and the Big Cottonwood Power Company, by which the latter company undertakes to sell to the former all the electricity required for lighting, heating and power in the city of Salt Lake from Sept. 1, 1895.

Frederick, Md.—There is some prospect of the projected electric railway between Frederick and Middletown being built next spring, as interest in the scheme has been revived. The Middletown Valley people have raised nearly all of their share of the necessary fund. The road will be eight miles long and will cross the Catoctin Mountain.

Franklin, N. H.—The directors of the Franklin Falls Company have appointed a committee, consisting of E. H. Sturtevant, John W. Dresser and E. G. Leach, to secure plans and estimates for generating and distributing electric power on the ground and to any part of the town and for utilizing the water power to better advantage.

Jersey City, N. J.—At a meeting here last week of representatives of the traction companies of the State, a mutual protection society was organized with David Young, the general manager of the Consolidated Traction Company, as president, G. S. Browning, of Camden, vice-president, and William B. Price, of Elizabeth, secretary and treasurer.

Greensburg, Pa.—The Ligonier Valley Railroad Company intend to fit their road for electric cars as soon as arrangements can be made, and instead of two or three trains per day as now, electric cars will be run from Latrobe to Ligonier every hour or oftener if occasion requires. The heavy freight will be carried over the road by steam. The road is ten miles long.

Fall River, Mass.—The number of electrical appliances in use in the cotton mills in this city is increasing every day, and one electrical enthusiast is already looking forward to the time when long lines of shafting and belting will be replaced by long lines of copper wires that will lead from one central dynamo room to small dynamos near various sorts of machines.

Ennis, Tex.—The Texas Midland Railroad Company have equipped their Greenville and Ennis trains with electric incandescent lights, eighteen to each car, with projecting brackets from the side of the car, which makes it convenient for passengers to read. An engine and dynamo in the baggage-car furnish the power. This is said to be the first electrically lighted train in the South.

Birmingham, Ala.—A deal is on foot, and it is said has about been consummated, by which Birmingham will in the near future be provided with a new electric power station, electric dynamos and other apparatus necessary for generating electricity for an electric light system. Plans for a power station to cost approximately $200,000 have been submitted and estimates for constructing the same asked for.

Kutztown, Pa.—The Lehigh Valley Traction Company, which controls all the electric roads in Allentown, is making surveys through this section for the purpose of extending its lines through Emaus, Macungie and Trexlertown to this borough. From Kutztown the line is to be extended to Topton and thence is to follow the towns along the East Penn Railroad and meet the former electric line at Macungie.

Keokuk, Iowa.—J. C. Hubinger's schemes to build a high bridge across the Mississippi River, at this point, and also electric railroads to Nauvoo and other Illinois towns, have been killed by City Attorney Hollingsworth, who submitted an opinion to the city that there was no legal way for the city to enter into a contract to give Hubinger an electric-lighting contract for twenty years, which was the consideration he demanded for building the bridge.

Harrison, Ohio.—Ex-Representative James Graft, who recently incorporated the Harrison (O.) electric light plant, has under consideration a plan to light the villages of Cleves, New Haven and Miamitown. To this end a point centrally located will be selected, about four miles from Harrison, which will be the distributing point for the Harrison plant. Including the distance from Cleves to the distributing point the whole circuit would cover 16½ miles.

Chamberlain, S. D.—P. J. Gerin, of this city, has been appointed receiver of the Chamberlain Electric Light Company. The plant had been advertised for sale by virtue of a chattel mortgage, but other creditors of the company began proceedings, which resulted in Judge Haney issuing an injunction preventing the sale. There are several liens against the company, and the foreclosure of the mortgage would have shut out these claims.

Philadelphia.—The charges made by James Breen, a former employee of the Mutual Automatic Telephone Company, that a large amount of the stock of that company had been used to secure the passage through councils of the ordinance granting privileges to the company, has resulted in the appointment of a committee by common councils to investigate the matter.

South Orange, N. J.—The ordinance for the proposed trolley line through the township provides that the successful competitor for the franchise is to deposit $10,000 in cash with the township collector to be forfeited if the company fails to keep its agreement. The road is to be completed on July 1 and the company is to give $25,000 in bonds for living up to its agreement. The franchise is to be awarded to the company making the best bid for it.

St. Louis.—The *Republic* says: "Officials of the Edison Illuminating Company and the Missouri Electric Light and Power Company, and large stockholders of the Laclede Gaslight Company, which companies have all the contracts for city lighting, emphatically deny that there is any movement on foot at present to form a combine and thereby place the city in the hands of a powerful monopoly."

Sault Ste. Marie, Mich.—C. B. Robinson, manager of the Michigan Telephone and Telegraph Construction Company, is seeking a franchise for the establishment of an electric lighting system in this city. The new company will be composed of men of means from the southern part of the State and will start business with a capital of $1,000,000. It is the intention to make a reduction in current rates of 20 per cent. both for light and power purposes. The cost of lamps and fixtures will also be reduced.

Nevada, Mo.—The associated water, gas and electric light companies of Missouri and Kansas met in Nevada on the 14th inst. to organize in the interests of all companies in the two States. F. J. Tygard, president of the Butler Water Company, was elected president, and C. F. Strohm, receiver of the Nevada Water Company, secretary and treasurer. The date for the next meeting was not determined fully, but will be in February, and the meeting will be in Butler, Mo.

Chicago.—The *Times* says: "More than one-half of the jangling of telephone bells will be silenced in Chicago during the next six months. Within that time the Chicago Telephone Company will have placed in operation its new system of signals. A person using a telephone will be able to reach the one with whom he desires to talk, say what he wants to and end the conversation, all without the jangling of a bell. The signal to the operator in the exchange will be given by flash lights from an electric lamp."

Bangor, Me.—The Worcester Construction Company has been awarded the contract for building the Bangor Orono and Old Town electric railway. The completed road will be about fourteen miles long and will cost $250,000. The same company has also been awarded the contract for building the Beverly, Wenham and Gloucester electric railway. This road will be eighteen miles long, and will cost $250 000. The Construction Company will also supply all the cars and equipments.

Brooklyn, N. Y.—Bernard Gallagher has been elected president of the Citizens' Electric Illuminating Company vice H. M. McLaughlin. The change gives entire satisfaction to the stockholders.—The strike of the trolley railroad employees for fewer hours and a better system of payment still continues, causing almost a complete stoppage of the cars on the several lines. Some rioting has occurred, but nothing very serious has happened as yet. It is difficult to predict at this time how the affair will end.

Manchester, N. H.—The following special dispatch appeared in the *Union* under the heading "Enormous Dynamo": "Lancaster, Jan. 10.--Another dynamo is to be added to the electric light plant. It is to be of the latest improved specimen and will have a capacity of 14,000,000 volts per second. It has been constructed especially for volts, instead of the common kind of electricity." News of that kind in the *Electrical World* would not be astonishing, but in the Manchester *Union* it is simply phlogogenous.

Niagara Falls.—The first of the three great dynamos for the Cataract General Electric Company of Niagara Falls arrived there last week. Prior to its shipment this mammoth machine was thoroughly tested in the shops of the Westinghouse Company at Pittsburg, and was found to be capable of making 261 revolutions to the minute, eleven above the required number. Shafting and hydraulic connections for the dynamo are already in place and the prospects are now that the power will be ready for distribution by the 1st of February.

Gettysburg, Pa.—The Gettysburg Electric Railway has been sold to J. Luttrell Murphy, of Chicago, and Walter B. Kendall and John A. Connelly, of Philadelphia. The price paid is equivalent to $250,000. The purchasers obligate themselves to complete the road to the Maryland line, there to connect with the Maryland system of trolley roads. They are to obtain possession of the franchise on March 1, 1895, and in the meantime the present company will endeavor to settle the condemnation proceedings of the Government, which are now in process in the District Court of Philadelphia.

Buffalo, N. Y.—The subject of Niagara power continues to be one of the principal topics of conversation and discussion in this city. President Graves of the Citizens' Association has appointed as a committee to consider the manner in which electric power should be distributed in the city Messrs. J. N. Adam, Jewett M. Richmond, Henry W. Box, Richard Hammond, Ansley D. White, Walter J. Shepard and C. Lee Abell. Two corporations, the Niagara Falls Power Company and the Niagara Falls Hydraulic Power and Manufacturing Company, are now asking from the common council permission to use the public streets and roadways for the distribution of the electric current.

Detroit, Mich. Detroit capitalists are corresponding with Paw Paw citizens with a view to constructing an electric road to Lawton to connect with the Michigan Central. It is designed to use water power to run the generators.—The Wayne Circuit Court, all the judges concurring, has rendered a decision denying the application of the Detroit Citizens' Street Railway Company for a temporary injunction restraining the Detroit Railway Company, a new concern, from constructing and operating street railway lines in Detroit upon the ground that the complainant possessed the first right to all streets in the city for railway purposes under the terms of its franchise.

Pittsburg, Pa.—The *Post* says: "Another gigantic street railway has been projected, and a company of Pittsburg capitalists has been organized to extend the electric street railway line from Washington, Pa., through the numerous towns on the Chartiers branch of the Panhandle Railroad into Pittsburg. An application has been made for a charter and work on the line will be begun as early in the spring as the weather will permit. The new company is composed of President Francis J. Torrance, treasurer and general manager of the Standard Manufacturing Company; Thomas B. Hutchinson, a prominent local structural iron and steel manufacturer; A. E. Townsend, president of the Washington Railway, and Senator Arthur Kennedy, a director in the Allegheny Valley Railroad and the Bellevue Land Company."

Albany, N. Y.—A bill has been introduced in the Senate by Senator Owens providing that in New York and Brooklyn the price of electric lights shall not exceed one half cent per light per hour for incandescent lights, nor more than four cents per hour per light for each arc light. Other bills introduced: In the Senate—Providing that contracts for electric lighting in Brooklyn may be made with the consent of the Mayor for not exceeding five years; in the House—Providing that telegraph companies shall charge only one cent a word for the body of day messages, for all distances, and one half cent a word for night messages for all distances; providing that in cities of over 250,000 inhabitants, electric cars shall not be run at a speed greater than six miles an hour. Senator Raines's bill giving electric light companies right to acquire right of way was reported in the Senate.

New York.—The Edison Electric Illuminating Company held their annual meeting in this city on the 15th inst. The year's report showed station earnings of $1.369.066 and operating expenses of $550,426. Other sources of income, less legal expenses and taxes, $124,443, leaving the net earnings at $789,466. The company also received royalties on the Edison lamp of $46,000; $207.266 interest on bonds, and $476,196 in dividends were paid, leaving $152,004 to be carried to the surplus.—The Board of Electrical Control reorganized on the 17th by electing Mayor Strong as chairman and Henry S. Kearney as secretary.—In the bicycle exhibition now being held in Madison Square Garden, there is an electric sign extending across the entire east end of the garden, 108 feet in length by 35 feet in width, which contains 2,192 lamps aggregating 29,147 candle power. The electrical illumination is the finest ever seen in the garden, and lends a brilliant effect to the magnificent aggregation of bicycles.

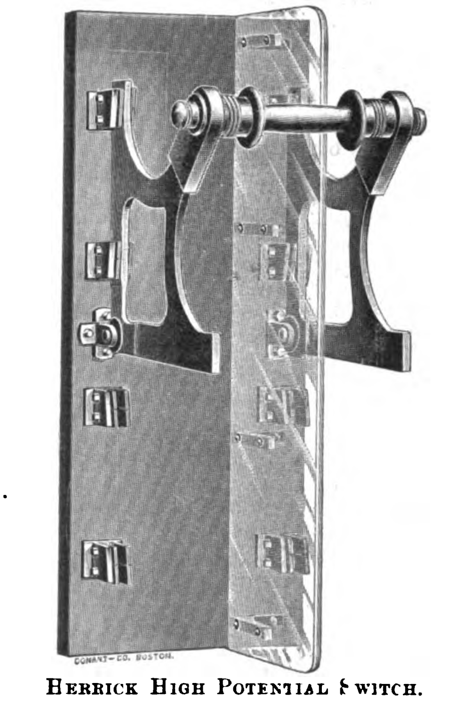
A New High Potential Switch.

We illustrate a new type of High Potential Knife Switch, designed by Charles H. Herrick, E. E., 183 Oliver street, Boston, Mass., and manufactured by the well-known firm of W. S. Hill Electric Company, 183 Oliver street, Boston, Mass.

The engraving shows one of a group of six switches now in use at the Narragansett Electric Lighting Co.'s station, Providence, R. I., where they are successfully carrying currents of 400 amperes at 1,000 volts, alternating current.

With the advent of large direct connected generators a need for a switch to handle and transfer the heavy currents was felt, and Mr. Herrick has successfully met the demand. It will be seen that the switch is very quick break, has a flash guard between its opposite poles, breaks both machines and circuit, and has its yoke at a point of absolute safety both to operator and switch. In operation there is no flash when switch is thrown and the slightest possible "wink" in the lamp to which it supplies current.

It will also be seen that our illustration shows a switch adapted for use on the front of switchboards, but designs have been completed for the same type of switch to be placed on the rear of the board. This type is operated by a lever and handle extending through a slot cut in the switchboard. The switch has solid cast copper blades, micanite insulation on yoke and the well-known Hill reinforced contacts, and will be given a carrying capacity of 50 per cent. in excess of its regular duty to allow for all reasonable overloads. It is adapted for all varieties of duty from 110 and 500 volt circuits to those carrying 2,000 volts and over, alternating current.


CONANT—CO. BOSTON.

HERRICK HIGH POTENTIAL SWITCH.

It is the intention of the Hill Company to build these switches in all sizes and types as demand may arise for them, and will design this switch to perform any special duty and guarantee results. The Hill Company have given it the name of "Herrick High Potential Switch."

As stated above, our illustration shows the switch in use on the alternating switchboard designed by Mr. Herrick for the Narragansett Electric Lighting Co., which is capable of handling 50,000 to 100,000 16-C. P. lamps. The design of this board is such that all changes of machines and circuits are made instantly and without the use of plugs or cables of any sort. The generators can be arranged to run in multiple or independently as desired, provision being made in the design of the board to admit of this feature. This board was also the product of the Hill Company's shops and is strikingly handsome, being 22 feet by 6 feet in size and the material Italian marble.

The Hill Company will be glad to answer all inquiries, make quotations, etc., to all who may be interested.

Wallace & Sons.

We beg to notify our friends that our new Catalogue for 1895 will soon be ready.

This Catalogue will contain the Latest Revised Price-Lists of goods of our manufacture that are in force at this writing. Yours truly,

WALLACE & SONS.

New York, January, 1895.

The Joseph Dixon Company.

"Graphite as a Lubricant" is the title of an interesting pamphlet issued by the Joseph Dixon Crucible Company of Jersey City. The pamphlet is now in the third edition and will be sent on application.

INCORPORATIONS.

The American Electric Meter Company, Camden, N. J.—to manufacture, buy, sell and erect electric meters, electrical machinery, appliances, etc. Capital stock, $100,000. Promoters: Wm. D. Marks, Walter F. Smith, James F. Cray, all of Philadelphia, Pa.

The Phœnix Telephone and Electric Company, Denver, Col.—to sell, lease and deal in telephones, telephone lines, systems and electric and magnetic appliances, instruments, etc. Capital stock, $750,000. Promoters: Gurnsey Walker, Preston H. Barker, Alfred W. Chamberlin, Denver.

The Milwaukee Dynamo Company, Milwaukee, Wis.—to do a general electrical business and sell electric goods. Capital stock, $15,000. Promoters: W. A. Ehlman, Jno. Koerta, Theo. Egelhoff, Milwaukee.

The Franklin Telephone and Electric Company, Jersey City, N. J.—to manufacture, buy, sell, build and use electrical machinery, etc. Capital stock, $200,000. Promoters: A. O. L. Havens, Point Pleasant, N. J.; John McG. Goodale, John R. MacArthur, New York City.

The St. Louis County Electric Light and Power Company, Clayton, Mo.—to furnish light and power for public and private use. Capital stock, $5,000. Directors: M. B. Greensfelder, E. W. Warfield, E. H. Benoist, E. L. Dosenbach, Charles Cunningham, Dr. Young, H. Bond and C. K. Ramsey. One of the leading objects of the enterprise is to furnish power for several electric railways that are shortly to be built in the county.

The St. Louis County Telephone Company, Clayton, Mo. Capital stock, $5,000. Incorporators: M. B. Greensfelder, E. W. Warfield, O. H. Benoist and others.

The West Shore Electric Light Company has filed articles of incorporation at Hackensack, N. J. Capital stock, $100,000. Incorporators: John A. Dempsey, Guy C. Dempsey, New York; Leon Abbett, Jr., Hoboken, and Robert W. S. Negus, Bogota. The places of business will be Ridgefield, Englewood, Palisades, Harrington and New Barbadoes. This includes all the property proposed to be covered by the Bergen Traction Company, of which the electric light company is supposed to be a branch.

The New York Electric Exchange Company has filed papers of organization with the county clerk at Newark, N. J. Capital stock, $100,000. Incorporators: James E. Blackmore, Bartlett Blackmore and Daniel M. Mandrell, all of Newark.

The Electric Purifier Company, Chicago. Capital stock, $800,000. Incorporators: George H. Reynolds, A. B. Jenkins, W. T. Rankin, W. M. Culley, Henry S. Williams.

The Newman Canning and Electric Light Company, Newman, Ill.—to can vegetables and operate an electric light plant. Capital stock. $14.000. Incorporators: B. Thomas, Joseph Venders, L. W. Root, W. J. G. Pound and J. H. Scotten.

The Staten Island Terminal Electric Company—to build and operate a street surface railway from the ferry landing at St. George to New Brighton. Capital stock, $50,000. Directors; Herman Bergholtz, De F. VanVleet, Franklin C. Cornell, Daniel Thomson, C. J. Rumsey, of Ithaca; Frederick Leuchter, Port Richmond, S. I.; Alfred Hendricks, New York City; Grant Crabtree, New Brighton, S. I., and W. H. Bostwick.

The Spiral Wire Company, Portland, Me.—to carry on the business of electric lighting, power, etc. Capital stock, $1,000,000, of which $215 is paid in. Incorporators: W. G. Burnham, J. W. Briggs and Gorham Gray, all of Boston.

The Napoleon, Deshler and Northwestern Railroad Company has been incorporated at Columbus. The object is to build an electric road from Deshler, Henry County, to Montpelier, Williams County, Ohio. Capital stock, $50.000. Incorporators: M. Donnelly, Robert K. Scott, W. O. Hudson, J. W. Hanna, D. Merkison, George Eggers, D. W. Humphrey and W. P. Tyler.

The Great Northern Electrical Manufacturing Company, St. Paul, Minn.—to manufacture and sell automatic electric annunciators, electric fire, police and burglar alarms, etc. Capital stock, $100,000. Promoters: Henry F. Hoyt, Jno. F. Hoyt, St. Paul; Rob't L. Hunter, Minneapolis.

The Nantucket Electric Company, Nantucket, Mass.—to generate and sell electricity for light, heat and power, etc. Capital stock, $20,000. Promoters: Fred. Howard Porter, John R. Bacon, W. A. Clark, Jr., Geo. L. Smith, Henry A. Burnham.

The Nutting Electric Company, Chicago, Ill.—to manufacture, buy, sell and deal in merchandise and do a general contracting business. Capital stock, $50,000. Promoters: Carl K. MacFadden, Frank A. Smith, Jas. W. Hedenberg.

The Combination Power Company of Chicago, Chicago, Ill.—to acquire patents protecting power-supplying devices; to lease on royalty or sell the right to use the same on railway engines, power plants, vessels, and manufacture power. Capital stock, $500,000. Promoters: Jno. E. Anderson, Isaac T. Dyer, L. I. Blades.

The Denver Heat and Light Company, Denver, Col.—to operate and maintain electric generating stations, machinery and wires for transmitting electricity for furnishing light, heat and power, etc. Capital stock, $1,000,000. Promoters: John C. Feldwisch, F. Cobb, Thos. Mohr, of Denver.

The Anglo-American Electrical Association, Brooklyn, N. Y.—to manufacture and sell magnetic clothing and all medical, surgical and curative preparations and appliances into which electricity enters as a factor or agent. Capital stock, $100,000. Directors: Frederick A. Blake, Emma L. Blake and Alice R. Lucas.

RECENT COMPANY ELECTIONS.

Dolgeville Electric Light and Power Company, Dolgeville, N. Y.—President, Edmund R. Wanekel, of New York; secretary, N. A. Snell; treasurer, W. S. Armstrong. Executive committee: Alfred Dolge, W. S. Armstrong, C. W. Millett. Directors: Alfred Dolge, Wyman Eaton, E. R. Wanekel, N. A. Snell, Wheeler Knapp, G. A. Freygang, Charles Dedicke, Edward A. Brown, C. W. Millett, Calvin Brockett, W. S. Armstrong, Louis Cavalli and Karl Fink, of New York.

New Orleans Traction Company, New Orleans, La.—President, James H. Maury; vice-president, R. M. Walmsley; general manager, H. M. Littell. Directors: James H. Maury, Albert Baldwin, R. M. Walmsley, Henry Bier, Frank T. Howard, C. H. Hyams and J. C. Denis.

East Reading Electric Railway Company, East Reading, Pa.—President, A. J. Brumbach; vice-president, J. G. Leinbach; secretary, A. Fedgely; treasurer, Isaac W. Levan. Directors: A. J. Brumbach, William R. McIlvain, J. Augustus Strohecken, Jonathan G. Leinbach, John H. Printz, George W. Bard and Frank P. Esterly.

Norristown Power Company, Norristown, Pa.—President, Joseph Shaw; vice-president, I. H. Brendlinger; treasurer, Wm F. Solly; secretary, B. F. Keiper. Directors: Joseph Shaw, I. H. Brendliger, Wm. F. Solly, Geo. W. Smith, James McGlinnis, Isaac W. Smith, John Slingluff, S. S. Kohn, Solomon Gilbert, J. Evans Isett and H. C. Crawford.

Pen Argyle, Bangor and Water Gap Electric Railway Company was lately reorganized at Easton, Pa., and the following officers elected: President, J. C. Merrill; secretary and treasurer, C. Albert Sandt. Directors: C. Albert Sandt and John Bitters, of Easton; Erwin Merrell, C. C. Wise and W. F. Jordan, of Bangor, and E. V. N. Hurmance, of New York City. President Merrell says he has such assurance of financial aid as to lead him to believe that the road will be speedily built.

H. B. Morehead has been elected general manager of the Cincinnati, Hamilton, Middletown and Dayton Electric Railroad Company.

Westinghouse Electric Light, Heat and Power Company, York City, Pa.—Directors: Logan A. Marshall, Edward Stubk, Geo. F. Motter, J. A. Walker, George B. Rudy, Charles Baylor, H. A. Wasbers.

Toledo and Maumee Valley Electric Railroad Company—Directors: Parks Foster, A. K. Detwiler, G. G. Metzger, W. B. Taylor and Thomas B. Tracy.

Sandusky Electric Street Railway Company, Sandusky, Ohio—Directors: A. J. Stoll, J. S. Cowdery, C. H. Moss, James Flynn, C. G. Nielsen, J. H. Emrich, Homer Goodwin.

Brush Electric Light and Power Company, Savannah, Ga.—President, S. P. Hamill; vice-president, D R. Thomas; secretary, W. K. Wilkinson. Directors: John C. Rowland, D. Y. Dancy, J. R. Sheldon, A. Minis, L. Kayton, W. W. Mackall, J. S. Collins, George W. Allen, J. Rauers.

Reading Traction Company, Reading, Pa.—Directors: John A. Rigg, Robert N. Carson, R. Nelson Buckley, Richmond L. Jones and David C. Golden.

Edison Electric Illuminating Company, New York—Directors: A. H. Boissevain, R. R. Bowker, C. H. Coster, C. E. Crowell, Thomas A. Edison, W. E. Glyn, D. O. Mills, George F. Peabody, W. A. Read, F. S. Smithers and Spencer Trask.

Adrian Electric Belt Street Railway Company, Adrian, Mich.—President, S. E. Graves; vice-president, W. A. Jackson; secretary, Charles F. Barker; treasurer, M. E. Chittenden. Directors: W. A. Jackson, F. E. Snow, Clark Rude, J. H. Blain, S. E. Graves, C. F. Barker and M. E. Chittenden.

Northampton Electric Lighting Company, Northampton, Mass. President, Alexander McCallum. Directors: A. McCallum, C. H. Pierce, C. E. Gould, S. B. Fuller, John T. Stoddard.

Boulder Electric Light Company, Boulder, Col.—Directors: Dr. I. L. Bond, J. H. Nicholson, Geo. M. McClure, Dr. R. Bartlett and B. M. Williams. The first three were elected president, secretary and treasurer respectively.

Rochester Electric Railway Company, Rochester, N. Y.—Directors: H. Sellers McKee, Pittsburg; Benjamin Graham, New York City; Herace Magee, Philadelphia; T. De Witt Cuyler, Philadelphia; John N. Beckley, Hon. Frederick Cook, Marcenus H. Briggs, Arthur Luetchford, William C. Barry, Chauncey C. Woodworth, Hon. Charles S. Baker, Charles F. Pond and Patrick Cox, of Rochester.

At the annual meeting at Norristown, Pa., of five electric railway companies in which the Me Shepp have a controlling interest, the five compa were merged into one, each retaining its own officers. following officers were elected: Citizens' Company President, D. B. Shepp. Directors: J. W. Shepp, D. Shepp, W. B. Krick, Joseph Fornance. Ambler Compan —D. B. Shepp. Directors: J. W. Shepp, D. B. Shep Henry Parker, E. Murphy, W. B. Krick. The officers of th Conshohocken, the Montgomery County and the Norristown Companies are the same as those of the Ambler Company.

At a meeting of the board of directors of the Susquehanna River Electric Company, which, as before reported, was organized to bring electric power from Conowingo to Baltimore after the Niagara Falls plan, J. W. Marsh, of Pittsburg, was elected president of the company, M. H. Houseman retiring from that position and becoming vice-president. John S. Bull having resigned as a member of the board of directors, was appointed real estate agent of the company. Winfield J. Taylor was appointed counsel of the corporation.

Woven Wire Brushes.

The Belknap Motor Company of Portland, Me., are the patentees and manufacturers of the best Woven Wire Brush on the market.—[*Adv.*

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JANUARY 15, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

532,448. Conduit Railway Trolley. William T. Dulany, Jr., New York, assignor of one-half to Oscar F. Shaw, Brooklyn, N. Y. Filed March 30, 1894.

532,449. Conduit Electric Railway. William T. Dulany, Jr., New York, assignor of one-half to Oscar F. Shaw, Brooklyn, N. Y. Filed Aug. 16, 1894.

532,477. Trolley-Catcher. Martin V. B. Nichols and James A. Fraser, Port Arthur, Canada. Filed May 26, 1894.

532,538. Controller for Electric Cars. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed April 14, 1894.

532,576. Closed-Conduit Electric Railway. George W. McClintock, Wollaston, and Daniel J. McLane, Quincy, Mass. Filed July 2, 1894.

532,599. Closed-Conduit Electric Railway. John Schnepf, New York, N. Y., assignor of one half to William H. Bellamy and William C. Doscher, same place. Filed Sept. 9, 1893.

532,593. Converter System for Electric Railways. Charles F. Scott, Pittsburg, Pa., assignor to the Westinghouse Electri and Manufacturing Company, same place. Filed July 31, 1893.

ELECTRIC LIGHTS AND APPLIANCES.

532,468. Carbon Filament and Method of Manufacturing Same. Arthur D. Little, Boston, Mass., assignor to the American Viscose Company, same place. Filed June 18, 1894.

532,531. Electric-Arc Lamp. Arthur Chester and John J. Rathbone, London, England. Filed March 26, 1894.

DYNAMOS, MOTORS, ETC.

532,441. System of Power Transmission. Charles S. Bradley, Avon, N. Y. Filed Sept. 12, 1893.

532,475. Brake for Electric Motors. William H. Morgan, Alliance, Ohio, assignor of three-fourths to Thomas R. Morgan, Sr., Thomas R. Morgan, Jr., and John R. Morgan same place. Filed March 19, 1894.

532,514. Electric Elevator and Motor Controller. Robert Wilson, Louisville, Ky., assignor to the Sulzergvogt Machine Company, same place. Filed June 23, 1894.

532,537. Automatic Circuit-Breaker. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 28, 1894.

532,549. Alternating-Current Motor. Ludwig Gutman, Pittsburg, Pa. Filed Aug. 27, 1890.

TELEPHONE AND TELEGRAPH APPARATUS.

532,605. Annunciator for Telephonic Circuits. Theodore Spencer, Cambridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Sept. 10, 1894.

BATTERIES.

532,701. Mechanism for Forming Battery-Plates. Charles J. Reed, Philadelphia, Pa., assignor to the Reed Electric Company, same place. Filed Sept. 12, 1894.

MEASURING INSTRUMENTS.

532,559. Galvanometer. Adrian H. Hoyt, Penacook, N.H., assignor to the Whitney Electrical Instrument Company, Saco, Me., and Manchester, N. H. Filed April 25, 1894.

532,560. Galvanometer. Adrian H. Hoyt, Penacook, N.H., assignor to the Whitney Electrical Instrument Company, Saco, Me., and Manchester, N. H. Filed April 25, 1894.

532,561. Galvanometer. Adrian H. Hoyt, Penacook, N.H., assignor to the Whitney Electrical Instrument Company, Saco, Me., and Manchester, N. H. Filed April 25, 1894.

MISCELLANEOUS.

532,588. Contact Device for Electrical Appliances. Friedrich W. Schindler-Jenney, Kennelbach, Austria-Hungary. Filed Feb. 19, 1894.

532,594. Non-Arcing Switch. Charles F. Scott and Harry P. Davis, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, same place. Filed March 29, 1894.

532,633. Railway Block-Signal. William Berrigan and William H. McClure, Elmira, N. Y. Filed Sept. 18, 1894.

532,662. Electric Switch. William P. Hancock, Everett, Mass. Filed Nov. 27, 1894.

532,718. Phonograph. Joseph Broich, Brooklyn, assignor to Frederick Pearce, New York, N. Y. Filed Dec. 13, 1893.

532,712. Magnetic Separator. Henry Arden, Seattle, Wash. Filed Aug. 15, 1894.

ELECTRICITY.

Vol. VIII. NEW YORK, JANUARY 23, 1895. No. 2

Self-Lubricating.
Saves Commutators.
THE PARTRIDGE CARBON CO.,
SANDUSKY, OHIO.

TRADE **GONDA** MARK.
The STANDARD BATTERIES of the world.
Highest Award and Gold Medal:
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is made by
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FOR ALL ELECTRICAL PURPOSES.
Incandescent Lamp and Cutout Terminals
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Stands without an equal in the market. Do not buy other makes when you can secure the BEST from a well known and reputable manufacturer.
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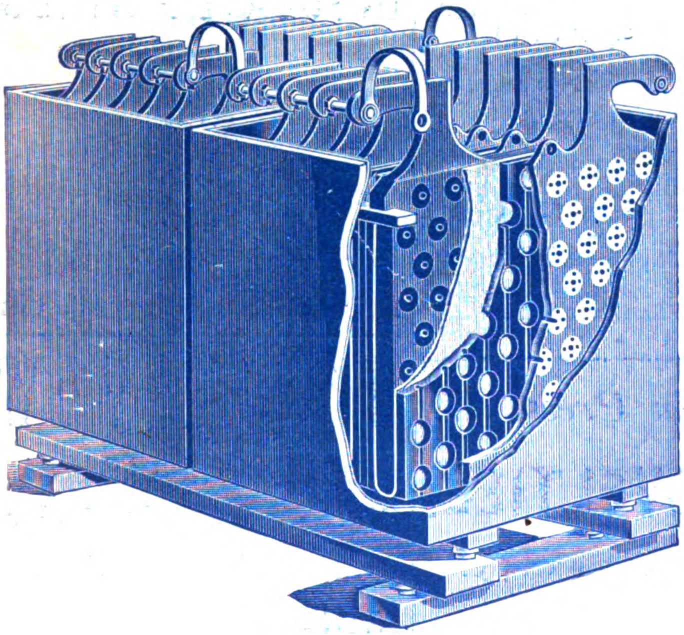

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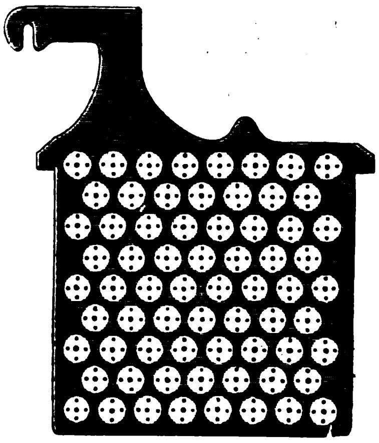

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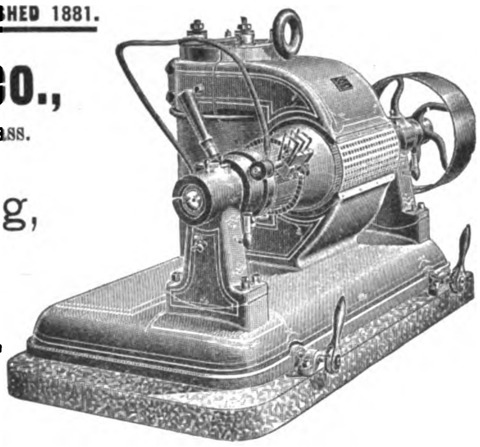

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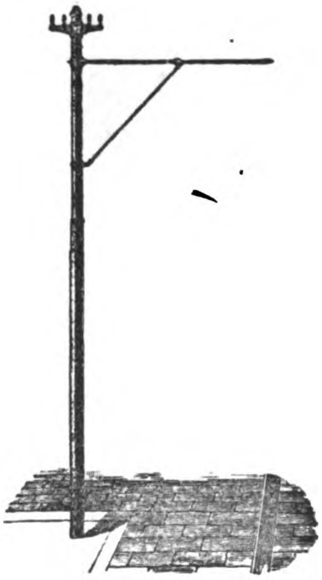

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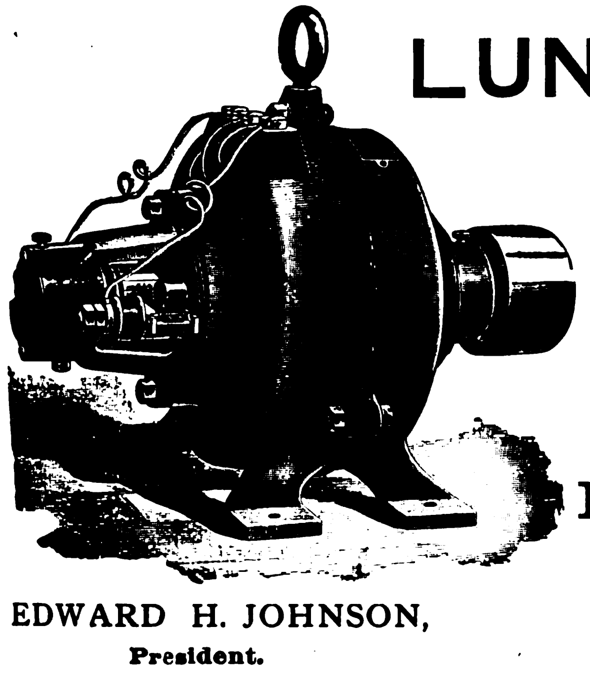

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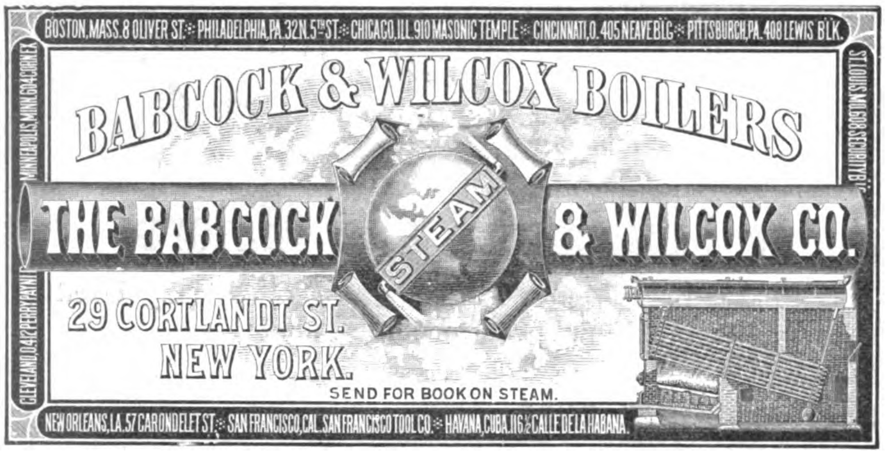

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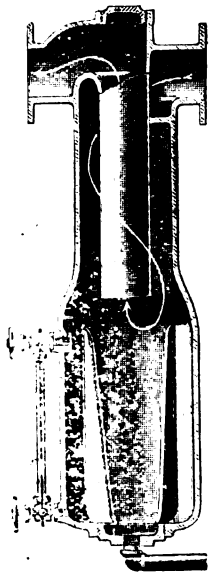

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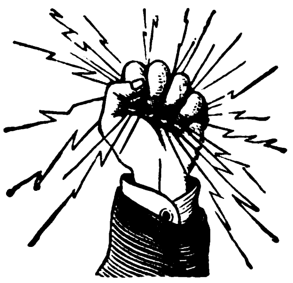

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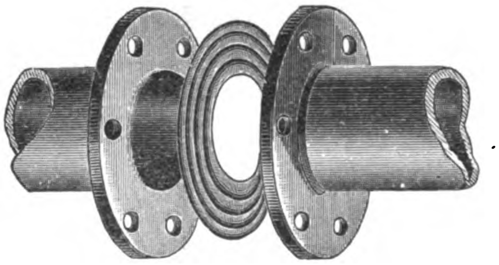

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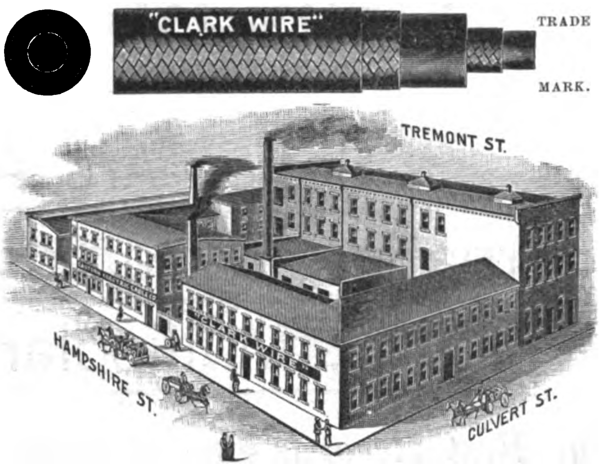
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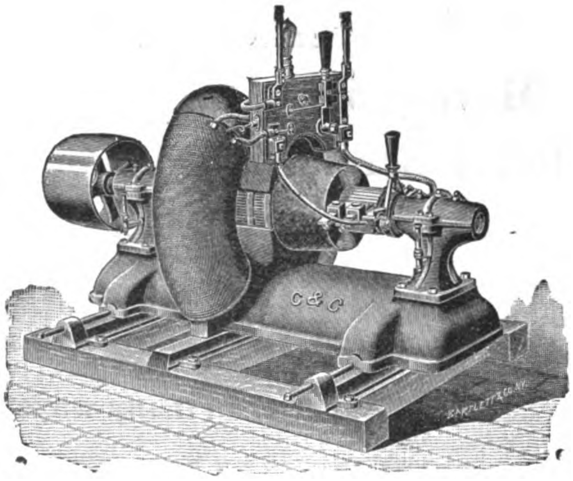

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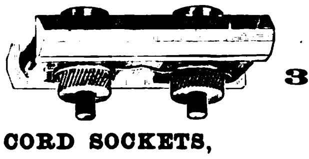

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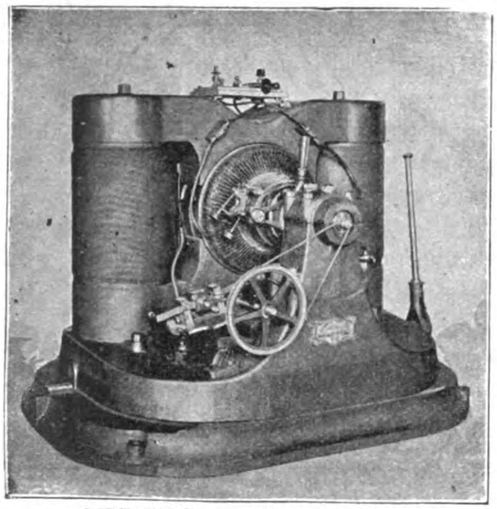

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delivered before the New York Electrical Society on November 27 by

GANO S. DUNN,

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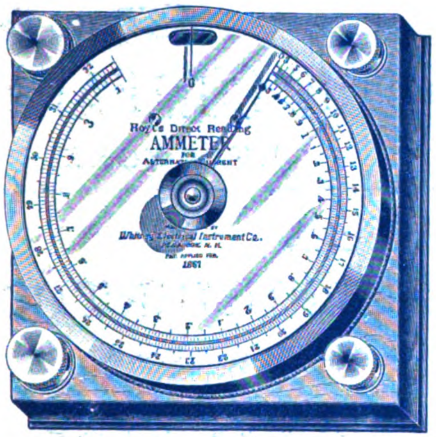

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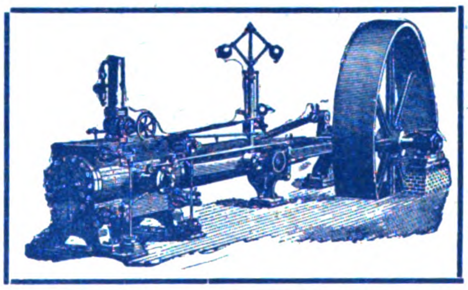

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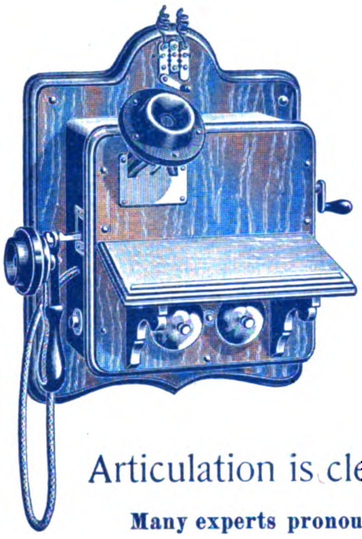

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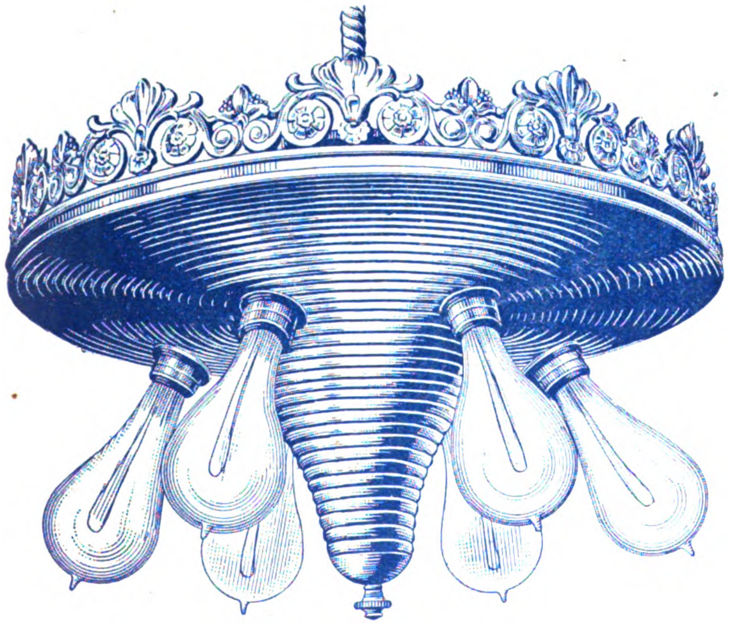

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Beacon Electric Co., St. Paul, Minn.

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ELECTRICITY.

Vol. VIII. NEW YORK, JANUARY 30, 1895. No. 3

ELECTRICITY.

Published every Wednesday by the

ELECTRICITY NEWSPAPER CO.

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N. E. L. A.—The next annual meeting of the National Electric Light Association will be held at Cleveland, O., February 19-21, 1895. Every concern interested in either lighting or railway work should be represented in the membership of this body, and should have at least one representative at the Cleveland meeting. The Secretary is Mr. Geo. F. Porter, 136 Liberty street, New York.

EDITORIAL NOTES.

An Important Decision. Judge Gaynor's decision in the mandamus proceedings against the Brooklyn Heights Railroad Company, when carefully studied, must command the respect of even the most partisan advocates of the corporations themselves.

He brushes aside all other questions, and presents the duty of the companies to the public. That duty is to run cars. The question of proper wages has nothing to do with the case, neither has the lawlessness of the strikers. If property is destroyed through want of protection, the companies have redress against the city in a lawful and regular proceeding.

It is not contended by the companies that they *can not* run cars, but that they would lose money by meeting the demands of their striking employees. Judge Gaynor holds that it is not for the courts to see that these companies do not lose money. The city does not guarantee profits in granting charters. The charter is a contract in which the companies agree to give proper service to the public. This service they must perform.

The suggestion that they may hire men at lower wages, one by one and as fast as possible, providing a new force if need be by degrees and *without stopping their service*, is not only good law, but it is common sense. It is a policy which would go a long way towards abolishing strikes.

It need not be pointed out that the relations of railroad corporations to the public are entirely different from those of the private employer of labor. The latter may close his works indefinitely. The former should not be allowed to discontinue their service for one hour from reasons of economy.

On the other hand, we must consider the position of the striker. Even if he be partly in the wrong in the beginning, he usually starts out with the sympathy of the public. But as a complainant he must come into court with clean hands. He cannot invoke the law's protection against a practice of which he himself is proven guilty. It is the unfortunate outcome of all strikes that sooner or later, no matter how just his cause at first, the striker commits offences against the law that put him beyond the pale of its protection. Doubtless much of the lawlessness attending strikes is committed by outside parties, but it is not always the case, and it has been proven in many cases, as in the Brooklyn trolley strikes, that some of the strikers themselves have been guilty of some of the most flagrant of the offences. It may be stated as a law that public opinion will eventually turn against the infractors of the law, and without the sympathy of the public no cause can be successful. The American public is proverbially good-natured and long-suffering, but when it learns from repeated experience that strikes are invariably accompanied by riotous proceedings and other infractions of the law, it must turn against the institution, and the side which is least conspicuous in its public infractions will have the most sympathy. Mayor Schieren is certainly right in the stand he has taken, that the period of riots is not the time for arbitration. That should take place before mob law takes sway. If unfortunately it cannot be arranged for at that time, then the opportunity is gone until the disturbances have ceased. Arbitration with the revolver is not arbitration and can never result in ultimate good to either side.

As we go to press, a very clever scheme is announced on the part of the strikers, the outcome of which will be awaited with interest. In order to disarm the Brooklyn Heights Company, should they be called to answer a charge of contempt in not obeying Judge Gaynor's order, Master Workman Connelly has addressed a letter to President Lewis, offering the services of all the men he needs upon the terms in force during 1894. In addition to this, it is reported that a large number of individual motormen have sent letters, offering to go to work again upon the terms suggested by Connelly.

It is claimed that according to Judge Gaynor's order there are only two sufficient excuses for not running cars on regular time. Mob violence is one, and the inability to engage men another. Judge Gaynor claims that the company has sufficient protection against the first, which however is likely to be disputed, whereas if President Lewis claims he cannot get men, copies of these letters will be put in evidence against him, and the enforcement of the mandamus be demanded by the Knights of Labor. The unfortunate thing for the Knights, however, is that there has been, and still is, at present writing, mob violence. Until this ceases absolutely the strikers' case has no ground to stand on.

* * *

New Scientific Periodicals. It is something unusual for us to be called upon to give space the same week to the review of two new claimants for public favor in the line of periodical literature, but it so happens that this is the case now, for in this issue we discuss two new periodicals at considerable length. The claims which these two periodicals have for our attention are based, however, upon entirely different premises. While the one deserves comment because it is so good, the other deserves equal attention because it is so utterly bad. That the two reviews are brought so strongly into contrast is purely the result of fortuitous or other chance, and not of design. In the case of the *New Science Review*, we have nothing of a commendatory nature to say. The best that can be said is that it had a splendid opportunity, but has recklessly thrown it to the dogs. With a splendid appearance, fine make-up, clear typography and a broad field almost unoccupied before it—starting out with a few names that would challenge respect and attention wherever those names were heard, it has deliberately forfeited that respect, brought odium upon its attractive title and belied the promises of its prospectus by giving place to a class of articles that should find no place in literature of any kind, much less that going under the head of Science. We had heard it rumored that the magazine in question was to be the organ of the Keely-motorites as represented by their at present most prominent mouthpiece, Mrs. Bloomfield Moore. We were loath to believe this at first, but the appearance of the third number lends strong confirmation to the report. We have no criticism to make of Mrs. Moore as an individual, but as a philosopher, to use a homely expression, she is as clear as mud. A good second to her is Henry Clay, or his materialized spirit, who discourses glibly in the same number of such things as "oppositions being proportionally equilibrated," and "the average harmony" and "sympathetic portion of the vibration, that with which it (the light rays) may be in harmony," etc., etc. It is hardly conceivable that any sane editor could accept such trash as having any meaning, and the only recourse left us is to assume as true the rumor that this is to be the repository of all such nonsensical twaddle as writers of this stamp, faith-curists, spiritual mediums and that ilk delight to indulge in. We fancy that the reputable contributors whose names have unfortunately been connected with the journal will regret their connection with it, and withdraw entirely, so that the twaddlers may have full sway and unrestricted room in the issues that are to come, if indeed the publication can survive another issue.

Of quite a different class is the second publication, which in name is old, but in form and nearly everything else is new. We refer to *Electric Power* in its magazine form.

Under the Searchlight.

Views and Opinions on Timely Topics.

The Bate Refrigerator Case.

The Bate Refrigerator case, which was argued before the U. S. Supreme Court November 15, 16 and 17, 1894, and upon which a decision has been expected every Monday since the Court reconvened, has not yet been decided. The next recess will begin February 4 and will last for a month. This recess is taken for the purpose of giving the Judges time to write their opinions, and it seems probable now that nothing further will be heard of the case until after the February recess. The slump in General Electric on Monday, which brought the stock down to 29⅜—the lowest figure yet reached—was therefore due in no way to a decision as many supposed.

* * *

The Roll of Honor.

A recent pamphlet issued by Mr. W. J. Johnston, the man who not only wants to run his own business but everybody else's, gives a list of concerns who advertise "only" in the *Electrical World*, and also a list of those who advertise in other papers. The first list, as is customary with both the printed and spoken remarks of the gentleman named, is a lie, containing as it does a large number of regular patrons of other journals.

Apart from the inaccuracies, the list is a good one for advertisers to study.

It shows that every concern of consequence patronizing the *World* exclusively has a competitor, doing twice or even ten times the business, advertising in other papers, included in list No. 2.

The moral to this is as old as the business of advertising: The wise man scatters his advertising and increases his business.

* * *

Organized to Abet Crime.

Some weeks ago when ELECTRICITY had thoroughly exposed the electro-medical fraud Electropoise, and called the attention of the leading religious journals and the monthlies to the fact that they were assisting in the promulgation of a fraud upon their readers, the advertising agents of these various publications held a meeting to discuss the situation.

It was finally decided that they would continue to publish the advertisements of the Electropoise as long as they could get paid for it, regardless of the merits or demerits of the article. They held that it was not their business to decide as to the quality of the article advertised, and that ELECTRICITY's publication could not injure them much, the paper being in a different field.

This is about the tone of morality and decency which might be expected to find expression at a meeting of Tammany politicians, but scarcely what we have a right to look for from the leading religious organs of America.

At slight expenditure any of these journals could make an examination similar to the one ELECTRICITY made, but this would stop their income from a criminal business, and this they have no intention of doing. The source of the income is of small moment; even if they sell their souls to get them, they must have advertisements. Thus they grow rich and pose as pillars of the church which they disgrace.

The *Churchman*, the *Observer*, and the other religious journals which have persisted in printing the advertisement of the Electropoise since ELECTRICITY's analysis, and also the *Review of Reviews*, the *Literary Digest*, and other secular journals, have shown conclusively that they would print lottery or green goods advertisements, Scotch Oats Essence testimonials, or anything else in the shape of fraudulent advertisements, IF THEY DARED.

Conscience does not guide them; they come just as near the line of being excluded from the mails as they dare.

They want money and evidently hold that the money of the swindler is as good as any other.

* * *

G. E. Directors Will Take Notice.

The indictment of Messrs. Henry B. Beecher and Vincent R. Schenck, charged with issuing a false report of the affairs of the American Casualty Company in 1891, is a wholesome sign.

It is of course not fair to assume that these men are guilty of the crime charged. If innocent they will be vindicated. But the incident shows that there are stockholders in, and creditors of, some companies with backbone and courage enough to try and secure the punishment of those believed to be responsible for public misrepresentations.

Section 611 of the Penal Code provides that "a director, officer, agent or employè of any corporation or joint stock association who knowingly concurs in making or publishing any written report, exhibit or statement of its affairs or pecuniary condition containing any material statement which is false is guilty of a misdemeanor."

Did the G. E. directors have this in mind when they resolved that casual statements don't go, and that all recent statements (favorable and unfavorable) regarding the company's affairs were false?

But how about the first annual report? Is that to go into history as a "casual statement?"

* * *

New York is the Place.

The suggestion made in ELECTRICITY two weeks ago, that New York should be the next meeting place of the N. E. L. A., has met with nothing but favorable comment from all quarters. Those who have visited the Grand Central Palace are enthusiastic in their opinion that no other building in the country presents so many advantages for the Convention proper, for the exhibitors, and for a memorable social event.

* * *

All There Is in the Classics.

Read Homer's Iliad, Virgil's Æneid, and then read the *Western Electrician's* phillipic on Pudd'nhead Johnston in the issue for January 13, and you have all there is of essential importance in the classics.

* * *

THE commercial instinct displayed by a couple of Cleveland gentlemen in mixing up the local entertainment committee with the sale of space to exhibitors is worthy of a neighborhood a great deal nearer the New York City Hall than is the Hollender Hotel.

* * *

IF there is any remaining space for exhibits in the Hollender House at the time the Convention meets, it would seem as though late comers should get it at regular rates.

Resolved,

That Giving Out Incorrect Statements is Becoming Dangerous.

Casual Statements Don't Go.

At a meeting of the Board of Directors of the General Electric Company held in Boston on the 22d the following resolutions were adopted:

Whereas, Various printed statements (favorable and unfavorable) regarding the company and its business have heretofore appeared, most of them reading in a manner calculated to give the impression that they are issued either with the sanction of this company or from information furnished by its officers and directors, and

Whereas, In point of fact, and almost without exception, such statements are unofficial, and while often having some foundation in fact, are so inexact as to be to a great extent misleading; now, therefore, be it

Resolved, That the Board of Directors desires to caution the public against assuming that any casual statements, whether favorable or unfavorable, emanate from sources competent to furnish information respecting this company.

Resolved further, That the Board now states for the information of stockholders that the company is entirely free from floating debt. Since the date of the last annual report the company has purchased $1,127,000 of its debenture bonds, using for the purpose the proceeds of various accounts and assets which have been liquidated since the date of the said report.

What will the flunkeys of the daily press say to this? For months they have been printing all the stuff which came to them from "A director," "A man close to the management," "An officer of the company," etc., claiming large business, huge profits, retirement of bonds out of profits, 4 per cent. earned on the $34,000,000 of stock; and now the directors themselves, in solemn conclave, in the sacred city of Boston, have kicked holes in all the rosy pictures which have been drawn.

The financial writers have not been paid much for their puffery—perhaps an occasional cigar or a pat on the back from the Magnetic Man—and now the burden of deceit is thrown upon them.

We would like to hear an expression of honest opinion on these resolutions from the Boston *Advertiser*, the New York *Commercial Advertiser*, the *Recorder*, the *Wall Street Journal*, the Boston *News Bureau* and several others among our esteemed contemporaries.

As for ELECTRICITY, our work and our statements stand sure—indisputable and unanswerable.

We are not compelled to rely on either the casual statements of individual directors or the official reports of the Board. We get our information from the records of that concern, and they are better than "official"—they are correct.

But, after all, are not these resolutions a trifle mysterious? What director is it whose "casual statements" are unworthy of belief? Certainly not the one who told the Boston *Herald* that the bonds had not been retired out of profits, but out of the proceeds of assets sold. The "casual statements" of most gentlemen are as much to be relied on as any other statements. Whoever this rascal is he should be turned out.

The following from last week's issue of ELECTRICITY are worth reprinting:

(From Electricity, Jan. 2.)

But admitting that the debts are paid, that bonds have been retired, how has it been done? From profits in the business? Certainly not. They (the G. E. Co.) have sold during the year a large amount of local securities, have cleaned up a number of bad accounts, and with the proceeds from these two sources they have reduced their debts and retired some bonds.

(Inspired Financial Paragraph, Jan. 3.)

The allegation that the $1,000,000 bonds retired last year were not paid out of earnings is declared to be untrue, as the company now depends upon its earnings rather than new capital for all its expenditures. This has been true ever since the St. R. and Ill. Properties issue.

Twenty days afterward the honorable Board of Directors resolves that ELECTRICITY was correct.

"Since the date of the last annual report the company has purchased $1,127,000 of its debenture bonds, using for the purpose the proceeds of various accounts and assets which have been liquidated since the date of the last report."

The situation is encouraging. If our memory serves us correctly this is the first official information ever issued by the company for the enlightenment of the stockholders and the public, except in the annual reports.

Let the good work go on, Messrs. Directors. You have now answered one portion of one question asked in ELECTRICITY three weeks ago. Now answer the remaining portion of that question and a few of the others.

No casual statements, remember; nothing but official resolutions will go hereafter.

Some of the questions were as follows:

Have not the treasury assets sold during the year (including notes collected) amounted to more than the notes payable wiped out and bonds retired?

Did not the company lose practically $2.000,000 by the defection of the Fort Wayne Company?

Is it not liable for nearly $2.000.000 as a stockholder in Northwest General Electric?

Is there not a penitentiary job for some one if the affairs of the Northwest Company are ever aired in the courts?

Is it not a fact that the $8.000,000 of patent assets would be marked off the books in any honest company?

Are not half the $9,000,000 of notes receivable claimed in the last report worthless?

Was not the inventory account of last year carried at least $1.000,000 too high?

Could the stocks of manufacturing companies, carried at $2,700.000, be sold for $500,000?

Is a dividend possible for the next twenty years under present conditions of cost, selling expenses and price received?

Will not the next annual report show a further deficit of $6,500,000 at least?

Has not the gross business of the company fallen from $20,000,000 to less than $10.000,00, at the same time that selling prices have been reduced one half?

Has not the company paid out within 60 days nearly $70,000 to make good some of its guarantees on stocks and bonds sold to a financing company? What is the extent of the possible liability in this direction?

And another very important question to answer before the stockholders meet in April is:

Why were the United Securities Company and the Street Railway and Illuminating Properties allowed to return worthless securities to the G. E. treasury, taking in exchange therefor the best they could find, months after the original sale and agreement was made and signed?

And another:

By whose authority was the treasury of Northwest General Electric emptied?

These questions will probably be asked in a truly official manner before many months.

Personal.

Mr. Henry F. Kellogg, of the Whitney Electrical Instrument Company, Boston, was in New York last week in the interests of his company.

Mr. A. C. Garrison, secretary and treasurer of the Columbia Incandescent Lamp Company of St. Louis, is a visitor to New York this week.

A Richmond (Va.) paper states that Mr. Cecil P. Poole, general superintendent of the Lynchburg Electric Company, has tendered his resignation to the company for the purpose of accepting a position on the editorial staff of the *Electrical World*.

The Cleveland Convention.

The arrangements for the entertainment of the N. E. L. Association are in the hands of a well selected committee with C. W. Wason as chairman. The other members are: Myron T. Herrick, W. H. Lawrence, Horace A. Andrews, E. P. Roberts, F. De Hass Robison, Charles F. Brush, Robert Lindsay, W. B. Cleveland, S. H. Short, C. Corlett, J. P. McKinstry, M. A. Hanna, S. M. Hamil, C. H. Rockwell, J. Potter, Frank Billings, N. S. Possons, E. L. Babcock, Samuel Scovil, E. P. Sperry, A. V. Kurtz, George M. Hoag and S. C. D. Johns.

The criticism having been made that previous conventions had been rendered less beneficial to the attendants by outside attractions, it is proposed that the ensuing one be devoted more to business than pleasure; and it will be the aim of the committee, while omitting nothing that can contribute to the personal enjoyment of all, to give such direction to the proceedings as will tend to give them the fullest practical value.

National Electric Light Association.

The following bulletin is issued by the secretary in regard to the Cleveland meeting of the N. E. L. A.:

In addition to the list already furnished of papers to be read at the Cleveland meeting of this association, February 19, 20 and 21, there will be one by Nelson W. Perry, E. M., entitled "The Storage of Energy Essential to Central Stations: How it May be Accomplished and the Economies Resulting." Professor Langley of Case School, Professor Stine of Armour Institute, Chicago, and others, will take part in the discussion.

The topic, "How to Light Large Cities," will be discussed by Frederic Nicholls, Charles R. Huntley, Frank H. Clark, J. Frank Morrison, T. Carpenter Smith, George A. Redman, E. F. Peck and others.

The Brooklyn Electrical Society.

The Brooklyn Electrical Society will give an entertainment and *smoke*, January 31, at 815 Washington street, Brooklyn, the object being to raise funds for the establishment of suitable headquarters, library, etc., for the use of its members. Meetings are held at present at the Edison Assembly Rooms, Tuesday evenings, when papers are read and discussed.

When the necessary funds are raised to start the club-rooms, a library and laboratory and other conveniences are in order.

This idea will bring the individual members who are engaged in the various electrical branches of the trade, as well as steam engineers, into closer acquaintance with one another and so make the meetings more and more enjoyable.

Interior Conduit and Insulation Company's Annual Report.

The report of the above company presented at the annual meeting on January 17 shows a prosperous year for 1894.

The business of the year has been as follows:

Net sales Conduit Mfg. (Dept. "A")	$328.531.01
Net sales Electric Mfg. (Dept. "B")	206,181,33
Total net sales	$534,712,34
Gross profit	$101,768.85
Bad debts written off	756.14
Net profits	$101,012.71

The net sales for the years 1892, 1893 and 1894 were as follows:

Net sales, 1892	$356,061.06
Net sales, 1893	478,652.15
Net sales, 1894	534,712.34

A plan was presented to enable the company to increase its working capital $100,000, to make possible the adding of other lines of manufacture, thereby allowing the profits to be distributed among shareholders instead of being diverted to increased plant. This plan involves the reduction of the common stock from $1,250,000 to $1,000,000, and the issuing of $600,000 preferred stock.

It is the intention of the company to engage in the railway motor and generator business on a large scale, operating under the Johnson-Lundell patents.

COMMUNICATION.

THE NATIONAL SCHOOL.

To the Editor of ELECTRICITY.

DEAR SIR: The reply to your letter of December 21 has been unavoidably delayed on account of pressure of other duties. If you will consult the files of ELECTRICITY you will find published a letter from me, dated May 29, 1894, stating that my connection with the National School of Electricity is bona fide. Since that time I have no sufficient reason for discontinuing the same. I have assisted in the organization of classes in Minneapolis, St. Paul and Cincinnati. At each place the methods and purposes of the School were fairly and clearly presented. At each meeting I attended it was distinctly emphasized that the School did not claim or expect to produce trained electricians, but that it did intend to give the students a thorough grounding in the elements of the subject and open the way for them to grow into a better knowledge. In no case were the people told or led to believe that they could become famous inventors or engineers because of the knowledge imparted by the National School.

I hear occasionally from the classes in Minneapolis and St. Paul, and learn that the students are more than satisfied with the National School of Electricity. I have learned directly from the employers of some of those men that as one result of their study they have done much better work in the shop, and some of them have become efficient workmen who had been in imminent danger of discharge for incompetency.

I might say further that I am preparing the weekly lessons for the special courses among street railway employees, being engaged at present on Lesson No. 26 of the street railway course. The proofs of these lessons are sent to other members of the honorary faculty, and each week I receive copies returned by them with suggestions and criticism. The lessons are then revised in accordance with these suggestions and are then returned to Chicago where electrotypes are made for printing the copies which are sent out to the classes. I also receive proof copies of lessons prepared for the general course by Prof. Jackson and of the electro-therapeutic course prepared by Dr. W. J. Herdnan. These are returned with such suggestions as occur to me.

Very truly yours,

GEO. D. SHEPARDSON.

The University of Minnesota, Minneapolis.

Long Distance Transmission.

The Snoqualmie Falls Electric Power Company of Seattle, Wash., appends to its prospectus a letter from the Westinghouse Electric and Manufacturing Company in regard to the transmission of electric power over long distances which contains the following: "One of the oldest power transmission plants is that of the Roaring Fork Electric Light and Power Company, Aspen, Col., transmitting several hundred horse power three to four miles, about six years. The Gold King Mining Company, Telluride, Col., transmits 1,000 horse power ten miles, selling power to several stamping mills. The San Antonio Electric Light and Power Company transmits light and power fifteen miles to Pomona and thirty miles to San Bernardino, and the Portland plant transmits power from the Willamette falls to Portland, a distance of about fifteen miles. There are many more plants in operation and a large number in course of construction, the most important of which is the Niagara Falls plant, which will be 15,000 horse power to start with and will transmit power to Buffalo, twenty-two miles or over, and the company contemplates a much larger transmission when they have the nearer market supplied."

THE DISTRIBUTION OF ENERGY IN THE SPECTRUM OF THE GLOW LAMP.*

(PRELIMINARY MEASUREMENTS.)

BY EDWARD L. NICHOLS.

I.

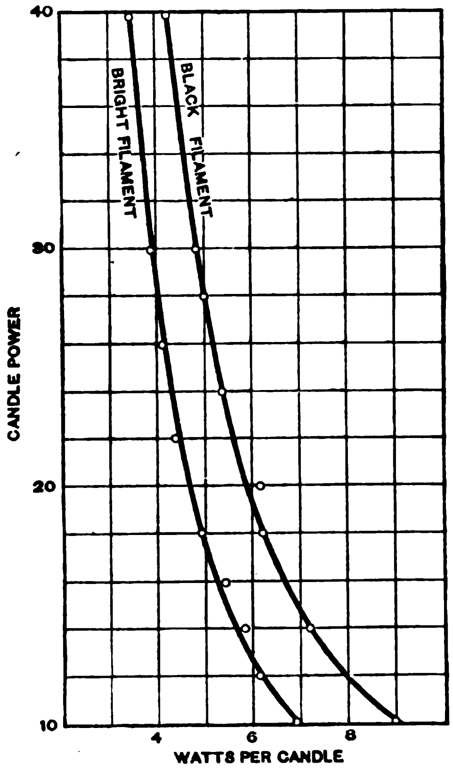
The glow lamp affords an interesting subject of study. In the first place, it is possible by varying the current in the filament to secure a very wide range in the temperature of the radiating surface, extending upwards to temperatures considerably higher than those of ordinary luminous gas flames, and to maintain more constant the condition of incandescence during the progress of each set of measurements than is possible in the case of any other source of light. In the second place, the study of the spectrum of the incandescent lamp affords an answer to certain questions of considerable practical importance.

In 1885, Messrs. Siemens & Halske, of Berlin, published the results of measurements for the purpose of showing the superiority of the silver-gray surface obtained by treating filaments of glow lamps by bringing the same to incandescence in an atmosphere consisting of volatile hydro carbon. In the following year Mr. Mortimer Evans† described comparisons of the radiation from bright and black incandescent lamp filaments in which the superiority of the former was very clearly demonstrated. Evans selected two filaments of similar size and structure, one of which he subjected to a surface deposition obtained by flashing in an atmosphere of ordinary coal gas, the result being a hard coating of carbon of the color of lampblack. The other filament was flashed in an atmosphere of volatilized hydro-carbons, by which means the usual silver-gray surface was obtained. The two filaments were then mounted and exhausted to the ten-thousandth of an atmosphere, and characteristic curves were made, showing (1) the relationship between the efficiency of the lamps, expressed in watts per candle, and candle power (see Fig. 1); (2) the relation between the total watts consumed in each lamp and the candle power. These curves show a very much greater amount of light for the energy expended in the case of the filament with bright surface.

Subsequently, two filaments of close, firm structure and of equal size were obtained which possessed the usual dull, dead black color resulting from carbonization without treatment. The characteristic curve of one of these was obtained after mounting the same in the usual manner and securing a good vacuum, after which it was removed from the lamp and was flashed in hydro-carbon vapor. After exhaustion it was again tested, measurements showing marked increase in efficiency; then it was removed from the bulb for a second time and flashed in coal gas, by which process a new surface of the color of lampblack was obtained. Having been remounted in this final condition and thoroughly exhausted for the third time, another characteristic curve was obtained. This curve was found to coincide quite closely with that of the original untreated filament. These three curves are given in Fig 2.

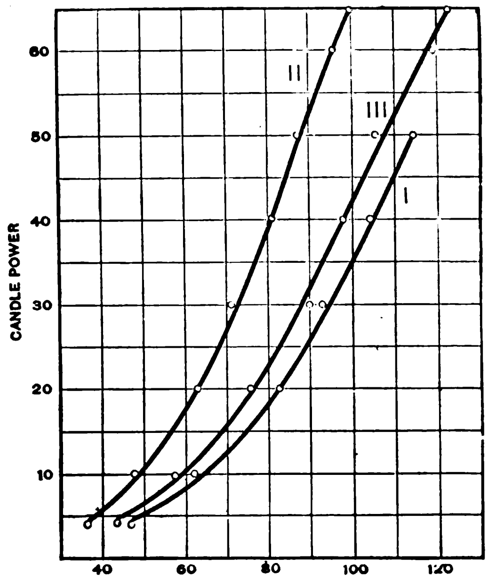
Mr. Evans's experiments seem to leave no question as to the fact that the bright surface obtained by flashing in hydro-carbon vapor possesses properties which fit it peculiarly for the production of light. Evans noted the fact that the lamp bulbs containing the black filaments were much hotter than those which surrounded filaments with a silver-gray surface, and he remarks: "I have little doubt that the loss of efficiency when black was due to the energy supplied being radiated in large quantities as heat waves from the blackened surfaces, which these surfaces when bright would not emit."

That the *total* radiating power of carbon in the form of lampblack is very much greater than that of the silver-gray graphitic form obtained by flashing in hydro carbons has been shown by H. S. Weber in a paper read before the Electrical Congress in Frankfort in 1891.* Weber, who tested thirty-three varieties of glow lamp filaments, found for the black carbon a coefficient of total emission lying between 0.0000169 and 0.0000174, and for treated filaments with bright surface, coefficients lying between 0.0000127 and 0.0000132.



Efficiency of Black and Bright Filaments (after Evans).

FIG. 1.



I. An Untreated Filament.
II. Same, after treatment (bright).
III. Same, after treatment (black).
(After Evans.)

FIG. 2.

During the winter of 1891-92, Mr. John C. Shedd† made a large number of comparisons of commercial lamps with treated and untreated filaments, for the purpose of further testing the conclusions reached by Evans. His method consisted in studying the visible spectrum of such lamps by means of the horizontal-slit photometer. The lamps were maintained for this purpose at various degrees of incandescence.

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* "Physical Review."

† Evans, Proceedings of the Royal Society, Feb. 18, 1886.

* Weber, Verhandlungen des Internationalen Elektrotechniker-Congresses zu Frankfurt am Main, 1891, II, p. 49. See also "Physical Review," Vol. II.

† Thesis: In Library of Cornell University, 1892.

Mr. Shedd's results were in the main confirmatory of the higher efficiency of bright carbons, but they indicate clearly that the efficiency of the incandescent lamp is dependent upon other factors than the character and radiating power of the surface of the filament. He found, for example, that the vacuum especially has much to do with the relationship between the energy developed in the lamp and the candle power.

His comparisons between glow lamps, at different stages of incandescence, and the gas flame, bring out two facts which are of interest in the comparative study of treated and untreated filaments.

(1) Spectro-photometric measurements with lamps of untreated filaments of vegetable fiber showed that the light was of the same color as that from gas (in the argand burner) when the lamp was being operated at an efficiency of 6.8 watts per candle. All efficiencies lower than this showed relatively higher intensities in the red, while all efficiencies above 6.8 showed a light which was bluer than that of the gas. The relative intensities of the various wave lengths in the light emanating from such filaments were found to vary quite rapidly as the incandescence rose. Such a lamp, for which the ratio $\frac{\text{glow lamp}}{\text{gas flame}}$ for the region of the D line was unity, gave for wave length 0.4 μ about 1.6

(2) In the case of treated filaments with bright surface, on the other hand, equality with gas light as regards whiteness was reached only at somewhat higher efficiencies, viz., between 4 and 6 watts per candle. The changes in the color of the light from such lamps appeared, moreover, to be much less marked than in the case of filaments with black surface. The variation in quality, indeed, was frequently scarcely noticeable when the lamp was brought up from 7 to 4 watts per candle. It would appear from Mr. Shedd's measurements that in the case of black filaments the increase in the intensity of short wave lengths with temperature was much more rapid than in the case of the longer wave lengths; whereas with bright filaments all the wave lengths of the visible spectrum gained in intensity at very nearly the same rate.

II.

A study of the results obtained by Mr. Shedd made it evident to me that the influence of the vacuum of the glow-lamp was so great as to render all comparisons unsatisfactory between different lamps in which the pressure was an unknown factor. In the hope of overcoming this difficulty I had some lamps constructed, through the kindness of a friend engaged in the manufacture of glow lamps, by means of which this difficulty could be obviated.

Two lamp filaments as nearly identical as possible were taken. These were brought to identity as regards resistance by the usual method of flashing in hydro-carbon vapor; one of them was then given a coat of black carbon by smoking. They were mounted in bulbs of the usual form, the two being connected by a glass tube as shown in Fig. 3. The pair of lamps thus connected were placed upon a pump together, and were exhausted in the usual manner, after which they were sealed. These lamps could be brought to incandescence separately; but since there was permanent communication between the interiors of the two bulbs, whatever changes in vacuum occurred in the one would be shared by the other lamp.

Upon measuring the candle-power, voltage and current in the case of these two lamps throughout a wide range of incandescence and platting the characteristic curves, it was found that the difference in efficiency as expressed by watts per candle was very great indeed. The efficiency of the smoked filament was extraordinarily low. Inspection of the results obtained made the cause of this difference obvious, the fact being that the mantel of carbon obtained by smoking was of extremely high electrical resistance. The result was that when the same current was sent through the two lamps, the total watts generated in each were identical (see Fig. 4); but since the radiating surface of the smoked filament was very largely increased, the temperature of the lamp was greatly lowered. The consequence was that the black lamp required a higher voltage and a correspondingly greater amount of energy to bring it to a given candle-power than did the bright filament, which was without the superficial non-conducting layer of carbon. It seems probable that something of the same kind may have occurred to vitiate the experiments made by Mr. Evans, although, doubtless, the non-conducting film in the case of his lamps was much thinner than in the pair of lamps now under consideration. Although it was impracticable to compare these lamps with one another by the mere determination of the candle power and the watts per candle, they afforded excellent material for the study of the laws of radiation of these two widely different carbon surfaces. I accordingly subjected them to detailed measurements as regards the distribution of energy in the infra-red of the spectrum through a very wide range of temperatures, making use, for this purpose, of a method nearly the same as that described by E. F. Nichols in the first volume of this Review.* Indeed, in many of these measurements, Mr. Nichols did me great service, bringing to bear upon what was in many respects an operation of unusual delicacy the skill attained by long practice in a similar research.

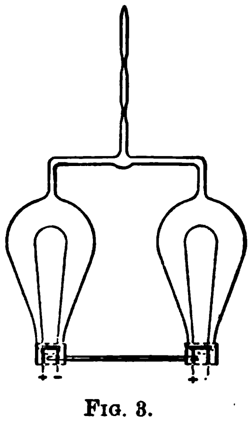

FIG. 3.

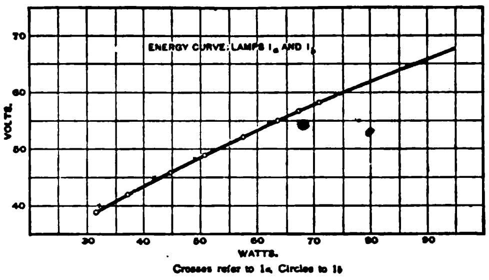

FIG. 4.

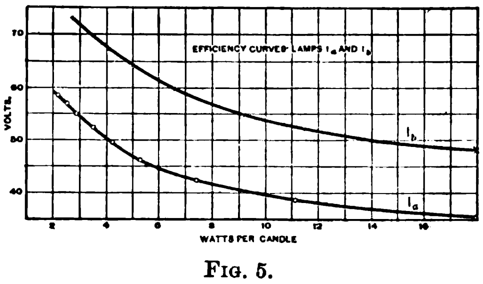

FIG. 5.

III.

The apparatus used in the study of the spectrum of these lamps was that described by Mr Nichols in the paper just cited. It consists of a spectrometer, in place of the eyepiece of which is inserted a linear thermopile of antimony and bismuth, the edge of which had been filed down until only a very narrow strip was exposed to radiation. Dispersion was obtained by means of a prism of carbon bi-sulphide contained between glass walls. This substance was selected because there is reason to believe that it obeys more closely than any other available material Cauchy's law for dispersion.

The use of the spectrometer with glass lenses, and of a prism the walls of which are of glass, in the study of the distribution of energy in the spectrum, is open to the serious objection that both glass and carbon bi-sulphide exert selective absorption upon the rays of light which pass through them. The only substitute for a prism and lenses would be a concave grating, or a plane grating used in connection with a concave mirror. The feebleness of the spectra produced by means of the grating offers in itself a serious hindrance to its use in bolometric work. The theory of the diffraction grating, as given by Rowland, is, moreover, conclusive as regards the unfitness of ruled gratings for the determination of energy in the spectrum, and it had been previously shown experimentally by Paschen that the exploration of the spectrum of incandescent lamps by means of the grating and bolometer led to results which were full of the most serious errors. No more striking verification of the theory can be given than the curves exhibited in Paschen's paper. So serious, indeed, are the vagaries of the diffraction grating in this respect that it would seem as though all work involving absolute measurements of the distribution of energy in the spectrum, in which diffraction has been made use of, must be discarded and the work done over by other methods.

As regards the fitness of the material used in the apparatus with which the experiments to be described were made, it may be noted that Angstrom has studied the absorption of carbon bi-sulphide in the infra-red and has found it to be transparent as far as wave length 3.0 μ, beyond which lie two strong absorption bands. Since, however, my measurements do not extend beyond 3.0 μ, there seems to be every reason to assume that no serious errors will be introduced by the passage of the rays under investigation through this medium.

Ernest Nichols, in the article just cited, has studied the diathermacy of glass. His curve for the percentage of light transmitted by a plate of glass (see "Physical Review," Vol. I, p. 8) indicates great uniformity in this material up to the longest wave lengths to be considered. The diminution of light due to the interposition of the specimen of glass which he tested is scarcely greater than the losses by reflection at the two faces of the plate, and while there is evidence of very slight decrease in the transmitting power as we pass from 2.0 μ to 3.0 μ, the change cannot amount to more than one or two per cent. Under these circumstances, it seems quite safe to assume that no serious errors will result from selective absorption of the rays of the infra-red spectrum of glow-lamps, either by the glass of the lenses and the walls of the prism, or by the contents of the prism itself.

The most serious objection to the use of the bi-sulphide prism lies in the fact that the dispersion is very small for the longer wave lengths. The shortening of the spectrum in the infra-red is such that measurements beyond wave lengths μ are of questionable value.

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* Nichols, "Physical Review," Vol. I, p. 1, 1893.

The choice of the thermopile, the width of the face of which was something more than half a millimeter, instead of a more strictly linear instrument such as the bolometer, is open to criticism. In point of fact, the thermopile showed itself to be so much more sensitive than any bolometer which Ernest Nichols and the writer were able to construct that we were led to adopt it in spite of this objection. It seemed quite certain, moreover, that there was but little of interest to be found in the spectrum of glow-lamps beyond the regions which it was possible to explore with the thermopile, so that it did not seem worth while to expend a great deal of time in the construction of a bolometer.

Our experience appears to differ from that of others who have worked in this field; but it may not be without interest to state that we both tried bolomoters constructed of the platinum cross hair wire, used by Snow in his exploration of the bright line spectra of the alkalies—an investigation which would seem to demand the very highest delicacy; also bolometric strips of iron, nickel, aluminium, etc. We were not able within the time at our disposal to construct a bolometer the sensitiveness of which for the purpose of our measurements was greater than one-twentieth of that of the linear thermopile.

The galvanometer used in these studies was he one briefly described by Ernest Nichols in his article already cited. It was built in the instrument shop of the department by F. C. Fowler, but the moving parts were made by Mr. Nichols, to whom also I owe the very careful study of the bi sulphide prism.

(To be continued.)

ON THE UNITS OF LIGHT AND RADIATION.*

BY A. MACFARLANE, D.SC., LL D.

One of the recommendations made by the subcommittee of the Institute in the programme for the International Electrical Congress at Chicago was that the practical unit of illumination should be defined as the illumination produced by the bougie-decimale at the distance of one meter, and that this unit should be denominated the bougie-meter. To this definition little objection was made, excepting that Prof. Nichols pointed out that it involved an arbitrary standard of light which had no relation to the C. G. S. system of units. More general objection was taken to the notation for the unit.

The London *Electrician* for February 3, 1893, objected to the "bougie-meter," that all other such compound names imply a product of the components, while in this case the former component is divided by the latter, or, more correctly, multiplied by the square of its reciprocal; and suggested, half seriously, that instead of 'candle-foot" we ought on the "mho" principle to speak of "candle toof-toof."

M. Hospitalier made the same objection, that "bougie-meter" according to existing usage means a product, and suggested "bougie-at-a-meter," or, if that were inadmissible, the use of a new term such as "lux." M. Blondel favored the single term "lux," and Mr. Lockwood the single term "davy."

Consider the philosophy of the substitute suggested by the *Electrician*. If we attempt to formulate the "mho" principle we find that it may be expressed as follows: The reciprocal of a given unit may be denoted by writing the name for the direct unit backwards. It supposes that the given unit can be expressed as the ratio of two other units; thus, ohm is the single name for the ratio, volt per ampere. The reciprocal idea is ampere per volt, and there is a convenience in not introducing a new and independent word, but in denoting it instead by the direct term written backwards.

It appears to the writer that here we have a principle which might well be adopted in mathematical analysis, for we have all felt the want of a suitable notation for a function which is the reciprocal of a given function; for example, the reciprocal of *tan* or *sin*. English and American writers use tan^{-1} and sin^{-1}, a notation which is half word, half symbol, which cannot be pronounced, and which suggests the reciprocal quantity instead of the reciprocal function. Continental writers use "arc tan" and "arc sin," which are too long and periphrastic. On the "mho" principle, the reciprocal of "tan" is "nat" and that of "sin" is "nis." Let $x = \tan y$, then $y = \text{nat}\, x$; let $a = \sin b$, then $b = \text{nis}\, a$. According to Lord Kelvin, who, I believe, introduced the "mho" notation, the expression for a function should consist of three letters; and, it may be added, the middle letter ought to be a vowel, the other two consonants. Such a syllable notation when inverted remains a syllable. This notation would have the advantages of being short, unambiguous, articulate and logically connected.

But in the case of a fundamental unit, such as the foot, is there any reciprocal idea? It is true that there are physical quantities which have the dimension l^{-1}; but on examination they will be found to express a physical ratio of some kind. For example, the unit of curvature has the dimension l^{-1}; it is expressed by radian per foot. The reciprocal unit is foot per radian, having the dimension l; it is not a measure of length, but of flatness.

The difficulty experienced in expressing the intensity of a candle or other spherical source arises from the want of a name for the unit of solid angle. Just as the natural unit for plane angle is meter of arc per meter of radius, so the natural unit for solid angle is square meter of spherical surface per meter of radius squared. The name "radian" given to the former unit (Everett's "Units and Physical Constants," 1879) has been very useful in expressing exact ideas; a recognized name for the latter unit would also be highly useful. For this purpose the word "steradian" was introduced by Dr. Halstead in his Metrical Geometry in 1880, and I have used it in my work on Physical Arithmetic. Though not faultless from the point of view of the etymologist, it is sufficiently expressive to the physicist.

How, then, is the unit of illumination properly expressed? Suppose that by "bougie" is meant the current of light which streams from a uniform standard candle through one "steradian," then the illumination anywhere may be expressed in terms of bougie per square meter, where the former component refers to the current and the latter to the cross-section. But in the case of light streaming from a point source, the illumination may be expressed in terms of (bougie per steradian) · (steradian per square meter), where the former component refers to the intensity of the source, and the latter to the solid angle subtended at the source by one square meter of cross section. If "lux" is the single term for this unit we have

lux = bougie per square meter
=(bougie per steradian) · (steradian per square meter).

Hence, candle per square foot or (candle per steradian) · (steradian per square foot) is the proper expression for the candle-toof-toof of the *Electrician*.

According to the above definition of "bougie," the total current from the candle would be 4π "bougies." But if "bougie" is defined to mean the total current from the candle, and by "lux" is meant the same quantity as before, we should have

$$\text{lux} = \frac{1}{4\pi} \text{ bougie per square meter.}$$

We cannot logically avoid the 4π; exclude it from the source, it appears in the intensity, and *vice versa*. This point is overlooked in the established system of magnetic units, and forms the basis of Heaviside's rational system.

The use of the hyphen to denote a product unit is not very appropriate, for it suggests the sign minus rather than the sign of a product. It would be better if it were omitted altogether and the two component units amalgamated as in footpound and kilogrammeter; for then the nomenclature would correspond to the algebraic convention which leaves the sign × to be understood, and in addition the hyphen would be set free to denote any compound unit other than the product or quotient.

If we consider the general subject of radiation we shall be led to distinguish the following ideas with their corresponding units:

TABLE I.

Idea.	C. G. S. Unit.
1. Quantity of radiant energy	Erg.
2. Current	Erg per sec.
3. Strength of source	Erg per sec.
4. Intensity of spherical source	Erg per sec. per steradian.
5. Intensity of cylindrical source	Erg per sec. per (cm.-radian).
6. Intensity of plane source	Erg per sec. per cm².
7. Density of source	Erg per sec. per cm².
8. Intensity of current	Erg per sec. per cm².
9. Time flow	Erg per cm².

Quantity of radiant energy of whatever kind can be expressed in ergs, and a *flow* in ergs per second. By *strength of source* is meant the whole quantity of radiant energy which leaves the source in a given time divided by the time; the appropriate unit is erg per second. The *intensity of a source* is differently expressed, according as the radiation is spherical, cylindrical, or plane. In the first case it is the ratio of a current through a solid angle to the solid angle, and hence it is appropriately measured by the erg per second per steradian. In the second case it is the ratio of a current through a wedge-angle to the wedge-angle. There is no recognized unit of wedge-angle, as it involves the radian in one plane and a length along the perpendicular to that plane; it may be expressed by cm.-radian. Hence the intensity will be expressed in erg per second per (cm.-radian). If the radiation proceed from an infinite plane, its intensity is measured in terms of erg per second per cm².

By the *density* of the radiation at any point of a source is meant the ratio of the flow normal to a small surface to the small surface, and is expressed in terms of erg per second per cm². By *intensity of current* anywhere, is meant the ratio of the flow through a small cross-section to the cross-section, and is also expressed in terms of erg per second per cm². By *time flow* is meant the ratio of the energy which has passed through a cross-section to the cross-section. It is expressed in terms of erg per cm².

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* Paper read before the American Institute of Electrical Engineers, January 16.

TABLE II.

Idea.		Unit.	Symbol.
French.	English.		
1. Quantité de lumière...	Quantity of light..........	Rad.; lumen-hour...........	Q
2. Flux lumineux...........	Luminous flux..............	Lumen......................	F
4. Intensité lumineuse.....	Luminous intensity.........	Pyr........................	I
7. Radiation Intrinseque.	Intrinsic radiation........	Lumen per cm²..............	R
8. Eclairement.............	Illumination...............	Lux........................	E
9. Illumination............	Quantity of illumination..	Phot.......................	L
Eclat intrinseque.........	Intrinsic brightness.......	Pyr per cm²................	E

The above is the appropriate system of C. G. S. units for any kind of radiation measured simply as energy. But in the case of light the eye exercises a selective power, not only singling out a certain range of wave-lengths, but discriminating among them as to amount. If one of the units is defined with reference to this discrimination exercised by the eye, then the other units of the light system can be defined in terms of it, and the units of length and time.

Recently M. Blondel has published (*La Lumière Electrique*, July 7, 1894,) an ingenious and logical system of units of light with corresponding practical units. When the ideas are arranged in the same order as in Table I, we obtain the system exhibited in Table II.

By "pyr" is meant a luminous intensity equal to one-twentieth part of the luminous intensity of the Violle standard. By "lumen" is meant the current of light through a steradian, the spherical source having a uniform intensity of one pyr; that is,

lumen = pyr-steradian.

By "lux" is meant the illumination produced by a current of one lumen falling perpendicularly on a surface of one square-meter; hence,

lux = lumen per square meter.

The idea of No. 9 is expressed in French by illumination, but this word in English means éclairement; hence it has been proposed by M. Hospitalier to introduce "lumination" into both the French and English languages to express the idea in question.

The "phot" is defined as equivalent to "lux-second." By "rad" is meant the unit of quantity of light. It is defined by

rad = lumen-second

just as the coulomb is defined by

coulomb = ampere-second.

The "phot" and the "rad" are said to be of special use in photography. But it may be asked whether the actinic system of units is not independent of the optical system. Is not the "pyr" then defined by the actinic effect instead of the optical effect? If so, we have two complete systems of units, both different from but parallel to the radiant energy system.

M. Blondel does not introduce Nos. 3 and 5. Let "bougie" denote a spherical source having a uniform intensity of one pyr; then we would have

$$\text{bougie} = 4\,\pi \text{ lumens.}$$

The symbols given in the last column of Table II have been proposed by M. Hospitalier, and he asks for criticisms. In the system of symbols and abbreviations recommended by the Congress, all quantities are denoted by oblique letters or script letters, and units and abbreviations for units by perpendicular letters. The proposed symbols, from their perpendicular character, will not harmonize well with the other symbols of quantity. Also they are already in use to denote vector quantities.

The Northwestern Electrical Association's Annual Convention.

The annual convention of the Northwestern Electrical Association, at Milwaukee on January 15 18, was attended by nearly 100 members, and those who were fortunate enough to be present found much to enjoy in the proceedings incident to the occasion. The papers submitted included "Interior Conduit and Interior Winding," by Charles E. Burton; "Hints Upon Daily Work About a Dynamo Plant," by Pliny Norcross; "Incandescent Lamps vs. Welsbach Burners," by William Goeltz; "Some Characteristics and Economies of Accumulators as Applied to Central Lighting and Power Stations," by John R. Markle; "Incandescent Lighting on the Meter System Compared With the Contract System," by G. L. Cole; "Competition," by John Schuette; "Electrical Business," by C. E. Gregory; "College and Station," by Prof. D. C. Jackson; "Common Councils," by P. K. Korst; "Water Power," by G. A. Davis, and "Profits," by Geo. Grimm.

President C. C. Paige's address at the opening session dealt disparagingly with governmental ownership of railroads, telegraphic, electric and kindred public services, and particularly with oppressive municipal enactments which fettered enterprise.

The following officers were elected for the ensuing year: President, H. C. Thom, Madison; first vice-president, George Grimm, Jefferson; second vice-president, Pliny Norcross, Janesville; secretary, William Goeltz, Milwaukee; treasurer, John Schuette, Manitowoc; directors, F. A. Copeland, La Crosse; E. M. Highland, Clinton, Ia., and O. M. Rau, Milwaukee.

On the second evening a banquet was provided at the rooms of the Deutcher Club, and the last day was taken up with visits to the great breweries and electric light stations.

The following new members joined: George S. McLaren, C. D. Wyman, John D. McLeod, Milwaukee; H. C. Higgins, Marinette; A. A. Forman, Iron Mountain, Mich.; C. D. Wilkinson, Chicago; W. F. Collins, Wausau; Willis D. Jameson, Chicago; J. W. White, Peoria; Richard A. Dix, Wauwatosa; E. P. Ingham, Fargo; Fort Atkinson Lighting Company, Fort Atkinson; James Montgomery, Wausau; J. E. Heaton, Reedsburg; Charles W. Rodman, Ravenna, O.; Hiram Stedman, Berlin; J. Wolff, Max A. Berg, J. H. Cooke, Chicago; Lewis Brittain, Waukegan; G. H. Strong, Richland Center; E. M. Highland, Clinton, Ia.; F. S. Copeland, La Crosse; M. B. Austin, Channing T. Gage, John Valentine, R. H. Pierce, Chicago; M. A. Warren, Baraboo.

BOOK REVIEWS.

ELECTRIC POWER: A Monthly Magazine devoted to the Theoretical, Mechanical and Financial Interests of the Electrical Transmission of Power. HORATIO A. FOSTER, Editor; MAX OSTERBERG, Associate Editor. 96 pp. $2.00 per year; 20 cents per copy. Publication office, 36 Cortlandt street, New York.

For some time past the reading public have been on the *qui vive* for the appearance of our old friend, *Electric Power*, in magazine form. The new magazine, for such it practically is, is now at hand and fully justifies the high expectations aroused for it. The question as to whether or not the time was ripe for an electrical magazine has agitated the minds of many for several years. Many have thought that it was, and several attempts have been made to fill the aching void, but the results in such cases have seemed to indicate that the aching void either did not ache very much or the panacea that was applied was not suited to that particular kind of an ache.

The writer has been one of those who, having given this subject much thought and study, came to the conclusion that the time *was* ripe for the right kind of magazine, and although he has not been one of those who have attempted to fill the bill, he is one of the many who will rejoice when the bill is filled. We have believed that a thoroughly high-grade publication conducted on liberal lines would pay. We have believed that well-matured editorial views covering the events of a past month, and especially the living questions of the day, should form a most valuable feature which the weeklies in the unavoidable rush to get to print cannot hope to fulfil in any complete measure. We believe that such editorials to have the highest value should not all emanate from the same mind, for one man's opinions, however valuable they may be in the direction of his specialty, cannot be of equal value in other directions. It would therefore be the province of the editor-in-chief to select editorial writers specially competent to speak on questions on which he might not be fully informed. We do not recall a single technical or semi-technical magazine of to-day in which the editorial page has sufficient merit to make its omission entirely a noticeable loss. With the weeklies not so much is expected, and the shortcomings of the editorial page are therefore less marked. We have thought, and still think, that in this direction lies the greatest chance for improvement. It is a field at present practically unoccupied, and one which if judiciously and properly worked should be more prolific of good results than any other now open to the electrical editor and publisher.

None of the sciences are so closely and tangibly interwoven with our everyday lives as the comparatively new one of electrics. It may be truthfully called *the* popular science, and in its ramifications and extensions may be called the science of *doing*, the science of *seeing*, the science of *hearing*, and when electro-therapeutics has thrown off its swaddling clothes it may prove itself the science of *being*.

The exponent of this science to meet the popular demand should therefore take on the garb of the people, and, so far as is consistent with strict accuracy of statement, speak in the language of the people. Its function in the science should be that of Franklin's kite and string in the lightning experiment, viz., to bring it down out of the clouds that we may see what it is and understand its nature. Severely technical articles should have no place in such a magazine, nor have they, we conceive, in the weeklies. Such articles have indeed an immense value among a certain limited circle, but their place is in the

Transactions of those societies composed of individuals who can understand them.

It has always seemed to us somewhat in the nature of an imposition for a journal that depends for its subsistence upon a constituency largely composed of manufacturers and laymen, in contradistinction to scientists, to offer them week after week and month after month pages and pages of the most abstruse mathematical logic, which none care to understand even if they were qualified by training to follow the reasoning out to its end, and then as a sop to this very class print page after page of free advertising puffs which too often express no one's opinions, not even those of the one they are intended to benefit and in whose handwriting the original copy most often is.

The bane of electrical journalism as it exists is its subserviency to supposed trade considerations. The editor is less to blame for this than the powers behind him, but the pressure is so great that he may not speak his mind without first looking around to see whom he is going to hit, and if he finds that he is an advertiser or a possible advertiser the truth must be left unsaid. This condition has become so engrafted upon trade journalism that it is probably too much to expect its abolishment at this late day, but in a monthly magazine it has no place and there is no excuse for it. In fact a monthly electrical magazine cannot be a trade journal and succeed.

In *Electric Power* in its magazine form we find the nearest approach to our own idea of what such a journal should be of any of the attempts thus far made in this direction, and the personnel of the editorial staff as well as that of other departments is such as to inspire the utmost confidence in a continuance of the good promises held out by the prospectus and the first issue. We therefore welcome the coming of this new aspirant for public favor and bespeak for it all the success which it may deserve.

THE NEW SCIENCE REVIEW: a Miscellany of Modern Thought and Discovery. Quarterly. Single numbers, 50 cents; per annum, $2. New York, London, Philadelphia: The Transatlantic Publishing Company.

In the announcement of the above we find the following:

> There are many scientific periodicals. "The New Science Review" differs from all of them. It is new in every sense—new in its appearance, new in its methods, new in its aims. It does not attempt to supersede the older and more conservative periodicals, but to supplement them. Those address themselves to the specialist, this to the public at large. While yielding to none in the scientific value of its material, it strives to present it in a popular style. It does not assume that the reader already has an esoteric acquaintance with the matter in hand and start from that standpoint,—it supplies him with a standpoint; it explains before it demonstrates. Thus it occupies a position midway between the ponderous scientific journals and the lighter magazines. It is as valuable as the first, as interesting as the latter. But it conflicts with none. It has a distinct individuality.
>
> The quarterly method of publication has been chosen because it has been thought that this affords ample time for the exploitation of every new theory, invention or discovery that may hold the public attention during the interim. When "The New Science Quarterly" speaks, it will speak with authority. It will have weighed the evidence impartially. Its decisions, if not infallible, will be in accordance with the latest development of modern thought.

That there is a field for a periodical planned on the lines indicated above no one will deny, and it was with anticipations of pleasure that we awaited the appearance of the first issue in July. "When 'The New Science Quarterly' speaks, it will speak with authority. It will have weighed the evidence impartially. Its decisions, if not infallible, will be in accordance with the latest development of modern thought." These words implied much,—led us to expect much—perhaps too much to render possible the full realization of our expectations. We were prepared for disappointment, but not for such as we experienced in looking over the first number, for here we found twenty-seven pages of good paper devoted to a defence of Keely and his motor, entitled "A Newton of the Mind." This is from the pen of Mrs. Bloomfield Moore, who, it will be remembered, came into notoriety not long since through the publication of a book on the same subject. We paused to ask, in face of the announcement, "Are Mrs. Bloomfield Moore's views on the Keely motor and mechanics in accordance with the latest development of modern thought?" and we answered ourselves that we hoped not.

The publication of this article in the initial number was enough to condemn the magazine for all time with intelligent people, but we withheld criticism, wishing to give to our contemporary opportunity for reflection and a chance to do better.

The second number was a decided improvement in that it not only contained considerable really good matter, but the bosh and trash that so characterized the initial number was largely absent. Our hopes were raised again and we were preparing to say a kind word for our new contemporary when, alas! the January number made its appearance. In its table of contents appear four titles which at once attracted our attention —three of them on "What Electricity Is," by Mrs. Bloomfield Moore, C. J. Reed and Henry Clay, and another, "Pre-Scientific Electricity," by Horace Hayden, Jr. The latter is indeed a very readable article and well fulfils the promise of its title. But the first three—well! we know who Mrs. Bloomfield Moore is, and we are not surprised that it is the Keely motor she is talking about instead of electricity. We don't know who C. J. Reed is, but in trying to criticise an anonymous writer in the October issue, who offered some suggestions as to the nature of electricity, he gets hopelessly mixed up in his chemistry and contributes nothing to our knowledge of the subject in hand. Henry Clay we do know as a historical character of great prominence in the United States in years gone by, and we presume that the present contributor is his materialized spirit. We come to this conclusion for the reason that it is of the general character of other reputed spirit communications from great men—meaningless and trivial.

There are always a lot of cranks who think they have, or try to make the world think they have, at one fell swoop upset modern philosophy, and they usually pride themselves upon presenting unanswerable arguments. Their arguments are unanswerable usually for the reason that they present nothing to answer, but they themselves cannot see this. They fondly imagine that they are leaders of modern thought, and if this class of literature, such as Mrs. Bloomfield Moore and the shades of Henry Clay are contributing, is "in accordance with the latest development of modern thought," then "The New Science Review" is fast gaining a reputation as an exponent of it; but we fancy that the few responsible writers who, misled by the prospectus to believe that the "Review" was to be conducted on rational thought, have contributed to its pages, will ask to be counted out in future issues. Certainly if "The New Science Review" is to be the organ of those believing in the doctrine of Keely *et id genus omne*, as seems probable from the issues now before us, reputable writers who have reputations to lose will keep out of it. We believe that "The New Science Review" has committed suicide by the admission to its pages of such scientific rot as that which is offered as argument or reason in the articles by Mrs. Bloomfield Moore and Henry Clay. If this is the best it can offer in the way of modern thought, it cannot be buried too soon.

London Notes.

(From our London Correspondent.)

Transformer Chambers in Public Streets.

Within the past few months there has been a nervous and unnecessary outcry in London against electricity supply companies being allowed to erect transforming chambers under public thoroughfares. The parties who protest against these powers being possessed by the companies are the London County Council and a number of public bodies governing districts in the suburbs of London. The Board of Trade was appealed to to take some steps in the matter, and accordingly arranged for a conference which was duly held in the middle of December last. Expert evidence was given by Dr. John Hopkinson, Sir Benjamin Baker, Mr. James Enright (of St. Mary's College), Prof. Henry Robinson, Sir Frederick Bramwell, Prof. Silvanus P. Thompson, Dr. J. A. Fleming, Mr. A. J. Lawson and others.

The Board of Trade has since gone very fully into the matter, and the result of its inquiry, which is now published, is that it has adopted the advice given by Sir Courtenay Boyle, that if proper precautions are taken to secure the public safety the department would not be justified in forbidding the use of transformer chambers in the way suggested. This seems the only reasonable decision that could have been arrived at. Any other decision would doubtless have hindered the progress of electric lighting, and the Board of Trade appears to have no particular desire in that direction.

What with transformer chambers and light railway conferences, and the inquiries regarding the main box explosions in Cannon street and St. Pancras districts, the Board of Trade is very busy in electrical matters. As the outcome of the inquiries into the cause of these explosions the London County Council now proposes that plans for street boxes should be approved only on the condition that provision is made for their adequate ventilation.

LECTURES ON THE ELECTRIC CURRENT AND THE ARC LIGHT.

The lecture season is now in full swing. Prof. J. A. Fleming has been interesting juvenile audiences at the Royal Institution of Great Britain with a course of six lectures on the "Electric Current." These lectures attracted very full audiences on each occasion. They were delivered in popular language and illustrated by simple experiments, including some of Faraday's.

Prof. Silvanus P. Thompson commenced on January 14th a series of three Cantor lectures before the Society of, Arts on the "Arc Light." In his first lecture the Professor, after remarking that much about the electric arc is still very obscure and little understood, discussed when and by whom it was first observed, and came to the conclusion that in the first year or two of this century Davy and other investigators found they could get sparks visible in daylight between well-burnt charcoal points connected each with a pole of the newly discovered voltaic pile. These early experimenters did not clearly discriminate between a continuous arc and a succession of sparks, but in 1808 this distinction was certainly known. In 1820 the hard carbon deposited in gas retorts came into use, and in 1846 the first mechanical arc lamp was devised. Professor Thompson then exhibited the arcs formed between various metals, and briefly pointed out their different characteristics. He afterwards confined his remarks almost entirely to the arc produced between carbon conductors, carbon being the only material as yet known that is suitable for the industrial production of the electric light. He then proceeded to consider the physics of the arc. He discussed the conditions necessary for its formation, the point from which the greatest light is emitted, the relations between electromotive force and length of arc and between amount of current and size of arc, the temperature of the crater, the fall of potential in the arc, and the question of the transfer of material from one carbon to the other, concluding, with regard to the last point, that material is transferred in one direction only—from crater to peak. He then showed an arc formed by an alternating current of 2,000 volts, though this, he said, was not a true arc, but of the nature of a flame. In the true arc there is combustion of the air with the production, as Professor Dewar has shown, of carbon monoxide and dioxide, and of various nitrous compounds, whose smell may sometimes be noticed.

LEGAL NOTES.

Interior Wiring Patent Decision.

The United States Circuit Court of Appeals, New York, Judges Lacombe, Wallace and Shipman presiding, on the 22d inst. confirmed the decision of Judge Coxe in the case of the Interior Conduit Company against the Eureka Electric Company, denying the application for injunction. Complainants' claims were, in brief, as set forth in the following:

"1. In house-wiring for electric light, the combination of a pipe of insulating material, a pair of wires insulated from each other and placed in close proximity to each other within said pipe, and each forming one side of an electric lighting circuit, and a safety catch interpolated in said circuit, substantially as set forth.

"3. In house-wiring for electric light, the combination of a pipe of insulating material, a pair of insulated wires twisted together within said pipe, each wire forming one side of an electric lighting circuit, and a safety catch interpolated in said circuit, substantially as set forth."

Judge Coxe had said in summing up his opinion:

I have examined the patent with care to discover what new idea it has contributed to the art, and am compelled to think that the art of electric lighting would have lost nothing tangible if the statements of the patent had never been made public.

Judge Call has rendered a decision refusing the motion for an injunction in the suit brought by the Jacksonville Electric Light Company against the city of Jacksonville, Fla. The suit was based principally on the ground that the General Electric Company's bid for an electric lighting plant for the city was not the lowest, and that plaintiffs' contract with the city barred the city against engaging in the lighting business.

Chancellor McGill, of New Jersey, has denied the application of Samuel K. Wilson for a receiver for the Trenton Passenger Railway Company, and the company has now brought suit against Mr. Wilson for $160,000 which it claims he owes it.

In the U. S. Circuit Court at Boston, on the 22d inst., Judge Carpenter overruled the plea in bar set up by the respondent in the equity suit of the Westinghouse Electric and Manufacturing Company against William Stanley, Jr. The defendant will have to answer the complainant's bill. The suit is brought for an injunction to restrain the defendant from an alleged infringement upon patent No. 469,809, granted March 1, 1890, for an improvement on the system of electrical distribution.

A suit has been filed in the U. S. District Court at Detroit, Mich., by the Detroit Motor Company against the Jenney Electric Motor Company of Indianapolis. In the complaint the plaintiff alleges that Harry H. Blake is the inventor and patentee of an electric switch for motors and that he sold the invention to the Detroit Motor Company. The plaintiffs allege that the Jenney Electric Motor Company has infringed their patent, and they ask for damages and an injunction against the company.

Boston Notes.

Several new red range lights for the use of captains of vessels entering Boston harbor are about to be erected. They are in every instance to be electric lights, and bids for their erection will shortly be called for by the Lighthouse Board.

The well known fixture manufacturing firm of Horn & Brannen Co., of Philadelphia, has been awarded the contract for equipping with gas and electric fixtures the new and handsome public building at Lowell, Mass.

Some of the suburban electric light companies are being badly mixed up just now and are being placed in the hands of receivers or being wound up in other ways owing to their inability to pay interest on their bonds. These different concerns are among the undertakings established by the T.-H. Company a few years ago, when they were in the heyday of popularity as "financial wonders." It is likely that at the approaching town meetings which are held in March more than one lighting contract will fail of renewal, which means the closing of the papier-maché concerns.

The New England Telephone and Telegraph Company has announced that after February 1 next it will offer to subscribers for telephone connection and service in its Boston and suburban exchanges, measured service rates, with metallic circuit and long distance wall equipment, within one mile of the central office, which are likely to prove very acceptable to subscribers, as they will thereby secure excellent service of a special character at much below regular rates.

The fifth annual ball of the Massachusetts Electrical Engineers and Mechanics' Association, held in Odd Fellows' Hall on the evening of the 21st, was a brilliant success. The immense building was gorgeously illuminated, both on the exterior and interior, by several thousand colored arc and incandescent lamps. By the means of an immense switchboard, constructed for the purpose, some singularly beautiful effects were produced in the ball room, which was a blaze of vari-colored lights. There were nearly 2,000 guests present, and dancing was kept up until four o'clock in the morning.

A spirited effort is now being made in the State Legislature to kill the entire subway project for Boston. Should its opponents succeed, public opinion will once more be directed to the reconsideration of the Meigs overhead electric railway plan. Meantime Boston is paying out money lavishly for a solution of the rapid transit problem.

There is likely soon to be an important consolidation of electric railway interests in the northeastern part of Massachusetts. If it is consummated, it will be one of the biggest railway deals for some time. The company will have $2,000,000 capital, 150 miles of track. Boston would be in direct electric communication with Newburyport, some forty-five miles away, and all intervening and adjoining cities and towns would be included. A number of wealthy capitalists and prominent railway men are interested, and the deal is likely to go through.

The Berlin Iron Bridge Company.

The Berlin Iron Bridge Company, of East Berlin, Conn., have closed their purchasing agent's office in Philadelphia, and hereafter all purchases will be made from the office of the company at East Berlin. Mr. W. E. Stearns, who lately occupied the position of purchasing agent, has severed his connection with the company and accepted a position with the Pennsylvania Steel Company.

Redlands, Cal.—The Redlands Electric Light and Power Company has voted to issue $100,000 in bonds, $50,000 of which is to be used in taking up the original bonds, and $50,000 to be spent in permanent improvements.

General News.

What is Going on in the Electrical World.

Phillipsburg, N. J.—$18,000 is said to be already pledged for the establishment of an electric lighting plant in this town.

Newport News, Va.—Preparations are being made for important extensions of the electric railway system in this place.

Gladstone, Mich.—A committee of the city council has been appointed to secure estimates on the cost of a municipal electric lighting plant.

Three Rivers, Mich.—The village council have under consideration the question of establishing an electric light plant to be owned by the village.

Lansing, Mich.—A bill is to be introduced in both branches of the Legislature providing an appropriation for an electric light plant for the Capitol building.

Bayonne, N. J.—The council has passed an ordinance granting a franchise to the Hudson County Electric Company to establish an electric light plant in Bayonne.

St. George, S. I.—The officials of the Staten Island Rapid Transit Company are considering the advisability of changing their motive power from steam to electricity.

Corsicana, Tex.—An Eastern syndicate has made a proposition to our citizens to put in an electrical railway here at a cost of $150,000 providing liberal franchises are given.

Dallas, Tex.—A franchise has been granted to L. S. Berg, C. L. Wakefield and associates to construct, maintain and operate an electric light and power plant in the city of Dallas.

Springfield, O.—A franchise for an electric railway between Springfield and Cedarville, via Clifton, has been granted to C. S. Courson and associates by the county commissioners.

Stroudsburg, Pa.—The Delaware Valley Electric Railway has passed into the hands of receivers. M. F. Coolbaugh and Edward H. Peters, of Bushkill, have been appointed.

Chelsea, Mich.—A proposition is to be submitted to a vote of the people of this village on the question of substituting arc lights for the incandescent lights at present in use here.

Nebraska City, Neb.—The stockholders of the street railway company have instructed their officers to secure estimates for an electric system, The road is now operated by animal power.

Lowell, Mass.—The Hon. John C. Burke, of the law firm of Marshall, Burke & Marshall, has recently been elected to the presidency of the Bradbury-Stone Electric Storage Company.

Dansville, N. Y.—The Dansville Electric Light Company's plant has been sold by the referee to C. H. Rowe for $8,000. The plant was sold subject to a mortgage of $10,000 held by a local bank.

Los Angeles, Cal.—E. E. Peck has filed a petition asking the council for the right to erect poles and wires for the purpose of furnishing arc and incandescent electric lights in the southwest portion of the city.

Wellsville, O.—The Citizens' Electric Light Company's plant has been purchased at receiver's sale by Homer Laughlin, of the Laughlin Pottery Company, East Liverpool, for $9,050. It was appraised at $9,900.

New York.—J. and W. Seligman, representing a syndicate of capitalists, hold an option on the stock of the Second Avenue Railroad, and if the deal is consummated the road will be changed into a cable or electric system.

Hartford, Conn.—The Hartford Light and Power Company is setting up at its works on Pearl street a new 2,000 light Westinghouse dynamo, to supply current for a large number of new lights recently contracted for.

Lexington, Ky.—The proposition to light Lexington more fully by electricity is meeting with much favor. The gas company, under the present arrangement, lights about two-thirds of the city, and the Central Electric Light Company the remainder.

Chattanooga, Tenn.—The mayor is quoted as being in favor of the city owning an electric lighting plant capable of thoroughly lighting all the streets and public places. The contract under which the city is now lighted expires in about four months.

Kingston, N. Y.—A member of the Morse Electric Economy Company of New York City has been locating the water powers in the vicinity of Rosendale with the purpose of establishing a manufactory of electrical storage batteries and switches under patents of Lansing Morse.

Reading, Pa.—The Reading and Womelsdorf Electric Railway Company has given to the Lancaster Electric Construction Company the contract to build the road from the western bank of the Schuylkill to Womelsdorf, and they are to complete it ready for operation by June 1.

Chester, Pa.—The Media, Middletown, Aston and Chester Electric Railway Company has paid Chester City $3.000, and to Chester township $1.100, and now has the right complete from Llewellyn via Village Green and Concord road to Chester city line. Operations will begin, it is said, in the spring.

Cape May, N. J.—A syndicate composed of ex-Mayor James M. E. Hildreth, ex-Collector James E. Taylor, Logan M. Bullitt and Thomas Robb, of Philadelphia, are arranging for the establishing of an incandescent electric lighting plant here. These men control the present electric light company.

Manitowoc, Wis.—The city council has directed the city attorney to prepare a bill to be presented to the Legislature empowering the city to own and operate its own electric light plant. The present plant here is owned and operated by John Schuette, whose five-year franchise expired some time ago.

Greenfield, Mass.—A temporary organization has been effected here for the purpose of getting an electric railroad built to Turner's Falls. N. S. Cutler, E. A. Hall, F. A. Pond and F. Lowe were placed upon the temporary board of directors with some Boston people, and measures will be taken to push the enterprise at once.

Clinton, Me.—A bill to incorporate the Clinton Water and Electric Company has been introduced in the Legislature. The purpose is to supply Clinton with water and electric light. The capital is not to exceed $100.000. The incorporators named are A. Rowell, S P. Felker, B. P. Porter, Geo. Leonard and W. T. Haines.

Waynesburg, Pa.—The H S. Sands Electrical Company of Wheeling has received the contract for lighting this town with 1,200 C. P. arc lights. There was very close competition between the Sands Company and the General Electric Company. The Sands Company will use Westinghouse machines.

Schoharie, N. Y.—There seems to be no doubt of the construction of an electric railway between Albany and Schoharie Court House at an early day. Local and other capitalists have been considering the scheme and are favorably impressed with the outlook. Several villages would be linked in such a line, and all would be benefited.

Milwaukee, Wis.—President James Petley of the Milwaukee and Wauwatosa Motor Railway Company says that if the council grants it a franchise to extend its line to the Northwestern depot, it will turn its entire system into an electric road, increase its capital from $200,000 to $500,000 and have the down-town line in operation by July.

Hughesville, Pa.—The Citizens' Electric Light and Power Company has been organized here and will apply for a charter. It will furnish electric light and probably power to the people of Hughesville and Picture Rocks. Among those interested in the new company are J. K. Rishel, James K. Boak, Milton Bodine, William Frontz, Peter Reeder and Howard Lyon.

Lagrange, Mich.—One of the most extensive electric plants in the State is being put in here to supply power for the Round Oak Stove Works and a commercial lighting circuit at Dowagiac. Lagrange has one of the best water powers in the State, and the electric current generated thereby will be transmitted over the intervening five miles to Dowagiac on heavy copper wires.

Springfield, Ill.—The bond given by the Standard Electrical Company of Chicago to the Capital Electric Company of this city, with the American Surety Company as security, covers the construction of the municipal light plant and guarantees it for two years. If the machines fail to give satisfaction the bond guarantees that the Standard Company will put in new machines of any manufacture the company may designate.

Binghamton, N. Y.—At a meeting of the stockholders of the Binghamton, Lestershire and Union electric road held at Union a few days ago the town commissioners signed the papers granting the company permission to construct and operate a street railway west from Lestershire through the streets of Union. It is expected that work upon the proposed road will be commenced as early in spring as the weather permits.

Brooklyn, N. Y.—The Brooklyn Electrical Society will give an "electrical smoking concert" at the hall, 315 Washington street, to-morrow (Thursday) evening, the proceeds of the entertainment to go toward the establishment of a headquarters for electrical men in this city.—The employees of the trolley roads are still on strike. Some ten or twelve of the lines are enabled to run a portion of their cars under military protection. Several regiments of militia have been guarding the stations for nine or ten days past.

Buffalo, N. Y.—The increase in the city's valuation of $50,000,000 in the last four years is attributed principally to the Niagara Falls power scheme.—Bids will be received at the Department of Public Works until February 5 for repairing and keeping in order all electric bells, pull bells, gongs, etc., at present in use in the various public schools and annexes in this city from February 1, 1895, to February 1, 1896.—The Real Estate Exchange has decided in favor of municipal distribution of the electrical energy transmitted from Niagara Falls.

Attleboro, Mass.—The Boston Safe Deposit Company, under a deed of trust, has conveyed to Edward R. Price, cashier of the Mutual Bank at North Attleboro, as trustee, all the property of the Attleboro, North Attleboro and Wrentham street railroad, the consideration being $50,000. Coupled with this is the sale by W. H. Haskell, of Pawtucket, of the North Attleboro Steam and Electric Company to the Attleboro Steam and Electric Company for 647 shares in the stock of the latter company, subject to a mortgage of $10,000. This means an immediate starting up of the electric road in this town.

Detroit, Mich.—H. A. Everett, general manager of the new Detroit Railway Company, announces that cars will be running over a portion at least of the new tracks on July 4 next. The company has contracted with the Westinghouse Electric Company for 50 motor cars, which are to be delivered at the rate of 15 cars every 30 days beginning April 11 next.—The franchise for an electrical railway line through Royal Oak township, in Oakland County, granted to the Hendrie syndicate, has been drawn up. The fare for a round trip from Royal Oak to Detroit will be 25 cents.

Worcester, Mass.—Dr. Arthur G. Webster of Clark University has received notice that he has won the Elihu Thomson international prize of 5,000 francs for the best treatise on electricity. The subject of Dr. Webster's thesis is "An Experimental Determination of the Period of Electrical Oscillations." The contest was originally instituted by the city of Paris for the best electric motor and was awarded to Prof. Elihu Thomson. With the desire that the sum should serve for the development of theoretical knowledge in electricity, he requested the general manager for Europe to offer it as a prize for the best work on a theoretical question in electricity.

Hackensack, N. J.—The National Trolley Company has filed articles of incorporation in the county clerk's office of Bergen County, N. J. The capital stock is stated to be $50,000. Ex-Assemblyman Delos Culver, of Jersey City, is the president of the company. The company will operate under the charter of the New Jersey and New York Bridge Company and will establish electric roads between Fort Lee and Englewood and the latter place and Hackensack. The Bergen County Traction Company have plans to establish trolley roads over the same route and there may be a conflict between the two companies.

Seattle, Wash.—The prospectus of the Snoqualmie Falls Electric Power Company, which proposes to transmit power from the falls to this city, has just been issued and thoroughly explains the advantages, cost and prospective revenue of the enterprise. It provides that the capital stock of the company shall be $2,000,000 in 20,000 shares of $100 each, and first mortgage bonds, $650,000, of an authorized issue of $1.000,000. The directors are Daniel H. Gilman, of Seattle; Hon. Watson C. Squire, of Seattle, United States Senator; Griffith Davis, postmaster of Seattle; Hon. Smith M. Weed, of New York, and Charles D. Wells, of Brown & Wells, of New York.

Grafton, W. Va.—Representatives of a syndicate of Baltimore capitalists have been making an investigation as to the feasibility of building a system of electric railways to connect ten of the largest towns in central West Virginia. They have gathered data concerning population, highways, traffic of existing railways, etc., and will report the plan entirely practicable. It is estimated that fifty miles of railway, built along the county roads already in existence, can reach 70,000 people and bring five county seats into communication with each other. The gentlemen who are back of the scheme are already largely interested in suburban trolley lines and want to extend their holdings.

Harrisburg, Pa.—A bill has been presented in the State Senate which provides for the establishment of a board of electrical inspectors who "shall have supervision over and the regulation of corporations supplying light, heat and power to the public; of fixing the maximum charges, and for testing the meters and measuring supply. The bill provides for one chief inspector at a salary of $4,000 per year and four assistants, one of whom shall be a practical electrician and another a chemist, at a salary of $2,000 per year each. Illuminating and fuel gas companies are included among the corporations subject to the new department." This remarkable bill has a number of other provisions, and taken altogether it would practically place every electric and gas company in the power of this board of inspectors.

Albany, N. Y.—Assemblyman Wilcox has introduced in the Legislature a bill requiring street railway companies to have the front platforms of all cars propelled by electricity or cable inclosed or screened during the months of November, December, January, February and March, except cars attached to the rear of other cars. The purpose is to shield the motormen from wind and storm while in the performance of their duty.—A bill has been introduced in the Assembly providing for the licensing of motormen and for a board of electrical commissioners in all cities of the first class in the State. The act creates a board of electrical examiners, the members of which shall receive no pay, but shall be paid their necessary expenses by the city, who shall employ an expert electrician at a cost of $10 a day, for thirty days, to conduct the examinations. Applicants for positions as motormen shall be citizens of the United States, who have resided in the State for one year and the county for three months before making application, the restrictions as to residence and citizenship not to apply to men who have been steadily employed for three months. The successful candidates for motormen are to be given licenses for which they shall pay fifty cents each. Provision is made, in case of emergency, for the board to appoint three additional expert motormen to conduct examinations, at a salary of $10 a day each. Railway companies may only employ licensed motormen where a knowledge of electricity is required, under penalty of $100 or thirty days' imprisonment.

Telephone and Telegraph.

The Orient and New York Telephone Company has begun putting up a line from Riverhead to Orient, L. I. It will extend from Orient to Riverhead, from Riverhead to Wading River, from Wading River to Oyster Bay, and then on to New York, taking in all villages on its route. The president of the company is James A. Gildersleeve, of Mattituck; secretary, John A. Bagshaw, of Riverhead; treasurer, O. B. Goldsmith, of Cutchogue.

The Telephone Company has introduced in Boston a method by which subscribers may base their contracts for service upon the amount of service desired, and pay accordingly. Small users may be charged according to the new "measured service" rates, under which the price is graded according to the amount of use, the minimum number being 500 calls per year. The price per call decreases as the number of calls increase. Every one adopting this will be supplied with the best known equipment, viz., a metallic circuit and a full long-distance outfit.

The telephone companies in Indiana towns are indulging in a rate war, and in consequence the users are being benefited. At Lafayette recently the Central Union Telephone Company cut prices from $4 per month for office and store service to $1.50, and from $3 for dwelling-houses to $1 a month. The Harrison Telephone Company has been for several months at work getting its system into operation there, and was just beginning to give the people service. They had secured a large percentage of the patrons of the old company, and the indications were that the Central Union would be without patrons. The Central Union has expended, in rebuilding and refitting its lines, adding new switchboards, etc., almost as much money as the new plant. The stockholders of the Harrison Telephone Company have decided not to make any reduction in rates to meet the cut of the Central Union Company.

The Phoenix Telephone Company of New York will put in a $11,000 plant in Dunkirk, N.Y., early in February. A representative of this company has been conferring with prominent capitalists at Jamestown, N. Y., with a view to putting in a new telephone system in that city. Jamestown has a population of 25,000.

It is reported that the Troy, N. Y., Telephone and Telegraph Company will not declare a dividend at the annual meeting, February 11th. It has been able to declare a dividend of only 2 per cent. in four years. The blizzard in 1891 damaged the lines to the extent of $70,000. The new switchboard and other improvements last year cost $30,000, and as a consequence no dividend will be paid.

Sioux City, Iowa, is getting to be quite a telephone center. Besides being headquarters for the Clark Automatic Telephone Company, the Electrical Supply Company is now making regular Bell 'phones and the Brass Works have just closed a contract for twelve automatic central telephone exchange equipments for an out of town company.

The franchise recently granted by the council of Hamilton, O., to a corporation to string wires, etc., for telephone and telegraph purposes in that city has, it is said, been sold to a newly organized company whose officers are: Jos. B. Hughes, president; F. W. Whittaker, vice president, and Thos. M. Boyd, treasurer.

The Troy *Times* has placed in its working departments the Colvin interior telephone system. The system used consists of five wall sets and a desk set, which allow communication between the editorial, counting, press, job, composing and artist's rooms.

A new telephone company in process of formation at Denver, Col., has applied for a franchise. The new concern claims to have a telephone which is just as good as the Bell and that it is now in use in many towns and cities of Iowa and Illinois. The applicants propose to incorporate for $500,000 and charge just half the rates exacted by the institution which has so long had the field to itself.

The Boston City Hospital buildings and grounds are to be equipped before long with a complete outfit for electric light and power, bells and speaking tubes, and with a telephone system of its own, which will connect all the buildings, and will consist of sixty-seven stations. There will also be a complete system of bells and speaking tubes. No official estimate can be had of the cost of this work, but it will probably range from $50,000 to $100,000.

A communication from the business men of Grand Rapids has been received by the mayor of Marshfield, Wis., asking for co operation in the establishment of a telephone line between the two places. The matter has been turned over to the Business Men's Association, and, as the proposition is heartily approved, the line will undoubtedly be built this winter. The distance is about thirty miles.

Thomas H. Epperson, a telegraph lineman, has been given a verdict in Judge Scarritt's court, Kansas City, Mo., for $4,000 against the Postal Telegraph Company. In September, 1891, Epperson was stringing wires for the Postal Company near Indianapolis, Ind. He received a shock from a live wire and fell from the cross bar to the ground, a distance of thirty feet.

It is reported that some New Yorkers are organizing a new telephone company for the District of Columbia. It is surmised that John W. Mackay is interested in the scheme.

A new telephone company at Appleton, Wis., is canvassing for subscribers. The rates are $2.50 a month for offices and $1.50 for residences. The company will start up in sixty days if 255 subscribers are obtained.

Electrician Wyman, of Boston, acting for the Central New York Telephone and Telegraph Company, is expected in a few days to begin operations in Syracuse for establishing the subway system there.

The police department of Rochester, N. Y., have made arrangements to install the Gamewell Fire Alarm Company's system in the new police building.

The Cumberland Telephone Company is preparing to run a line from Nashville, Tenn., via Culleoka to Fayetteville.

The Harrison Telephone Company, having secured a large number of subscribers in Flint, Mich., will put in a first class telephone plant in that city.

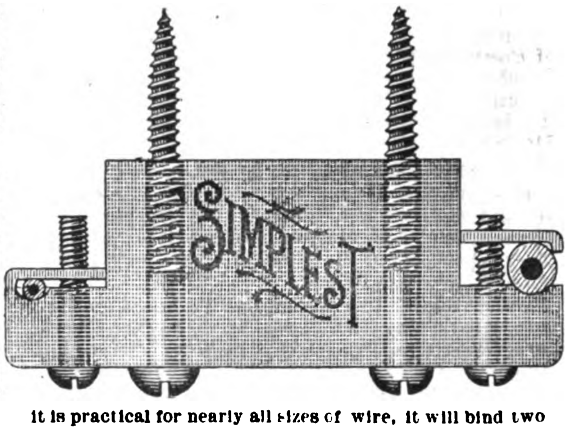
A telephone line is being erected between Magnolia, Miss., and Tylertown.

The Citizens' Mutual Telephone Company's application for a franchise is before the council at Lockport, N. Y.

The Mutual Telephone Company, a new organization, has been granted a franchise to construct and operate a telephone system in Elizabeth, N. J.

The "Simplest" Cleat.

The accompanying cut is an illustration of a new style of Porcelain Cleat recently placed on the market by the Electric Heat Alarm Company of Boston, and judging from reports the trade throughout the country is learning to appreciate its merits, numbers of good orders being daily received for it. The owners of this device explain their reason for naming it the "Simplest" by claiming that it is in one piece, it anchors the wire, it doesn't break, it doesn't cut or bend the wire, it can be put up independently of the wire, it gives perfect insulation of the wires, it is practical for nearly all sizes of wire, it will bind two different sizes of wire at the same time, and further, that it has more merit than any other cleat now in use. It goes without saying that a cleat for which so much is claimed ought to be in demand everywhere, for a first-class cleat has long been a desideratum. The electrical fraternity knows a good thing when it sees it, and doubtless the Electric Heat Alarm Company of Boston, which is already well known for other high-grade specialties, will enjoy a constantly increasing demand for what they have introduced as the "Simplest" Cleat.



The Keystone Electric Company.

The Keystone Electric Company opened the new year with prospects of the largest business they have ever had. They have just closed a $50,000 contract with the Smith-Hill Elevator Company, of Quincy, Ill., for electric motors, the contract to be completed during the year. The order is gratifying evidence of the thoroughly reliable service rendered by the Keystone motors, and is also to be taken as evidence that productive industry is on the up grade.

Notice of Removal.

The Electric Storage Battery Company, manufacturers of the well known Chloride Accumulator, announce a change in their New York offices from 45 Broadway to the Manhattan Life Insurance Building, 66 Broadway, Room 65.

It will be remembered that we announced not long since that this company had acquired all the patents and patent rights concerning the manufacture of storage batteries of the General Electric, Edison Electric Light, Thomson-Houston Electric, Brush Electric, Accumulator, Consolidated Electric Storage Battery and the General Electric Launch companies, and in this way have disposed of the legal complications which have so hampered the industry heretofore. Mr. Chas. Blizard, the New York sales agent of the company, will be found in attendance at the new quarters.

The Warren Engine-Dynamo Company, 307 Dearborn street, Chicago, has issued a handsome pamphlet containing a full illustrated description of the engine-dynamo it manufactures and calling attention to the advantages it affords in the economical and efficient production of electrical energy.

The Boudreaux Dynamo Brush Company.

The above company have established a plant in Chicago for the manufacture of the Foliated Dynamo Brush. They have all standard sizes in stock and are prepared to make special size brushes to order on short notice.

Annual Meeting of the Standard Underground Cable Company.

The Standard Underground Cable Company held its annual meeting at Pittsburg on Tuesday, January 22, 1895, and the old Board of Directors was re-elected as follows: George Westinghouse, Jr., Mark W. Watson, J. W. Dalzell, James H. Willock, John B. Jackson, George B. Hill, John Moorhead, Jr., Robert Pitcairn and Joseph W. Marsh.

The gross business for the year 1894 was $963,464, which is an excess of $101,551 over the business for the year 1893.

Out of the net profits for the year the company paid four quarterly dividends of 1½ per cent. each, or $60 000 in all. The capital stock is $1,000,000, fully paid up, with a surplus of $531,000. The company has practically no debts, except for current purchases for the months of December and January.

The prospects for the year 1895 are very good. The unfilled orders carried over from last year amounted to $58,000, in addition to which the third annual contract with the Philadelphia Traction Company for lead-covered underground feeders has just been secured, besides an annual contract with an Electric Light and Power Company for electric light cables, which two contracts give promise of at least $250,000 worth of business during the year. The Philadelphia Traction Company has bought from the Standard Underground Cable Company about $700,000 worth of feeder cables (practically underground, but also some overhead) in the last three years, and, owing to special patented devices furnished by the Cable Company, the Traction Company has an extremely satisfactory and flexible system.

In order to relieve the crowded condition of the factories the company erected during the past year a two story and basement building adjacent to its former factories, at the corner of 16th street and Allegheny Valley Railway, in the city of Pittsburg, and this building will be ready for occupancy in a few weeks. The company also expects to erect early this spring a large four story and basement building on the site of one of its present factory buildings, and when this is completed it will have an extensive and conveniently arranged plant, with sufficient capacity to keep up with any demands that may be made upon it for a good many years.

RECENT COMPANY ELECTIONS.

Edison Electric Light Company, Philadelphia. Directors: L. D. Brown, Arthur Colburn, C. A. Coffin, Samuel B. Huey, D. S. Lindsay, Amos R. Little, John Lucas, Wm. D. Marks, Chas. M. Swain, Wm. T. Tiers, H. Blake Tyler.

Market Street Consolidation Railway Company (Metropolitan branch), Easton, Pa. President, E. P. Vining; vice-president, Richard Gray. Directors: Richard Gray, C. E. Greene, W. Mills, A. N. Towne, E. P. Vining.

Card Electric Motor and Dynamo Company, Cincinnati. President and treasurer, J. W. Wilshire; vice-president, George Bullock; secretary, J.S. Neave. Directors: George Bullock, J. W. Wilshire, James W. Bullock, Capt. Geo. N. Stone, S. R. Burton, P. R. Mitchell and J. S. Neave. The only change made in the old board was the election of J. S. Neave to fill the vacancy caused by the removal to New York of Col. L. C. Weir.

Salem Electric Lighting Company, Salem Mass. President, Charles H. Price; treasurer, Henry M. Batchelder. Directors: Charles H. Price, James F. Almy, Israel P. Harris, Benjamin W. Currier, George M. Harris, C. A. Gallup, Joseph N. Peterson.

Waushara Telephone Company, Berlin, Wis. President, John Moffatt; vice-president, Mahlon Safford; secretary, Matthew Whitney; treasurer, L. E. Davis. Directors: M. Safford, J. J. Wood, Jr., Berlin; James Spencer, Auroraville; John Moffatt, Poysippi; Charles Kimball, Pine River; John P. Pederson, Mt. Morris; George P. Walker, Wautoma. C. G. Starks was appointed superintendent.

Manchester Electric Light Company, Manchester, N. H. President, Alonzo Elliott; vice-president, James A. Weston; treasurer, Walter G. Africa; clerk, J. W. Hildreth; superintendent, J. Brodie Smith. Directors: James A. Weston, Alonzo Elliott, Walter G. Africa, J. Brodie Smith, Joseph C. Moore, Harry E. Parker, John B. Varick, Frank Dowst, Joseph W. Hildreth.

Youngstown Street Railway Company, Youngstown, O. President, James Parmelee; vice-president, Silas Shook; treasurer and general manager, A. A. Anderson; secretary, John E. McVey. Directors: J. G. Butler, Jr., Silas Shook, A. A. Anderson, G. E. Herrick, James Parmelee, B. F. Miles and W. H. Lawrence.

Mahoning Valley Electric Railway Company, Niles, O. Directors: C. F. Clapp, R. G. Sykes, G. E. Herrick, B. F. Miles, Andrew Squire, A. A. Anderson and John E. McVey.

Wilkesbarre and Wyoming Valley Traction Company, Wilkesbarre. President, B. F. Meyers; general manager, John B. Graham; secretary, W. G. Eno. Directors:

B. F. Meyers, Harrisburg; J. W. Hollenback, Wilkesarre; J. J. Patterson, Lancaster; Robert McMeen, Miflin; John Graham, Wilkesbarre; Benjamin Reynolds, Wilkesbarre; Patrick Russ, Harrisburg; S. P. Light, Lebanon; W. G. Eno, Wilkesbarre.

Cleveland Electric Railway Company, Cleveland, O.—President, Horace E. Andrews; vice-president, Henry A. Everett; secretary, R. A. Harmon; treasurer, James Parmelee; general superintendent, J. J. Stanley; electrical engineer and purchasing agent, Charles W. Wason. Directors: Tom L. Johnson, Horace E. Andrews, Henry J. Davies, Henry A. Everett, R. A. Harmon, Hiram Kimball, James Parmelee, J. J. Stanley, Charles W. Wason and J. F. Whitelaw.

Cleveland Electric Illuminating Company, Cleveland, O. President, James Parmelee; vice-president, Samuel Scovil; secretary, S. C. D. Johns; general superintendent, Robert Lindsay. Directors: James Parmelee, Hubbard Cooke, Charles A. Otis, Horace E. Andrews, George Foster Peabody and Samuel Scovil.

Hartford Light and Power Company, Hartford, Conn. Directors: David Henney, W. F. Henney, E. G. Whittlesey, J. Henney, W. E. Goodwin, P. H. Quinn.

Reading and Temple Electric Railway Company, Reading, Pa. President, Benjamin F. Owen; vice-president, Matthias Moyer; secretary and reasurer, Frank G. Livingood. Directors: Matthias Meyer, W. S. McKnight, William McIlvain, Frank G. Livingood, Jonathan C. Leinbach.

Reading and Womelsdorf Electric Railway Company, Reading, Pa. President, John A. Rigg; secretary and treasurer, M. C. Aulenbach. Directors: John A. Rigg, Samuel E. Rigg, Richmond L. Jones, A. B. Hawk and M C. Aulenbach.

Metropolitan Electric Light Company, Reading Pa. President, John A. Rigg; secretary and treasurer, M. C. Aulenbach; general superintendent, Jerome L. Boyer. Dirctors: John A. Rigg, Robert N. Carson, Richmond L. Jones, Wm. R. McIlvain, R. Nelson Buckley.

Bethlehem Electric Light Company, Bethlehem, Pa. President, James Thomas; secretary and treasurer, C. A. Wolle. Directors: James Thomas and Daniel Milson, of Catasauqua; J. S. Hess, of Hellertown, and F. W. Leinbach, T. M. Dodson, Alvin Hill and C. A. Wolle, of Bethlehem.

Central Union Telephone Company, Chicago. Directors: C. H. Brownell, R. C. Clowry, C. R. Cummings, Arthur G. Fuller, F. H. Griggs, W. A. Jackson, J. Russell Jones, M. G. Kellogg, Henry B. Stone John F. Wallick and Norman Williams.

Chicago Telephone Company, Chicago. Directors: Arthur G. Fuller, John Le Koven, J. Russel Jones, John B. Drake, C. E Perkins, W. A. Jackson, Henry B. Stone, Norman Williams, Robert T. Lincoln.

At a recent meeting of the stockholders of the Franklin Electric Illuminating Company, of Sea Cliff, L. I., four new directors were added. They were Messrs. James Norton and Louis T. Duryea, of Glen Cove, and H. F. Noyes and John Tichborn, of New York City.

Schenley Park and Highlands Railway Company, Pittsburg, Pa. Directors: Richard G. Wood, president; Thos. A. Noble, F. G. Kay, S. J. Macferron, Alan D. Wood, John T. Davitt and E. M. Fulton. The Homestead and Highlands Street Railway Company elected Richard G. Wood, Messrs. Noble and Macferron and Jacob Trautman and Louis Rott as directors.

Lock Haven Electric Railway Company, Lock Haven, Pa. President, L. M. Patterson; vice-president, W. H. Mayer; general manager and secretary, R. H. Irvine; treasurer, John A. Seeley. Directors: Wilson Kistler, J. H. Fredericks, L. M. Patterson, W. H. Mayer, all of Lock Haven; C. O. Baker, Jr., J. A. Seeley and P. J. Bennett, of New York City; A. J. Belden, of Syracuse, N. Y. and Geo. Porter, of Philadelphia.

Waverly, Sayre and Athens Electric Traction Company, Waverly, N. Y. President, A. N. Broadhead, of Jamestown; vice-president, Dr. F. M. Stephens, Sayre; secretary, A. C. Wade, Jamestown; treasurer, F. K. Harris, of Athens. Directors: W. L. Watrous and W. Quigley, of Waverly; S. B. Broadhead, Jamestown; Wm. Christie and James Christie, Jr., of Akron, O., and A.C. Robertson, Athens, Pa.

Norristown and Perkiomen Creek Electric Railway, Norristown, Pa. President, Thomas H. Regan; secretary and treasurer, Paul W. Smith. Directors: Josiah Thompson, Harry E. Parsons, Jas. J. Regan.

Sanatoga, Royersford and Collegeville Electric Railway, Norristown, Pa. President, Josiah Thompson: secretary and treasurer, Paul W. Smith. Directors: John C. Lynch Clark Dillenbeck, William C. Lynch.

Philadelphia and Rosemont Railway Company, Philadelphia. President, Lincoln L. Eyre; secretary and treasurer, Arthur W. Depue. Directors: Harry Parsons, John C. Lynch and Edward H. Faulkner.

Jenkintown Electric Railway Company, Jenkintown, Pa. President, C. F. Fox. Directors: R. N. Carson, Wm. H. Shelnerdine, George S. Fox, Caleb F. Fox. D. C. Golden.

INCORPORATIONS.

The State Harrison Construction Company, Chicago. Capital stock, $100.000. Incorporators: James H. Talbot, Henry L. Talbot, William R. McLaren and John F. Talbot.

The Fulton Electric Light and Power Company, Fulton, Ill.—to operate an electric light and power plant and to furnish the citizens with electric light and power. Capital stock, $20,000. Promoters: C. C. McMahon, Ed. Wyatt, H. S. Remer.

The Wellston and Jackson Belt Railway Company, Wellston, Ohio—to construct or acquire and operate a railroad to be operated by steam, electric or other motive power. Capital stock, $500.000. Promoters: Harvey Wells, J. C. Clutts, Charles L. Currier, A. D. Lutz, F. H. Alfred.

The Jackson, Wellston and McArthur Railway Company, Wellston, Ohio—to build or acquire and operate a railroad to be operated by steam, electric, horse or other motive power. Capital stock, $$10,000. Promoters: Isaac E. Adams, Daniel J. Ryan, Edwin R. Sharpe, Chas. Kinney, Edw. B. McCarter.

The Phillips Electric Motor Company, Paterson, N. J.—to construct, establish and operate plant for supplying light, heat and power, etc. Capital stock, $100,000. Promoters: Simeon L. Phillips, New York City; Francis H. Leonard, Jr., Paterson, N. J.; Floyd B. Wilson, East Orange, N. J.

The Dravosburg and Elizabeth Electric Street Railway Company, Pittsburg, Pa.—to construct and operate a street railway. Capital stock, $40,000. Promoters: H. W. Juergen, Pittsburg, Pa.; Jno. Shrader, McKeesport, Pa.; J. R. McQuaide, Duquesne, Pa.

The Rawson Electric Company, Elyria, Ohio—to purchase, sell and manufacture telephones, electrical supplies; construct telephone lines, etc. Capital stock, $50,000. Promoters: H. C McKinley, J. B. Coffinberry, T. M. Brush.

The King Solomon Mining and Power Company, Chicago, Ill.—to develop and locate mining property; furnish light, heat and power, electric or otherwise: construct railways, tramways, etc. Capital stock, $1,000,000. Promoters: Jno. Cassleman, Arthur B. Lewis, Harry C. Igel.

The Lindner and Remig Manufacturing Company, New York—to manufacture machines wherewith to manufacture gas, electric, water, steam and other fittings and fixtures. Capital stock, $100,000. Directors: Ernst Lindner, of New York; Theo. H. Mulch, of Mount Vernon, and Philip W. Remig, of Brooklyn N. Y.

A bill to incorporate the Merrimack Valley and St. Lawrence electric road has been presented to the New Hampshire Legislature. The incorporators are Thomas Sanders, Chas. Corliss, E. B. Fuller, B. F. Sherburne and C. H. Hoyt. The road is the scheme of Chas. Corliss, of Haverhill. The road will pass through Salem, Windham, Hudson, Nashua, Litchfield, Merrimack, Londonderry, Bedford, Manchester, Hooksett, Suncook, Allentown, Pembroke, Bow, Concord, Canterbury, Boscawen, Northfield, Franklin, Sanbornton, Hill, Alexandria, Briston, New Hampton, Bridgewater, Plymouth, Ashland and other towns to the boundary line between the United States and Canada.

The Vicksburg Electric Light Company, Vicksburg, Miss. Capital stock, $125,000. Incorporators: Joseph Hirsh, Charles E. Armstrong, Murray F. Smith and others.

The Molyneux Electric Manufacturing Company, Buffalo, N. Y. Capital stock, $80,000. Directors: H. Walter Webb, Edgar Vanetten, Arthur G. Leonard, of New York City; Frank Hammond, John P. Trible, Barton S. Molyneux and Lawrence T. Hammond, of Buffalo; Frank L. Darrow and John W. Cobb, of Minneapolis.

The Mutual Automatic Telephone Company, Chicago. Capital stock, $1,000,000. Incorporators: Athol R. Mackin, Joseph Kelley and James F. Dubig.

The Natick Gas and Electric Company, Natick, Mass.—to manufacture and sell electricity for light, heat and power. Capital stock, $125.000. Promoters: Guy Wilkinson, Arthur E. Appleyard, Crayton N. Wilkinson.

The Missouri Telephone Manufacturing Company, St. Louis. Capital stock, $2,000. Incorporators; Isidor J. Kusel, Russell Parker and George J. Chapman.

The White River Water Power Company, Newark, N. J. —to develop water for commercial purposes and operate plants for furnishing light, heat and power. Capital stock, $1,500,000. Promoters: Edward Henry Brush, Brooklyn, N. Y.; Thomas A. Quillin, Hoboken, N. J.; Thos. F. Brothers, West Orange, N. J.

The Metropolitan Register Company, New York, N. Y.—to make and sell mechanical and electrical registers and indicators. Capital stock, $10,000. Promoters: J. H. Carson, New York City; J. B. Benton, Elizabeth, N. J.: J. M. Stoughton, Yonkers, N. Y.

The Westchester County Central Electrical Railway Company, White Plains, N. Y.—to build and operate a street surface railroad three miles in length in the village of White Plains and to Silver Lake Park in the town of Harrison. Capital stock, $75,000. Directors: Charles A. Johnson, Frederick H. Reed, George N. McKibbin, Charles M. Nichols, Lloyd McK. Garrison, of New York City; S. H. Gainsburg, E.C. Sniffin, and J. Henry Carpenter, of White Plains, and George W. Mansfield, of South Norwalk, Conn.

The Metropolitan Register Company, New York City—to manufacture and sell either mechanical or electrical registers or indicators. Capital stock, $10,000. Directors: John Henry Carson, New York City; John B. Benton, Elizabeth, N. J., and Joseph M. Stoughton, Yonkers, N. Y.

The E. S. Karoly Electrical Construction Company, Chicago. Capital stock, $12,000. Incorporators: E. S. Karoly, V. Merriman and J. H. Weber.

The Grand Island Light and Power Company, Grand Island, Neb.—to erect, construct, operate and maintain an electric incandescent light power, etc. Capital stock, $50 000. Promoters: H. T. Julius Fuehrman, Henry C. Joehuk, W. H. Thompson.

The Rushville Electric Light Company, Rushville, Ill.—to furnish electric light and power. Capital stock, $12,500. Promoters: C. W. Wainman, Jno. Foote, Chas. B. Griffith, J. P. Clarke, Chas. H. Wells, Jno. D. Little.

Woven Wire Brushes.

The Belknap Motor Company of Portland, Me., are the patentees and manufacturers of the best Woven Wire Brush on the market.—[*Adv.*

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JANUARY 22, 1895

ELECTRIC RAILROADS AND APPLIANCES.

582,812. Trolley Wheel. Benjamin O. Paine, Millbury, Mass. Filed June 11, 1894.

582,905. Trolley Breaker. Wm. B. Potter, Schenectady, N. Y., assignor to the General Electric Company, Boston, Mass. Filed Aug. 4, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

532,760. Incandescent Lamp. Mark H. Branin, Lynn, assignor to the General Electric Company, Boston, Mass. Filed April 10, 1893.

532,797. Flash-Light Device. Thomas H. Macdonald, Bridgeport, Conn. Filed April 28, 1894.

DYNAMOS, MOTORS, ETC.

582,776. Apparatus for Bending Armature Bars for Dynamo-Electric Machines. Henry Geisenhoner, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 28, 1894.

532,782. Magnetic Brush Holder. John C. Henry, Westfield, N. J. Filed Dec. 11, 1894.

582,789. Electric-Fan Motor. Joseph L. Ketcher, New York, N. Y., assignor of one-third to William L. Beadnell, same place. Filed April 26, 1894.

532,795. Armature for Dynamo-Electric Machines or Motors. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed March 29, 1890.

532,814. Electric Safety Device. Charles T. Penton, Christopher C. Gartland and Patrick J. Casserly, Buffalo, N. Y. Filed Feb. 2, 1894.

582,820. Machine for Assembling Laminæ of Armatures. John Riddell, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 19, 1894.

582,821. Machine for Winding Armature Coils. John Riddell Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 19, 1894.

582,861 Regulator for Dynamo-Electric Machines, Louis Bell, Boston, Mass., assignor to the General Electric Company, same place. Filed Dec. 18, 1893.

532,925. Frictional Driving Gear for Bicycle-Dynamos. Ernest Tilmann, New York, N. Y., assignor of one-half to Charles K. Lexow, same place. Filed Nov. 30, 1894.

533,038. Commutator Brush. Maria R. Hirsch, Milwaukee, Wis. Filed May 31, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

532,769. Call Generator Connection. Frank B. Cook, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed Nov. 27, 1894.

532,979. Telephone Transmitter. William A. Mason, Sumter, S. C. Filed Oct. 26, 1894.

533,015. Telephone Switching Apparatus and Circuit. Joseph J. O'Connell, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed May 1, 1894.

MISCELLANEOUS.

532,790. Electrical-Display Apparatus. Joseph L. Ketcher, New York, N. Y., assignor of one-third to William L. Beadnell, same place. Filed April 26, 1894.

582,796 Electrical Conductor. Edward D. Lewis, Savona, N. Y., assignor of two-thirds to Fred S. Lewis, Lewis H. Hill, Adelbert D. Dusinberre, Horatio S. Johnson, Charles A. Van Housen, and Charles W. Gillmer, same place. Filed June 16, 1894.

532,798. Electrically-Operated Clutch. Thomas H. Macdonald, Bridgeport, Conn. Filed April 28, 1894.

582,826. Galvanic Battery. Charles B. Schoenmehl, Waterbury, Conn., assignor of one-half to Clark M. Platt, same place. Filed Nov. 14, 1893.

532,838. Electric Welding Apparatus. Elihu Thomson, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Aug. 13, 1889.

582,839. Electric Meter. Elihu Thomson, Swampscott, assignor to the General Electric Company, Boston, Mass. Filed Aug. 10, 1894.

532,860. Electric-Alarm Mail Box. Edward C. T. Belding, Chicago, Ill. Filed Feb. 17, 1894.

582,868. Electrical Annunciator. John S. Bull, New York, N. Y. Filed April 23, 1894.

582,909. Electric Stove. Charles E. Roehl, St. Joseph, Mo. Filed Jan. 4, 1894.

582,973. Screw-Press for Forming Insulators. Seraphin Cribs, Brooklyn, assignor to William Brookfield, New York, N. Y. Filed Sept. 6, 1894.

ELECTRICITY.

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N. E. L. A.—The next annual meeting of the National Electric Light Association will be held at Cleveland, O., February 19-21, 1895. Every concern interested in either lighting or railway work should be represented in the membership of this body, and should have at least one representative at the Cleveland meeting. The Secretary is Mr. Geo. F. Porter, 136 Liberty street, New York.

EDITORIAL NOTES.

Modern Theories as to Electricity. In our issue for January 9 we reprinted from the *Engineering Magazine* Prof. Henry A. Rowland's article on "Modern Theories as to Electricity," and editorially commented upon it, calling attention to some of the radical differences between his opinions and those held by Prof. Oliver Lodge as expressed in his work, "Modern Views of Electricity." We also questioned the sufficiency of the "Vortex Theory of Magnetism," as held by Kelvin, Maxwell and others, and asked for more light on this perplexing question. In our ignorance of the subject, it seemed to us that the observed facts controverted the idea that magnetism could in any way be a kinetic phenomenon as the vortex theory would seem to imply. It seemed to us that if it were kinetic, then the presence of a magnetic substance in a magnetic field should constitute a drag upon that energy which would require a constant supply of energy from without to maintain it at undiminished strength. This retarding effect on the vortex would be entirely separate and apart from that which might be attributable to molecular friction or to hysteresis, and would, it seems to us, have to be provided for in any kinetic theory of magnetism. As a matter of fact, however, in a permanent magnet, be it either of highly tempered steel or of the softest iron, the magnetism seems to remain unimpaired in strength as long as work is not done on the metal to discharge it. We are speaking now of magnetism as evinced in ferric substances. In non-ferric substances such as air, the phenomenon would seem to be clearly kinetic, requiring a constant expenditure of energy to maintain it even in air, but a still greater expenditure in the presence of magnetic substances which act as a drag on the supposed vortex. Thus in the phenomena of heat which is generally believed to be kinetic and due to molecular vibrations, we find all other cooler substances acting as a drag upon these vibrations until they and the originally hotter body have both been brought to the same temperature. According to Kelvin's theory of matter, the atoms are themselves nothing but vortex rings of the ether. It postulates a frictionless medium, else these vortices would themselves die out, and we would have the phenomenon, which is contrary to experience, of the destructibility of matter. But however difficult it may be for us to accept this theory of matter, and it seems thus far to be the most tenable of any yet presented, let us assume that matter has this construction—and there is no difficulty in the assumption—still we are met by the fact that *one* kind of vibration of this vortex matter, such as heat, is capable of retardation, and so are all forms of radiant energy when impinging upon matter. How then can magnetism, if a phenomenon of the same order, be explained? It is not enough to advance the theory of molecular magnets any more than it is enough to advance the theory of molecular vibrations as the source of sensible heat—the question still remains, what *maintains* those conditions and how do they in the case of the molecular magnet produce the observed phenomena? A theory that magnetism is entirely static would seem to fill the requirements more fully, and while the explanation would not be ultimate any more than are the current explanations of electrostatic attractions and repulsions, it would bring the two into the same *order* of phenomena, and do less violence to our accepted theory of the conservation of energy than the vortex theory does, *as we understand it.*

In the issue before referred to, we expressed our misgivings with considerable diffidence, assuming that they were due entirely, or at least largely, to the insufficiency of our grasp of the theory rather than to the insufficiency of the vortex theory itself. We had hoped for our own benefit, as well as for that of many of our readers, that Prof. Rowland would clear up the difficulty for us—at least in part—and we addressed him a personal letter on this subject, but as we go to press have heard nothing from him.

It seems, however, that we are not alone in our perplexity, for during the past two or three weeks we have received a number of communications from men who stand high in electrics who are in the same mental darkness on this point as ourselves.

In this issue, we reprint from the London *Electrician* of January 18 a communication from Dr. Oliver Lodge himself, who in reviewing Prof. Rowland's Paper raises very much the same questions that we did in our review of January 9th. In regard to Prof. Rowland's theory of the earth's magnetism, which is but a corollary of the general vortex theory, Dr. Lodge quotes the author thus :

"To account for the earth's magnetism, we must suppose the ether to have such properties that the revolution of ordinary matter in it produces magnetism." . . . "The ether must also account for the earth's magnetism. If we assume that magnetic lines of force are simple vortex filaments in the ether, we have only to suppose that the ether is carried around by the rotation of the earth, and we have the explanation needed. The magnetism of the earth would then be simply a whirlpool in the ether."

Upon this he makes the following comment :

"Now these statements are full *of more than doubtful hypotheses.* [Italics ours.—ED.] First, that magnetism is certainly due to rotation of something, which, although Thomsonian and Maxwellian, *has never been proved ;* next, that rotating ether is the necessary and sufficient whirling material, whereas all that is known is that rotating electrification is sufficient; and lastly, that the spinning of matter on its axis, magnetizes it, against which may be adduced a crowd of specially-directed experiments, all of them *having had a negative result.*"

And further along he says, in speaking of Prof. Rowland's adhesion to the vortex theory of magnetism : "It may be assumed as probable that he had strong reasons for this orthodox Maxwellian belief, and it would be interesting to know them."

This, it will be observed, is exactly the position which we assumed a month ago.

While it is too much to expect at this time an ultimate theory of magnetism that will be acceptable to all, it is only by discussions such as Prof. Rowland's Paper has called forth, and is likely to call forth, that we can hope to approach more closely to the desired end.

Personally, we had hoped to see these great questions, What is electricity ? What is magnetism ? What is the ether ? brought up before the Electrical Congress at Chicago. We believed that although no definite answer could be expected in the present state of our knowledge, still an open discussion would have resulted in a more definite understanding of where science stands to-day on this vital question; that even though no ultimate and satisfactory statement could have been made, it would have given us a new datum from which to build *toward* that which *would* be more satisfactory. That opportunity has passed by, but another one will be presented at the Paris Exposition, and it is to be hoped that preparation for the final discussion may be made by a free interchange of thought through the electrical press during the intervening time.

* * *

The Hopeless Case of General Electric. The friends of General Electric, or rather those who are still making apologies for that rotten concern, tried to excuse away the slump to 29⅝, which its stock took a week ago, on the ground that it was in anticipation of an unfavorable decision in the Bate Refrigerator case. A purchase of some 2,500 shares at a very low figure by Boston parties sent the price up a point or two, but it could not hold at this and has been below 29 part of the past week. At one time it touched 28½, and is going still lower before long. Monday has come again and, as predicted in these columns last week, there is still no decision in the Bate case, and this must go over now until after the February recess. The sales in General Electric during the past week exceeded those of every other stock except American Sugar, being a very good second, however—102,900 for the former as against 126,979 for the latter. In point of decline, however, General Electric refuses to take second place to any other stock. Its only competitors in the downward scale among the more active stocks were L. and N. with a decline of ⅜, Distillers ⅝ and Southern Ry. pref. ¼. General Electric made a net loss of 3⅜ or nearly three times as much as the combined slump of the other three.

The apologists for G. E.—apologists for revenue only, for there is no apology for the existence of this fraud—attempt to account for this showing by the general disturbance of the money market and the uncertainty in regard to a new bond issue. But why should G. E. decline 3⅜ while nearly every other stock of importance on the list advanced ?

There are two very plausible excuses for this slump, which is larger relatively than it is intrinsically, viz., the gradual approach of the annual statement, which must either be falsified or else show the utter worthlessness of the stock or the too evident desire of the Board of Directors to get under cover before the crash comes, as evinced in the extraordinary resolutions which they passed and which we published in the last issue.

Anything more inane or transparent than these resolutions would be difficult to conceive of and the public was not slow in catching on. But desperate cases require desperate measures, and when the penitentiary stares a criminal in the face there is no straw too small for him to clutch at in his vain endeavor to escape the just penalty of his crimes.

Consumption is regarded as a surely fatal disease. Its course is marked by spurts of apparent improvement followed by relapses, each one of which is worse than the preceding. Down, down, and further down the patient sinks until death relieves him of his mortal cares. Is not this a correct diagnosis of G. E.?

Under the Searchlight.

Views and Opinions on Timely Topics.

HAS MR. TWOMBLY GOT ENOUGH ?

It was stated last week in several of the daily papers that Mr. H. McK. Twombly had unloaded a large part of his G. E. holdings, and that this caused the conspicuous weakness of the stock.

Of all the legs in the G. E. Company, those of Mr. Twombly have been the longest and most elastic. It has been said by those who ought to know that he lost over $1,000,000 on the decline. If at last he can see the actual situation of the company, he may save a part of his large fortune.

* * *

Oh, Musha! Musha!

Our esteemed contemporary, the *Electrical Review*, in its last issue mentions by name some of those that ELECTRICITY in a previous issue referred to as having too much self-respect to continue patronizing a sheet that descends to Baxter street methods. We quote verbatim :

> "Four well-known houses—the Armington & Sims Engine Company, the McIntosh & Seymour Engine Company, the Okonite Company, Limited, and the Law Battery Company—have discontinued their advertisements in the *Electrical World*. The impertinent circulars issued from that office did it. The proprietor, W. J. Johnston, with a record of three failures in the past, with a sawdust periodical in the present and a challenge ringing in his ears to produce a few paying subscribers, sends out a pathetic card headed :
>
> "'Tis the wounded bird that flutters.'
>
> "Poor flutterer !"

Other people better fortified in every way than Pudd'nhead Johnston have found that "the public be damned policy" didn't work. Mr.—no, beg pardon—Pudd'nhead Johnston is likely to learn that when a man goes around town with his coat tails trailing on the ground, crying "There's not a gossoon in the village dare tread on the tail o' me coat," it is very likely to be trodden on in time to interrupt the refrain, "and mush, mush, mush toori a laddie, and a mush, mush, mush toori a lay" all the eggs in one basket.

* * *

A generally well-informed Jersey City paper states that the General Electric Company intends to remove the Harrison, N. J., branch of its lamp department to Lynn, Mass. ELECTRICITY predicted some months ago that the establishment at Harrison would soon be closed. This adds another to our predictions concerning G. E. that have been fulfilled. The writing at Belshazzar's feast was not plainer to Daniel than the drift of G. E.'s concerns to ELECTRICITY.

* * *

MR. A. J. DE CAMP will be looking after his probable election to the Philadelphia City Council during Convention week, and will be one of the old-timers missed at the Cleveland meeting.

* * *

IT certainly was not a daily paper attack that played the mischief with G. E. last week.

American Institute of Electrical Engineers.

POSTPONEMENT OF FEBRUARY MEETING.

We are informed by Mr. R. W. Pope, secretary, that on account of dates conflicting with the Convention of the National Electric Light Association at Cleveland February 19, 20 and 21, the regular monthly meetings of the Institute at New York and Chicago have been postponed from February 20 to Wednesday, February 27, 1895.

The paper to be presented on the latter date is by Mr. H. Ward Leonard, entitled "Notes on

Recent Electrical Engineering Development in France and England," being the results of the author's personal observation in electric light, railway, central station and underground practice.

The usual notices will be mailed in advance of the meeting.

National Electric Light Association Convention.

The following have been added to the papers and topics heretofore furnished for the Cleveland programme:

Paper: "A New Method of Measuring Illumination," by Professors E. J. Houston and A. E. Kennelly.

Topic: "Underwriters' Rules vs. National Electric Light Association Rules."

Topic: "Practical Demonstration of Protecting Lines from Lightning," by A. J. Wurtz.

The entire programme for the Cleveland Convention is now completed and only awaits the approval of the president. It will doubtless appear in the next issue of this paper.

In the interests of those who wish to attend the N. E. L. A. Convention, arrangements have been completed with the New York Central and Hudson River Railroad Company for a special train of the Wagner vestibule, parlor, dining room and buffet cars, leaving Grand Central Depot, 42d street, New York, at 9:30 A. M. Monday, February 18, running as second section of the fast mail on the following schedule: Leaving New York 9:30 A. M.; Albany 1 P. M; Utica 3:17 P. M.; Syracuse 4:40 P. M.; Rochester 6:30 P. M.; Buffalo 7:25 P. M. (Central time); Erie 9:33 P. M. (Central time); arriving at Cleveland 11:55 P. M.

Seats can now be secured on this train by applying in person or by letter to the office of the National Electric Light Association, 136 Liberty street, New York.

A special rate has been granted (on certificate plan) of a fare and one-third from all points in the United States east of the Mississippi River, Peoria and Chicago, Ill., to Cleveland. To obtain this rate it is necessary in purchasing going ticket to ask the ticket agent for a certificate, which, when properly viséed and indorsed at Cleveland, will entitle the purchaser to a one-third fare returning.

That the best results may be obtained it is very desirable that delegates should make their application for space on the New York special at the earliest possible moment.

The following gentlemen have charge of transportation in their respective districts, and application can be made to them for all information:

A. C. Shaw, 620 Atlantic avenue, Boston.

H. A. Cleverly, 1018 Chestnut street, Philadelphia.

E. H. Heinrichs, Westinghouse Electric Company, Pittsburg.

E. L. Powers, Monadnock Building, Chicago.

The Brooklyn Electrical Society's "Smoker."

The electrical smoking concert of the above society, on Thursday night last, was a very pleasant affair, and though begun in smoke and carried through amid the fumes from corn-cob pipes, cigars, cigarettes and congeneric stock, yielded substantial enjoyment to about two hundred of the brightest young men in the city.

President Burling opened the proceedings with a few remarks, and was followed by Arthur A. Fisk, chairman of the Entertainment Committee, who in a humorous speech welcomed the crowd to all the amusement they could obtain from what the committee had provided for their benefit.

Under the direction of James H. Mason, "Funny Things from the Phonograph" were given. Then came "The Sheehan Boys," John T. and Dan, and their comic songs and parodies, which were repeatedly encored. Others who entertained the audience during the evening were Thomas A. Ballantyne, the humorist; George J. Gaskin, the Brothers Murray, May Alpine and Harry W. Wright, of Harrigan's, who sang selections from McSorley's Inflation." A vote of thanks was given to the talent, whose services were given gratis, and "A Night Cap for All" concluded what was pronounced by every participant "A night well spent."

The "smoker" was given as one of a series of entertainments to raise funds to open club rooms where members of the society can meet in social as well as educational intercourse, and to make such rooms a headquarters for electrical men in Brooklyn.

Explosion at Brinton.

On Saturday last a laborer at the Brinton Works of the Westinghouse Company held a lighted match in the bunghole of an old barrel to see what was in it. It had contained alcohol, and enough was left to make a terrific explosion. The man was killed and two others seriously injured.

Obituary.

The electrical fraternity will be shocked to learn of the death at Washington, D. C., on January 23 of Mr. Rudolph Eickemeyer, whose name is so well known in connection with numerous important inventions relating to the electrical industry. While Mr. Eickemeyer's health had for a long time been impaired—he was a great sufferer from asthma—his friends had at no time been alarmed at his condition, but in the hope of finding relief he was on his way to the South. He had stopped over at Washington for a few days on a matter of business connected with the Patent Office when his trouble took on a serious turn and the end came as announced.

Mr. Eickemeyer was a Bavarian by birth, but came to this country in 1850, settling in Yonkers, N. Y., where he established a tool repairing shop. The faculty of invention was strongly developed in his nature and he soon found both fame and fortune in the exercise of this faculty. Among his earlier inventions were improvements in the manufacture of hats. A machine for making leather hat bands, now widely used; a sewing machine for sewing these same bands into the hats, and hat blocking machines and bouncers were the chief of these, from which he received large royalties.

With the advent of electrical development he turned to this as an inviting field, and the Eickemeyer method of winding for motors and dynamos was received with great favor. In connection with Stephen D. Field he developed many improvements in electric car equipments, one of which, following steam locomotive practice, consisted in driving both axles from the same motor by connecting the two drivers by means of parallel motion connecting rods. He was an indefatigable worker and his inventions in the electrical line alone are too numerous to mention in this connection. Some of them were of extreme originality and have failed as yet to meet with favor, but others have possessed such unquestioned merit as to stamp him as an inventor of an original and high order. A widow and six children survive him.

Two novel applications of the electric heater have been made in London. One is a wheat dryer in the form of a wooden box containing nineteen electrically-heated plates, which are maintained at about 200 degrees F. Air is forced over these plates by a blower, coming out at about 150 degrees F. The second novelty consists in applying electrically-heated plates to the top and sides of the case of steeple clocks, by which the accumulation of snow and ice on the face is prevented, and the movements of the hands are protected from the interference which would take place from this cause.

London Notes.

(From our London Correspondent.)

THE CHLORIDE BATTERY LITIGATION.

I am pleased to be able to state that the disputes which were likely to lead to lengthy and expensive litigation between the Electrical Power Storage Company, Chloride Electrical Storage Battery Company, Limited, and the Electrical Construction Company, Limited, have been settled on mutually satisfactory terms. Under the agreement which has been arrived at the Chloride Company continue to make and sell their batteries as heretofore.

THE ARC LIGHT.

Prof. Silvanus P. Thompson delivered the second of his Cantor lectures on "The Arc Light" on Monday, January 21, before the Society of Arts. He dealt more particularly on this occasion with the optics of the electric arc. Most of the total light, he said, is given off from the crater, less than 10 per cent. coming from the peak. The crater may be regarded as a flat, self-luminous area. If it could be seen in such a way that the peak never came between it and the eye it would give the greatest light when looked at perpendicularly and the least when the line of vision was parallel with its surface. But the shadow of the peak has to be reckoned with, and it is found that the light given off is directly proportional to the area of crater actually exposed to view, being greatest at an angle of 40° or 50°. In the middle of the crater there may sometimes be discovered with the unaided eye a nebulous patch, rather whiter than the rest, which seems to be in motion. By the use of appropriate artificial means this patch may be seen as a comma-shaped object, which rotates around the crater at very varying speeds and not always in the same direction. It is a question whether this is a true physical rotation of the flame or only an optical effect. As to the efficiency of the arc regarded as a means of transforming energy into light, the lecturer said that of all the rays given off by it only 20 or 25 per cent. are visible to the eye, the rest of the energy consumed is transformed into heat. The light from an alternate current arc is more equally distributed than that from a continuous current arc. As to the comparative efficiency of alternate and continuous arc lights, he thought it wrong to suppose there would be any difference between the two if the same amount of energy were consumed under equal conditions.

LECTURE BY PROF. DEWAR.

At the Royal Institution on Friday, 18th ult., Prof. Dewar, F. R. S., delivered a discourse on "Phosphorescence and Photographic Action at the Temperature of Boiling Liquid Air." The lecturer showed a number of experiments proving that bodies which at ordinary temperatures are very faintly, if at all, phosphorescent, glow very brightly if, after being cooled to the temperature of boiling liquid air they are stimulated in the light of an electric lamp. Among the substances he experimented upon were cotton-wool, feathers, flowers, egg-shells, quinine, acetic acid, and some of the complex platino-cyanides, the latter giving very brilliant effects. He proved experimentally that the stimulating power of the electric lamp lies chiefly, if not altogether, in its ultra-violet rays, and he showed the curious fact that the luminous and heat rays are able to dissipate the luminosity of a phosphorescing body in those parts upon which they have fallen.

The New Westinghouse Works.

The new factories of the Westinghouse Company at Brinton are assuming a business-like aspect. Manufacturing is being done already on a large scale, and one day last week over 100 motors were loaded and shipped.

Popular Electrical Science.

X.

The Microphone or Battery Telephone Transmitter—The Footfalls of a Fly Made Audible to Human Ears—The Great Service Rendered to Science by this Simple Invention.

BY NELSON W. PERRY, E.M.

I have pointed out that the principle underlying telephonic transmisson was an electric current varying in strength in exact harmony with the sound waves which are to be reproduced. In the magneto instrument described in Chapter IX the vibration of an iron diaphragm before a magnet carrying a coil of insulated wire was used to generate this current. The same results can be produced more efficiently, however, if we generate a steady current in a battery and then cause this to vary in strength by adding to and taking away from the line some of its resistance. Prof. Hughes in trying some experiments to find a method of readily varying the resistance of an electrical circuit, filled a glass tube of about 3 inches in length with bronze powder. The ends of this tube he closed by means of dense gas retort carbon plugs, so that the metal powder was pressed gently together. The wires fastened to the carbon plugs formed a closed circuit with a battery and a galvanometer. So long as the tube was untouched the galvanometer needle remained stationary—indicating the passage of a perfectly steady and unvarying current. But when grasping the two ends of the tube in his hands he exerted a pressure or pull, the needle showed a deflection either in one direction or the other. This could only be attributed to an infinitesimal elongation or compression of the tube, due to the manual force applied. Placing this same tube upon a resonance box and inserting a telephone receiver in the circuit, he found that words spoken into the resonance box could be distinctly heard in the telephone. In other words, the sound vibrations imparted to the resonance box had modified the resistance of his tube in such a way that the current which was passing through it was modified in like manner, and this undulatory current was translated back into sound waves by the telephone which corresponded in every particular except volume with those which originally gave rise to them. Prof. Hughes had invented the microphone. After the principle that a very slight variation in the pressure between contact surfaces was sufficient to vary an electric current within the limits of delicacy of the telephone to detect was discovered, and that sufficient variation in pressure could easily be produced by sound waves, a thousand different forms of microphones sprang into existence, and in fact that which had previous to Prof. Hughes's discovery been regarded as so impossible of attainment as to make it seem almost a waste of time to experiment on proved afterward to be the simplest thing in the world. Prof. Hughes himself showed that three wire nails, arranged as in Fig. 1 so that the current passed from one to another by means of a third lying across the two, if placed on a sounding board were an efficient microphone. It seems, too, that we cannot throw a mass of metallic rubbish together even in the most careless and haphazard manner but that it will, if connected in an electric circuit with a telephone, transmit articulate speech if spoken to. It required no new device after the principle was discovered to make that principle operative. The Morse telegraph sounder if adjusted to very light touch is itself an excellent telephone transmitter, and so would have been Reis's transmitter, described some weeks ago, had not the pressure of the contacts been purposely made so light that at every vibration of the diaphragm the contact became broken. In Reis's time, however, there was no instrument delicate enough to detect these slight variations in current. Had there been, it seems extremely probable that to him rather than to Hughes would the discovery of the microphone been accredited. It remained, however, for the telephone to make the recognition of these slight variations possible, and the microphone has in turn contributed much to the efficiency of the telephone—especially where long distances are involved and where volume of sound is essential.

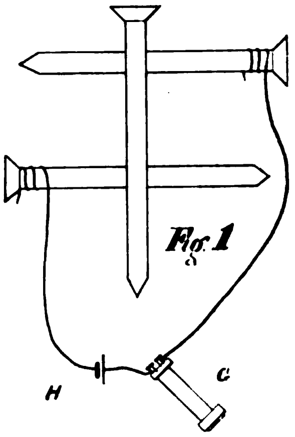

Fig 1

The microphone, therefore, is simply a contact between two conducting substances, the resistance of which is caused to vary by the sound waves which agitate them. If the vibrating parts be very light, the instrument will be very delicate and respond to sounds entirely inaudible to the human ear. If on the other hand they be heavy, or they be held against each other with some pressure, they will respond only to the louder sounds. If the instrument is so delicate as to break contact from the vibrations to which it is exposed, it cannot be used to transmit those sounds, but in many cases it is desirable to make the instrument as delicate as possible. For this purpose the moving contacts are placed upon a sensitive sounding board, so as to magnify the disturbance as much as possible. Where extreme delicacy is required, nothing better in the way of a sounding board can be devised than a thin pine board, and the thinner the better.

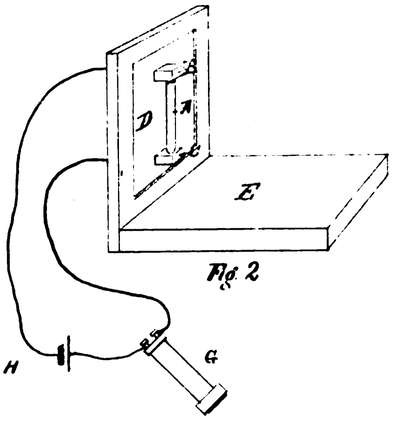

Fig 2

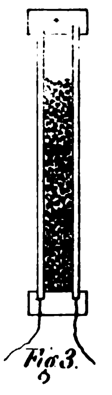
Fig 3

Now as to the material of the contact pieces. While the broad statement that anything that will conduct electricity may be used is entirely true, there is still a great choice, and of all known materials carbon is found to be best. If two small carbon rods be glued to a pine board and a third rested lightly upon these two, and the whole connected up with a battery and telephone as in Fig. 1, a microphone of extreme delicacy will have been constructed. If all the parts be very light, such an instrument will be too delicate for the transmission of speech, simply because the vibrations of the board due to the voice will cause the riding piece to hop and break contact. If this should be found to occur, it is only necessary to replace the light riding piece with a heavier one.

Another and more convenient, and still very delicate, microphone is illustrated in Fig. 2. *E* is a square pine block carefully planed, and varnished if desired. Its dimensions may be 3 inches or 4 inches square and ½ to ¾ inch thick. Nailed to the back of this is a light pine wood frame upon the back of which is glued a pine board *D*, about ⅛ inch thick. Attached to the face of this are two carbon blocks about ½ inch square and ¼ inch thick. These are represented by *B* and *C*. Between these two blocks is placed a light carbon pencil *A*, tapered at both ends and fitting *loosely* into conical recesses cut into *B* and *C*. These latter blocks are then connected in circuit with a galvanic cell *H* and a telephone *G* as shown.

If the parts be made of the dimensions given, this instrument will be too delicate for the transmission of any sounds louder than the softer whispers, but a watch placed on the base *E* will sound something like a trip hammer over a circuit hundreds of miles in length, and the soft musical ring of the mainspring, which perhaps few have ever heard before, will be plainly audible. It is said that the tread of a fly may be distinctly heard under such conditions, and I see no reason why that should not be true if the parts of the apparatus be made light enough and other sounds entirely excluded.

Another type of microphone, known as the "Hunning," is shown in Fig. 3. This consists simply of two thin metal diaphragms set up in a wooden or other non-conducting frame, with the space between the two diaphragms filed in with finely granulated carbon or graphite. These granules are usually about the size of a small pin head. The electric current is caused to pass from one diaphragm to the other *through* the granulated carbon, which normally has a high resistance. So long as the two diaphragms remain perfectly still this resistance remains perfectly constant, but if one of the diaphragms be spoken to it will be set in vibration by the sound waves, and this vibration will alternately bring the carbon particles into greater and less intimate contact with each other, thus varying the resistance and the strength of current that will flow. This type of microphone has some marked advantages for transmitting conversation. In the first place it is exceedingly delicate, and will readily transmit whispers, while at the same time it will transmit the loudest noises without danger of breaking the circuit, which I have pointed out would be fatal to the transmission of speech. It has great range. It has the disadvantage, however, when constructed as shown, of becoming less and less serviceable with use. This is due to the eventual *packing* of the carbon particles. When this occurs, however, it may be brought back to its original sensitiveness by simply inverting it, or shaking it a little so as to loosen the pack. A very large variety of telephone transmitters are made on this principle.

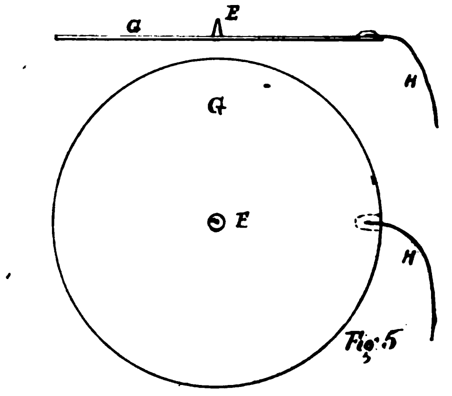

Fig 5

Among the best known of these are the long distance transmitters used on the American Bell Telephone lines between Boston and New York and Chicago. In these the packing tendency is entirely overcome.

Still another type of microphones is that represented by the Blake transmitter, which has heretofore been used almost exclusively by the telephone companies throughout the United States. This is an adjustable microphone, which for a given adjustment has a somewhat limited range, but which is capable of any adjustment desirable, so as to adapt it to the service required. The instrument as installed by the American Bell Telephone Company looks somewhat more complicated than it really is, but could not be reproduced by the amateur unless he had more facilities for manufacture than he usually possesses. I will describe one, however, that I have frequently constructed for myself out of ordinary materials at home, and which works admirably in every respect.

In the first place, take a square block of wood about 4 inches square and an inch thick. In the center of this bore a hole half an inch in diameter clear through, and then cut away on one side a conical or bell-shaped area to concentrate the sound waves. This is shown in section in Fig. 4. Cut out a circular disk of ferrotype plate about 2½ inches in diameter, and after having scraped off the enamel in the center, solder on a metal point, as shown at *E* in section and plan in Fig.5. To the edge of the disk also solder the end of a fine insulated copper wire—having, of course, previously cleaned the disk at that point for this purpose. Then buy at the drug store about 8 inches of soft rubber tubing ⅛ inch or less in external diameter, and slitting it longitudinally along one side, stretch it somewhat tightly around the circumference of the disc just as you would apply a braid to the edges of a piece of cloth, and sew the two ends together so as to keep the rubber in place. The wire *H*, Figs. 4, 5, 7, may be brought out through a little hole punched in the tubing for that purpose, or, better, at the point where the two ends of the tube come together. The object of this rubber braid is, first, to dampen the vibrations at the circumference of the diaphragm, and, second, to form an elastic cushion for the diaphragm when it is placed in position on the block. This diaphragm is then placed centrally on the reverse of the block, as shown in Figs. 4, 6 and 7, in which similar parts are lettered alike. *E* is the point or boss. *O* is the rubber tube.

To hold the diaphragm in position, mount a short piece of heavy clock-spring *M* on the block. Cover the end of this which is to bear on the diaphragm with a short length of rubber tubing, and then screw it down sufficiently so that it will hold the diaphragm fairly tight in place. It would be better if this finger was made of something considerably stiffer than a clock-spring, as its pressure must be firm. All the elasticity required will be given by the rubber cushion on its bearing surface.

We must now have a carbon anvil, whose pressure against the contact point *E* can be regulated at will. This can be conveniently made as follows: Procure an empty pistol cartridge shell and cut it off to about half its length (*A*, Fig. 8). Cut off a piece of clock spring about 2¼ inches long *B*, and solder one end of it to the back of the cartridge. This will make a holder for the carbon button attached to a flexible arm. Drive into the bottom of the cup *A* about ¼ inch of lead in order to give it inertia, and then force into it a carbon button *C*. Draw over the arm *B* a section of soft rubber tubing, shown at *P* in Figs. 4 and 7, and mount the whole on the block, as shown in the same figures, in such a way that of its own weight the carbon button *C* will not come in contact with the point *E*. This may be accomplished even after the spring is mounted by bending back the spring so that it will acquire a sufficient set to hold the button away. Then construct on the block a light wooden bridge *Q*, Figs. 4, 6 and 7, spanning the diaphragm and the spring, and in the center of this bridge insert an ordinary wood screw *L*, so that when screwed down it will press on the rubber covered spring about ⅓ the distance between the anvil and the other end of the spring. Fig. 6 shows a section of this bridge and screw, Fig. 7 a plan of the completed microphone, and Fig. 4 an elevation of the microphone on a plane passing through the spring, anvil, contact point and finger *M*.

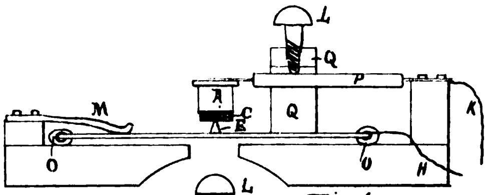

Fig. 4

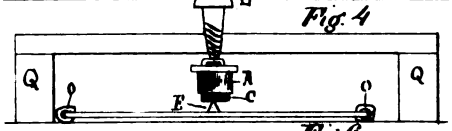

Fig. 6

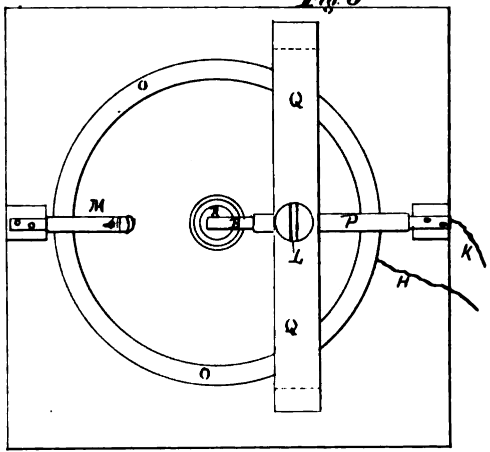

Fig 7

By screwing in or out the screw *L* the normal pressure of the carbon button *C* upon the point *E* may be made anything desired, so that the transmitter may be readily adjusted either to whispers or loud shouts. By attaching a copper wire *K* to the end of the spring the microphone may be easily connected in circuit with a battery and telephone. The course of the current will be through the wire *K*, spring, anvil *A*, carbon button *C*, contact point *E*, diaphragm, and wire *H*, or in the reverse direction.

The object of placing the rubber tubing on the spring is to dampen any vibrations that might be set up in it by the diaphragm when in use, and the object in adding lead to the cup is, as before stated, to give this sufficient inertia, without which the action would be less satisfactory.

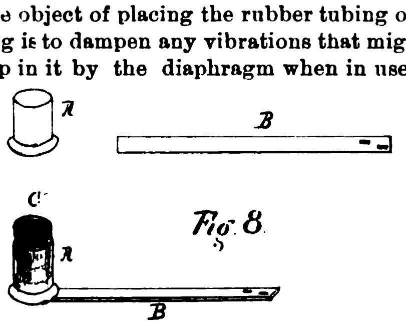

Fig. 8

This particular feature of the instrument is of historical interest. During the celebrated Drawbaugh litigation, in which the endeavor was made to show anticipation by Drawbaugh of the telephone invention and its various adjuncts, a microphone of the Blake type, purporting to have been made and used prior to the issue of Blake's patent, was brought in evidence. The Bell people met this by the claim that the instrument in question was merely a copy, and that in copying from Blake he had omitted the soul of the invention. viz., giving the anvil inertia by weighting it. The Blake patent has now expired, so that instruments such as the ones described may be made by anyone without liability or danger of infringing.

In the next chapter I expect to describe the methods of connecting up the transmitters, receivers and call-bells for service such as is required on private lines.

The Best Metal for Field Magnet Frames.*

BY ALTON D. ADAMS.

Cast-iron, cast-steel and wrought-iron being the materials at our command for field magnet construction, it is an important question to the engineer and manufacturer which will produce a dynamo of given capacity, speed, efficiency and working qualities at the least cost.

I am not aware that any of the works on dynamo construction attempt a definite answer to this question, and the practice of builders is by no means uniform. Economical points of saturation requiring about the same magnetizing force per unit of length in each metal, are for cast iron a little under 40,000, cast-steel, 70,000 to 80,000, and wrought iron about 90,000 lines per square inch.

The cost of cast-steel is fully equal to that of forgings in simple shapes, and as it lies between cast and wrought iron in magnetic qualities, the cost of machines made with it will be between those of cast and wrought iron. A comparison will therefore be made between the cost of the latter two.

To be fairly compared, machines of different materials must be equal as to magnetic flux in field and armature cores, ampere-turns on armatures, field ampere-turns required in air-gaps and as nearly as possible in magnet frames, watts used in windings, and be of the same capacities and speeds.

Taking wrought-iron at a saturation of 90,000 and cast at 40,000 lines per square inch, the section of an equivalent cast will be two and one-quarter times that of a wrought frame, and as the length of the cast-iron frame must be a little greater to give enough winding length, its weight will be about two and one-half times the wrought. A saving is thus at once made in favor of the wrought magnet, as forgings can be had per pound for much less than two and one-half times the cost of cast-iron.

The same number of ampere-turns and watts being required for the coils of the cast as the wrought-iron magnet, and the weight of wire varying as the square of its length, the coils for the cast-iron frame will be much heavier. The armature core may have the same diameter in each frame, but must be longer in the cast frame so as to come under the pole-pieces, thus materially increasing its weight.

As for the same resistance the weight of armature winding increases as the square of its length considerable more wire is required for the armature core of the cast-iron machine. In addition, the purely mechanical parts, shaft and base, must be larger and more costly in the cast-iron machine because of the greater weights they have to carry.

To illustrate the difference in cost of construction, the following data of two machines is presented, each having capacity of 25 K. W. of 1,275 revolutions per minute, the same winding losses, the same ampere-turns on armatures and field ampere-turns in air-gaps equal to about twice the armature ampere-turns active at the pole corners.

The air-gaps and armature cores of each machine are crossed by 4,320,000 magnetic lines, and allowing a leakage of 25 per cent. the field core must furnish 5,760,000 lines.

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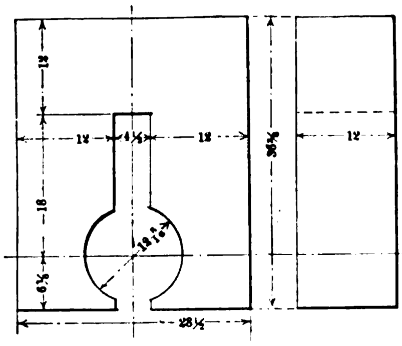
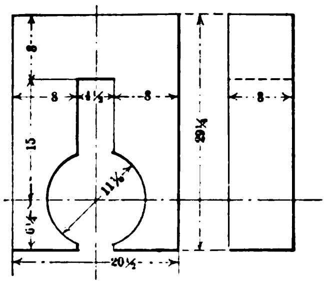
*A paper presented at the 93d meeting of the American Institute of Electrical Engineers, January 16th, 1895.

A wrought-iron field to carry 5,760,000 lines, at 90,000 per inch saturation, requires a section of 64 square inches, which is provided by a core of 8 inches square and a cast-iron field at 40,000 lines per square inch requires a section of 144 square inches provided by a core 12 inches square.

Allowing sufficient length for magnet windings the same air-gap resistance and an armature core of 11 inches diameter for each of these frames, their dimensions will correspond to the following drawings:



Cast-Iron Frame.



Wrought-Iron Frame.

The weights of these frames are :

Wrought-iron frame	1,020 lbs.
Cast-iron frame	2,780 "

For work as shunt motors the wrought-iron machine requires 11,000 ampere-turns in the air-gaps and 2,000 in iron, the cast machine 11,000 ampere-turns in air-gaps and 3,800 in iron.

With 440 watts expended in field coils of each machine, an average length per turn of 38 inches in the coils for wrought iron, and 54 inches in the coils for cast-iron, the weights of these coils are :

Wrought-iron machine	138 lbs. copper.
Cast-iron machine	340 " "

The drum armature for the wrought frame is 11 inches diameter and 8 inches long, that for the cast frame 11 inches diameter and 12 inches long, without allowance for shaft hole.

The weights for armatures are :

Wrought-iron machine	211 lbs. disk.
Cast-iron machine	316 " "

With a loss at full load of 490 watts in the armature winding for wrought-iron machine, and 464 watts in the armature winding for cast-iron machine, these windings require in

Wrought-iron machine	49 lbs. copper.
Cast-iron machine	71 " "

The above indicates plainly the great saving of wrought over cast iron in dynamo construction.

From the user's standpoint the wrought-iron machine seems preferable on account of its lesser weight and bulk, this difference being especially marked in machines for direct connection to engines, and other purposes where slow speed is necessary.

The Swiss Bundesrath is urging the construction of an electric railroad to the very summit of the famous Jungfrau. It is proposed to operate the road by power to be obtained from the Grindelwald glacier or from the water of the Tummel River. Ruskin would have thought this far more sacrilegiously and profanely modern than even the Joppa and Jerusalem Railroad, whose newsboys sell popcorn balls and prize candy to pilgrims on their way to Calvary.

THE DISTRIBUTION OF ENERGY IN THE SPECTRUM OF THE GLOW LAMP.*

(Preliminary Measurements.)

BY EDWARD L. NICHOLS.

IV.

Mr. Nichols, in his paper, has described briefly the calibration of the bi-sulphide prism. Since, in work of the kind under consideration, the accuracy of this calibration is of the utmost importance for the determination of wave lengths in the infra-red, it may be well to give some additional details. The containing vessel of the prism consisted of a block of cast-iron bored through so as to give a cylindrical opening about 4 cm. in diameter. The glass faces of the prism were cemented over this opening, forming an angle of almost exactly 60°. Since the refractive index of carbon bi-sulphide changes greatly with the temperature, it was necessary to have an accurate knowledge of the temperature of the contents of the prism at the time when each measurement was made. The method finally adopted for this purpose was as follows :

At the back of the prism a small pocket was constructed, one side of which was formed by the iron wall of the prism itself. Within this a delicate thermometer was inserted, the bulb of which was surrounded by water.

The dark room within which the spectrometer was mounted was an inside room of the laboratory, containing only one opening, that, viz., through which the rays from the incandescent lamp, which it was our purpose to study, reached the collimator lens of the spectrometer. The temperature changes in this room were very slow, and a comparison of the readings of the thermometer with those of a similar instrument, the bulb of which was placed within the liquid of the prism itself, showed that the difference of temperature within and without, through the very slight range to which both would be subjected, was negligible. Having satisfied ourselves that the indications of the thermometer in the water pocket at the back of the prism might be taken, the other thermometer was withdrawn and the prism was sealed up. Readings of the remaining thermometer were made before and after each set of readings.

The prism was standardized for a temperature of 23.5° C., a reading which represented very nearly the mean temperature of the room, and all observations were reduced to this temperature. The entire range to which the prism was subjected in the course of the measurements was about 3°. The indices of refraction of the prism were determined by Mr. Nichols with great care for temperatures lying within the above-mentioned range, the wave-lengths selected for this purpose being those of the C and F lines of Fraunhofer. The results of this calibration, which are given in Table I of Mr. Nichols's paper, are in close agreement with similar determinations made by Wüllner.

The method of calibration consisted in determining with all possible accuracy the Cauchy equation of the prism from the indices of refraction at the standard temperature for wave-lengths corresponding to the lines A, B, C, and *b* of Fraunhofer. By means of the equation thus obtained a curve was platted extending to the wave-lengths in the infra-red which we wished to measure. This method of determining the longer waves is less satisfactory in some respects than that made use of by Mouton and afterwards by Rubens, but it was believed that the errors thus introduced would not be important in comparison with those which result from other sources.

V.

Briefly stated, the method of experimenting was as follows :

The thermopile already described was placed in close circuit with the galvanometer, the latter instrument having been sensitized to a degree found by previous trials to suffice for the exploration of the region to be tested. The spectrometer was then set to a circle reading corresponding, at normal temperature, to the wave-length in question. The thermometer was then read, the time noted, and the inner room was closed, not to be entered again until the measurements for that region of the spectrum had been completed.

The thermal disturbances produced in the course of these preliminary adjustments lasted in uncontrollable intensity for about thirty minutes, after which time it became possible to bring the galvanometer needle to a position such as to render the scale visible to an observer at the telescope. The drift, still very rapid, would then diminish in the course of ten minutes more to a state of comparative repose, such that readings for the ballistic throw could be obtained. The next step was to close the lamp circuit and to read volts and amperes. The galvanometer was then brought to the proper part of the scale and preliminary calibrating throws were taken. For the purpose of calibration a subsidiary coil was used. This coil was mounted permanently about twenty centimeters behind the needles. It could be thrown into shunt circuit with a compensated resistance through which flowed a very steady current from a storage battery. The current was measured from time to time by means of an accurate mil-ammeter. The swing due to the closing of the circuit of the subsidiary coil gave the relative sensitiveness of the galvanometer. Such calibrations were made before and after every reading of the thermopile throws, and thus all the determinations were rendered reducible to a common scale, although the figure of merit of the galvanometer varied greatly in the course of the experiments.

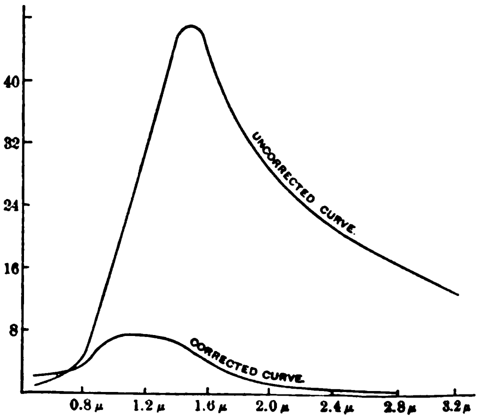


Fig. 6.

After the completion of the preliminary calibration, the radiation measurements were begun, sets of five throws being taken for each condition of the lamp, which was changed stepwise between each set until the entire range to be covered had been included.

When all the readings to be made for the region of the spectrum to which the thermopile was exposed had been completed, the inner room was entered, the thermometer was read and the time noted. The spectroscope was then set to a new wave-length, and after thermal equilibrium had again established itself, the operations above described were repeated. In this way the entire infra-red spectrum between 0.8 μ and 3.0 μ was explored.

The data thus obtained were reduced in the following manner :

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* "Physical Review."

(1) All deflections were brought to a common scale by reference to the continually repeated calibration throws.

(2) Wave-lengths were determined by correcting the values corresponding to the circle readings of the spectroscope for temperature. These corrections were obtained graphically from calibration curves platted to a large scale.

(3) The deflections were corrected for the width of the face of the thermopile. This was a most important correction, since, owing to the fact that the spectrum was prismatic instead of being normal, the surface of the pile received radiation from a larger and larger number of waves as the wave-lengths increased.

To be comparable one with another in different parts of the spectrum, the deflections should be those obtained by exposure of a surface varying in width with its position, in such a manner as always to receive radiation from a region of unit breadth, measured in wave-lengths. This correction it was possible to apply with satisfactory approximation up to wave-length 3 μ. How important this correction was will appear from Fig. 6, in which a corrected and uncorrected curve are platted to a common scale. In this diagram the width of the thermopile is taken as normal for the region of the D line.

The two lamps described in the second section of this paper were measured throughout a range of temperatures from the red heat upwards to a condition of incandescence beyond which they could not be carried without rapid deterioration. The corrected results are given in the following tables:

TABLE I.

SPECTRUM OF GLOW LAMP 1_b (BRIGHT FILAMENT).

Wave lengths.	Intensities at					
	35 watts.	45 watts.	55 watts.	65 watts	75 watts.	85 watts.
0.8 μ	0.360	0.744	1.140	1.490	1.820	2.220
1.0	0.859	1.450	2.050	2.700	3.410	4.150
1.2	1.560	2.350	3.170	4.040	5.010	6.000
1.4	2.280	3.150	3.970	4.730	5.460	6.160
1.6	1.560	2.050	2.590	3.050	3.490	3.830
1.8	0.859	1.140	1.360	1.630	1.860	2.080
2.0	0.490	0.656	0.793	0.923	1.050	1.160
2.4	0.148	0.195	0.240	0.284	0.325	0.362
2.8	0.0465	0.0613	0.0768	0.0910	0.106	0.194

TABLE II.

SPECTRUM OF GLOW LAMP 1_a (BRIGHT FILAMENT).

Wave	Intensities at								
	75 watts.	65 watts.	55 watts.	45 watts.	35 watts.	25 watts.	15 watts.	10 watts.	5 watts.
0.7 μ	2.22	1.66	1.08	0.626	0.240	0.107	—	—	—
0.8 μ	3.30	2.62	1.90	1.260	0.744	0.464	0.248	0.224	—
0.9	5.45	4.22	3.13	2.270	1.480	0.900	0.372	0.306	—
1.0	6.43	5.16	3.17	2.970	2.040	1.300	0.461	0.312	0.167
1.2	6.84	5.84	4.75	3.790	2.790	1.74	0.732	0.372	0.313
1.4	6.27	5.50	4.72	3.880	3.050	2.06	0.799	0.599	0.419
1.6	4.40	3.86	3.27	2 680	2.030	1.33	0.572	0.418	0.257
1.8	2.20	2.02	1.78	1.480	—	0.813	0.361	0.281	0.179
2.0	1.31	1.20	1.07	0.908	—	0.523	0.255	0.199	0.115
2.4	0.64	0.527	0.467	0.400	0.333	0.258	0.147	0.125	0 118
2.8	0.28	0.259	0.233	0.204	0.169	0.133	0.077	0.0633	0.0469

Of these two sets of measurements, those upon the lamp with the bright filament were the more complete, being carried down to temperatures much below the red heat. The results may be treated graphically in either of two ways:

(1) By the construction of curves with intensities as ordinates and electrical activity expressed in watts as abscissas, each curve representing a separate wave-length.

(2) By platting intensities as ordinates and wave-lengths as abscissas.

Curves obtained by the former method show the rise in intensity for each wave-length with increase in the energy expended in the lamp. These curves are very similar in form to those for the radiation of platinum as a function of the temperature, as measured by the writer* and also by Violle.

The curves of the second type are shown in Fig. 7, which shows the distribution of energy in the spectrum of the lamp with lampblack-coated filament (1_b), and in Fig. 8, which gives similar curves for the lamp with bright filament (1_a).* It will be seen that the distribution is very different in the two cases, the maximum in the case of the latter being nearer the visible spectrum. Were both sets of curves extended to the shorter wave-lengths, it would unquestionably be found that the area of the portions lying within the range of the luminous rays is larger in the case of bright filaments, a result which would afford a complete explanation of the superiority of such filaments in the production of light, as shown by Evans in the experiments already described.

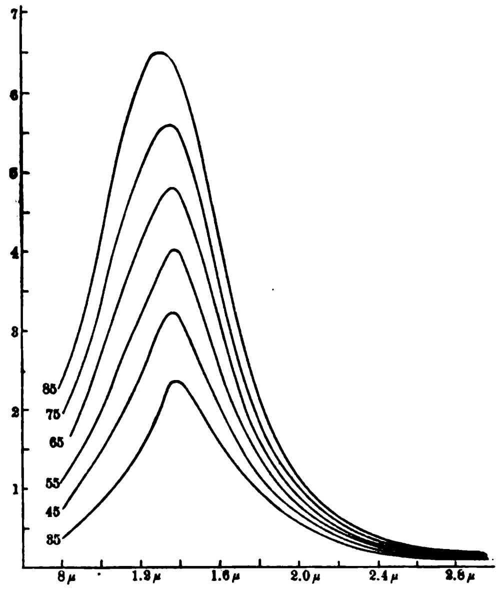

FIG. 7.

Similar measurements to the above were made upon a commercial lamp with untreated filament bamboo. The lamp in question is the one used as a reference light in the experiments of E. F. Nichols upon the infra-red.† It will be seen, by reference to his curves, that the distribution in the spectrum of this lamp was in every respect similar to that in the spectrum of lamp 1_b.

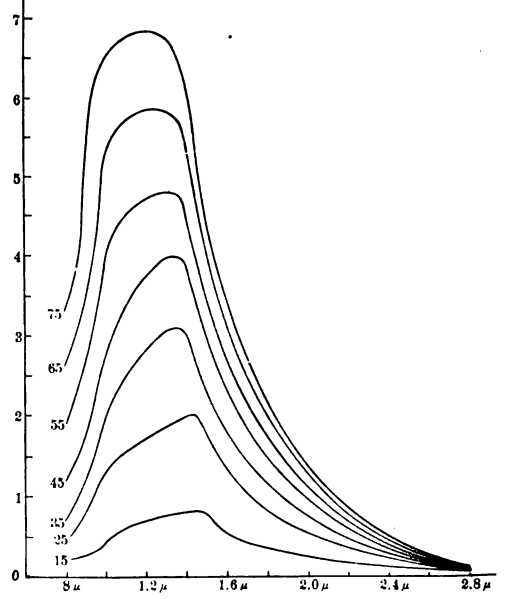

FIG. 8.

The complete investigation of the problem with which this paper deals would involve the direct measurement of the temperatures of the radiating surface. In such an investigation, to which the experiments here described are preliminary, the writer is now engaged. The results are to be given in a subsequent article.

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* Nichols, Ueber das von gluhendem Platinum ausgestrahlte Licht. Gottingen, 1879.

* The only measurements in any way comparable with these, so far as the writer is aware, are those of Abney and Festing. Their curves are, however, platted with scale readings instead of wave lengths as abscissas, so that it is difficult to make any exact comparison.

† E. F. Nichols, *l. c.*

Prof. Rowland on Modern Theories of Electricity.*

BY PROF. OLIVER LODGE, F.R.S.

A popular exposition should not be judged by too high a standard of rigorous criticism, nor need it always be instructive to specialists in the department of which it treats; but when a man like Henry A. Rowland, of Baltimore, endeavors to expound modern theories in ordinary language to untechnically instructed readers, the effort is always of interest and seldom fails to yield some modicum of instruction.

In the *Engineering Magazine* of New York for the current month, there is an article by Prof. Rowland bearing the title "Modern Theories as to Electricity." He begins by saying that electricity no longer exists; and that nothing is more certain than that electricity is not a fluid; he also speaks of that unfortunate term "electric current," and says that "even the definition of electrical units, as adopted by all scientists, suggests a fluid theory."

For our part we should not like to have expressed ourselves quite so unreservedly as this. To say that electricity no longer exists, though of course it only means that it is the ether which is now claiming the lion's share of attention, is hardly a helpful statement; and we fail to see how the orthodox electrical units are clever enough to suggest a fluid or any other theory.

As a specimen of exposition, the following can hardly be considered extremely luminous:

> "But the question now arises as to how the lines of electric force can be produced in the ether, or, in other words, how bodies can be charged. In the first place, we know that equal quantities of plus and minus electricity are always produced. As an illustration, suppose it is required to charge two balls with electricity. Pass a conducting wire between them, with a galvanic battery in its circuit. The galvanic battery generates the lines of force; these crowd together around it and push each other sideways until their ends are pushed down the wire, and many of them are pushed out upon the balls."

But the following attempt to explain electrification by friction is rather better:

> "We can consider, for instance, in chloride of silver that the atoms of silver are joined to the atoms of chlorine by lines of electrostatic force, which hold them to each other. If, by rubbing the chlorine of silver, we could remove the chloride on the rubber while leaving the silver, we could stretch them asunder, and so fill space with the lines of electrostatic force. According to this theory, then, each atom has a number of lines of force attached to it, and it is only by stretching the atoms apart that we can fill an appreciable space with them, and so cause electrostatic action at a distance. We come to the conclusion, then, that all electrification is originally produced by separating the atoms of bodies from one another . . . by friction . . . or some other manner."

He speaks of an electric current as the sliding of the ends of these electrostatic lines on matter, and on matter always, and he continues, "but as they cannot end in a vacuum they cannot pass through it. Thus we conclude that a vacuum is a perfect non-conductor of electricity."

Here the phrase "pass through it" must be interpreted "*move* through it," or it will mislead a reader into thinking that a vacuum has no dielectric properties; and thus a novel discovery might be worked up by the newspapers, quite as good as the memorable and much puffed "discovery" of Prof. Dewar, that radiant heat was stopped by a vacuum.

Leaving these more or less verbal criticisms, we arrive at a bold and uncompromising statement, several times repeated, regarding the earth's magnetism.

"To account for the earth's magnetism, we must suppose the ether to have such properties that the rotation of ordinary matter in it produces magnetism."

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* The "Electrician" (London), January 18, 1895.

And, again:

> "The ether must also account for the earth's magnetism. If we assume that magnetic lines of force are simply vortex filaments in the ether, we have only to suppose that the ether is carried around by the rotation of the earth, and we have the explanation needed. The magnetism of the earth would then be simply a whirlpool in the ether."

Now these statements are full of more than doubtful hypotheses. First, that magnetism is certainly due to rotation of something, which, although Thomsonian and Maxwellian, has never been proved; next, that rotating ether is the necessary and sufficient whirling material, whereas all that is known is that rotating electrification is sufficient; and, lastly, that the spinning of matter on its axis magnetizes it, against which may be adduced a crowd of specially-directed experiments, all of them having had a negative result.

Certain arithmetical calculations as to the strain required in the ether, in order to explain known electric and magnetic forces, may be of interest.

> "1st. It must be able to explain electrostatic attraction. These electrostatic forces are mostly rather feeble as we ordinarily see them. Air breaks down and a spark passes when the tension on the ether amounts to about $\frac{1}{100}$ pound to the square inch. It is the air, however, that causes the breakdown. Take the air entirely away, and we then know no limit to this force. In a suitable liquid it may amount to 500 times that in air or 5 lbs. to one square inch, and become a very strong force indeed. In a perfect vacuum the limit is unknown, but it cannot be less than in a liquid, and may thus possibly amount to hundreds, if not thousands, of pounds to the square inch.
>
> "2. It must explain magnetic action. These actions are apparently stronger than electrostatic actions, but in reality they are not necessarily so. A tension on the ether of only a few hundred pounds on the square inch will account for all magnetic attraction that we know of, although we are able to fix no limit to the force the ether will sustain. No signs have ever been discovered of the ether breaking down."

It might be added that to explain gravitation—after a Maxwellian fashion—the stress that must be borne by the ether amounts to hundreds of thousands of atmospheres in the neighborhood of very large lumps of matter such as the sun.

The most instructive statement here is the emphatic perception that it is the air which causes disruptive discharge. It is the residues of air which are responsible for the break down of condensers, as Tesla found; and in absolute vacuum there can be little doubt that all modes of conveyance of electricity, whether conductive or disruptive, must cease. And this is best expressed, as Prof. Rowland himself has done in an above-quoted paragraph, by saying that the very phrase electric charge ceases to be applicable to vacuum; *charge* is absolutely limited to the surface of material atoms, and accordingly where they are absent there cannot possibly be any conveyance of electric charges, such as is involved in a current of any kind.

Another useful remark concerns the velocity of ethereal rotation in a magnetic field, supposing always, as Prof. Rowland evidently does, that such rotation is a certain physical fact. He points out that the speed of rotation can be estimated from the known value of the Verdet constant; in other words, by the amount of the Faraday rotation of the plane of polarization of light in magnetized transparent substances. He says:

> "The velocity of rotation is immense, the plane of polarization rotating in some cases 300,000,000 times per second."

It is a perception of facts of this kind which has deterred the writer, and doubtless other experimenters, from a serious attempt to rotate the plane of polarization by rotating a transparent substance.

With respect to an explanation of gravitation, he shows how far away we still are from any approach to it. One of the difficulties connected with this subject is the necessity for infinite speed of transmission. Nothing less than a practically infinite speed suffices to account for astronomical facts.

The natural conclusion is that the ether must be incompressible, and must transmit this action by some sort of thrust or tension; and certain facts suggest that the ether really is incompressible, or else is insusceptible itself to gravitational forces; viz., the fact that "light passes in a straight line through space even when near one of the larger planets, unless the latter possesses an atmosphere. This could hardly happen unless the ether was entirely incompressible or else possessed no weight."

Lastly, Prof. Rowland deals with the ether as a conveyer of energy; he does not consider it in its function of a great storehouse or reservoir of energy on which the whole activity of the material universe depends; but he points out that it is remarkably competent to convey, and convey rapidly, much more energy than any known form of matter is.

> "The amount of energy which can be transmitted by the ether in this manner is enormous, far exceeding that which can be carried by anything composed of ordinary matter. Thus, take the case of sunlight: on the earth's surface illuminated by strong sunlight a horse-power of energy falls on every square foot. At the surface of the sun the ethereal waves carry energy outward at the rate of nearly 8,000 H. P. per square foot.
>
> "Again, an electric wire as large as a knitting needle, surrounded with a tube half an inch in diameter, in which a perfect vacuum has been made to prevent the escape of electricity, may convey to a distance 1,000 H. P.—indeed, even 10,000 or more horse-power, there being apparently no limit to the amount the ether can carry.
>
> "Compare this with the steam-engine, where only a few hundred horse power requires an enormous and clumsy steam pipe. Or, again, the amount carried by a steel shaft, which, at ordinary rate of speed, would require to be about a foot in diameter to transmit 10,000 H. P."

He concludes by emphasizing once more his belief that magnetism is due to ethereal rotation, and says definitely that "a magnetic line of force is a vortex filament in the ether." The alternative view, championed by Dr. Larmor, that magnetism may be due to flow and electric current to spin, has evidently not yet impressed him as possessing any force or validity. It may be assumed as probable that he has strong reasons for this orthodox Maxwellian belief, and it would be interesting to know them.

He considers magnetism more simple and easy to comprehend than electrostatics, which again must be considered as a thoroughly Maxwellian position, and it is interesting to see how the great foreign philosophers of the world are all slowly coming to recognize the magnitude of this great teacher. Prof. Rowland, indeed, has long recognized it, and it is hard to speak of members of the Anglo Saxon race as foreigners; but their aloofness from insular prejudice and the bonds of the mother country render their adhesion to the English, instead of to one of the many forms of Continental theory, of special interest.

The domain of electrostatics is evidently regarded by Rowland, as it is also by Poincaré, as the least edifying and satisfactory parts of the present theoretical treatment of the subject, regarded from an ethereal point of view, and almost the concluding words of the article now under notice are the following:

> "Electrostatic action is more difficult to explain, and we have hardly got further than the vague idea that it is due to some sort of elastic yielding in the ether.
>
> "Light and radiation in general are explained when we understand clearly magnetic and electrostatic actions as the two are linked together with certainty by Maxwell's theory."

A Notable Discovery in Electricity.

The year 1894 was not remarkable for epoch-making discoveries in science, but was busily occupied in the prosecution of familiar lines of research, with useful applications of existing knowledge as the chief result. Nevertheless, something has been done to widen the intellectual vision and stimulate thought in new directions. Perhaps the most striking original work of the past year was Mr. Philipp Lenard's application in England of Hertz's discovery that metallic films are transparent to the dark rays issuing from the negative pole in the case of electric discharge in a high vacuum. Mr. Lenard closed one end of a vacuum tube with an aluminum film thick enough to resist atmospheric pressure and studied the rays after passage through the metal. The air outside was seen to glow faintly. All the ordinary phosphorescent effects produced by Crookes in a vacuum were thus readily produced in air. These rays from the negative pole, though not affecting the eye and producing no sensation in the skin, are yet photographically active, and to the tongue and nostrils have the taste and smell of ozone.

Unlike the rays of ordinary light they cannot pass through quartz plates, but do pass through metal films which are opaque to light. In respect to air or gas their behavior is equally novel. Ordinary light passes through a gas as if it were a homogeneous medium and becomes dispersed or makes its path visible only in case there are solid particles, such as dust, floating in the gas. But these rays from the negative pole, or "cathode rays," affect the gas molecules as if they were solid particles floating in a continuous medium. In other words, all gases, however transparent to ordinary light, are turpid to cathode rays, and the degree of turpidity depends wholly upon the density or mass of the gas molecules present, irrespective of their chemical character. Oxygen, for example, under a reduced pressure that brings it to the density of hydrogen, is as transparent as hydrogen, while hydrogen, if brought by pressure to the density of oxygen, becomes as turpid as oxygen.

The cathode rays traverse a perfect vacuum with facility. After passing through the aluminum screen their radiation in air stops at a distance of eight tenths of an inch, but in hydrogen it extends to four inches and in a vacuum to fifty-two inches. While the rarest gas disperses the cathode ray into a blur, as a fog disperses an ordinary ray, its movement in a vacuum is in a straight line. But a magnet brought near deflects it. The question of the nature of matter is raised by some of Mr. Lenard's experiments, the experimenter being of opinion that the fact that every gas molecule acts as a solid obstacle to the passage of the cathode rays is a proof that the molecule is only "a function of the ether itself"—virtually that there is no matter, unless the name can be given to ether, a substance that eludes all tests. Prof. J. J. Thompson, on the other hand, finding that the rate of propagation of these phosphorescence-producing cathode rays is much less than that of ordinary light, but about one hundred times as great as that of the hydrogen molecule, solves the difficulty by assuming that electrified gaseous molecules, rather than the ether, are the seat of this mysterious force.

A practical utilization of the cathode rays has been in the Ebert luminescent lamp. The inventor states that a serviceable light can be obtained by means of his lamp with an expenditure of one-two thousandth part of the energy consumed in the acetate unit lamp. Just what weight is to be given to this claim is in doubt, but it is evident that we have in Hertz's discovery and Ebert's lamp a promise of a new method of electric lighting vastly cheaper than those with which we are at present familiar.—*Baltimore Sun.*

LEGAL NOTES.

The Supreme Court of Michigan has rendered a decision against the city of Detroit in the suit brought by the city questioning the right of the Detroit Citizens' Street Railway Company to the use of certain streets for its railway tracks. Chief Justice McGrath in his decision concisely explains the case thus: "A controversy arose between the city of Detroit and the Citizens' Railway Company as to whether the consent of the city had been given in such a manner as to be available to the present company [some individual changes had been made in the company] and binding upon the city, and the city appealed to the courts, where the matter has been determined. The only question litigated was, whether the consent given survived to the present company." The matter has been before the courts for about two years.

Judge Wright, of the Circuit Court at Baltimore, has rendered a decision in the case of Randolph Barton, receiver, against the stockholders of the old Wenstrom Consolidated Dynamo and Motor Company, holding that the directors of the company only were to be held liable for the difference between what they actually paid for the stock of the company and the par value of $100 per share, according to their holdings, for the purpose of paying the creditors of the company. The indebtedness to outside creditors is about $40,000, or possibly $45,000, and the case will now go to an auditor for the purpose of making up an account. Should the creditors' claims allowed be less in the aggregate than the aggregate sum due by the directors upon their stockholdings, they will be assessed per share of stock only to a sufficient extent to meet the claims.

The Appellate Court in Chicago has reversed the order of the Circuit Court restraining the Northern Electric Railway from erecting an electric line on Central avenue. The decision will result in considerable damages to be paid by the Chicago, Milwaukee and St. Paul Railroad Company. Since the granting of the injunction the defendant company has added to its tracks at the crossing point in dispute. The electric road will have to cross forty-five tracks.

Judgments in the Superior Court in Seattle, Wash., continue to pile up against D. T. Denny and his sons. A few days ago defaults were signed in two actions by the Northwest General Electric Company, and one by W. J. Grambs on assigned promissory notes aggregating $84,791, and a confession was made in a suit on a $9,000 promissory note executed to George F. Gund. The notes held by the electric company are dated March 1, 1893, and are as follows: Northwest General Electric Company, $24,000; L. H. Griffith ($20,000, $12,000, $10,000, $8,750, $5,250), $56,000; F. T. Blunck, $4,134.75; Jacob Furth, $656.25; total, $84,791. The amount with interest and attorneys' fees is now in the three former cases $97,298.52, and in the Gund case $9,455.62, bringing the grand total to $106,758.12. This sum, together with the confessions in the cases of the Puget Sound National Bank and F. T. Blunck, makes a total of $409,372.58.

In the Federal Court at Indianapolis, on the 31st ult., Judge Baker entered a decree of foreclosure and ordered the sale of the Queen City Electric Street Railroad at Marion, Ind. The decree was entered upon the suit of the Metropolitan Trust Company of New York, and the judgment was for $79,551.88. Howard Cale has been appointed special master in chancery to sell the road on March 6. Russell B. Harrison has a claim against the company for $11,000.

The suit of the city of Lockport, N. Y., vs. the Lock City Electric Street Railroad Company to obtain the forfeiture bond of $6,500 and determine the rights of the city in the property of the company and its franchise will be tried in the term of Supreme Court which convenes at Lockport this month.

In the suit brought in Jersey City by E. J. Stanley and J. C. D. Outwater against Edward J. Weiss to recover $2,000 advanced to Weiss to have his invention of an electric motor patented the jury gave a verdict in favor of the defendant. Weiss claimed for his invention that with 200 feet of coil he could produce as much motive power as 2,000 feet used in the ordinary motor. He told Stanley and Outwater of his invention and they entered into a partnership with him and advanced money towards getting it patented. Weiss testified that he had not secured a patent because a lawyer had told him it was not patentable. Experts testified that the invention will do all that the inventor claims for it. Weiss proposes to institute proceedings to cancel the agreement by which Outwater and Stanley were each to receive one-third of the profits of the invention.

Boston Notes.

The West End Railway officials and their employees are discussing an agreement for the current year. The men have submitted a draft agreement making the pay of motormen, drivers and conductors $2.50 per day of nine hours. The best of feeling thus far has prevailed between the conferrees, and it is believed these terms will ultimately be conceded by the company.

An electric snow plow broke loose a few nights ago at Haverhill, Mass., through the failure of the brakes to operate. The machine went on the rampage like a flash, dashing down a steep declivity on Main street and ending its mad career by running into a drug store. The men in charge jumped and escaped injury.

The Swedish Electric Singers, all of whom are employees at the Lynn works of the General Electric Company, held a banquet in Electric Hall last Friday evening. The gathering was a success in every respect. The hall and tables were very tastefully decorated. There were many guests, some fine music, and singing and dancing until a late hour.

The fight over the franchise for the construction of a local line between rival railway companies in Quincy and Weymouth waxed very warm last week, the citizens of the latter town being in a state of excitement over charges made by opposing counsel that the Weymouth company is an illegal corporation. The selectmen are considering how best to dispose of the franchise.

The Edison Illuminating Company of Boston has just closed a long time lease on a piece of land in Bumstead Court, and will use it for the site of an addition to its fine central station on Head Place. A four-story building is to be erected on the site, which will be used for a storage battery plant that will be somewhat of a novelty. At the present time the company has at its Atlantic avenue central station a small battery plant capable of running 6,800 lights for about 2½ hours, while the one to be erected in Bumstead Court will be of sufficient capacity to run something like 30,000 lamps for the same time. The battery plant is of German type, and by its use the company hopes to effect a considerable saving in operating the station.

The extraordinary slump in General Electric stock has started speculators on the outlook for the final tumble that everyone is now satisfied the Trust as a whole will take, the result of which will be a complete smash-up. Reorganization and a capital reduction of at least 50 per cent. are now suggested, and insisted upon as the only possible chance of saving the concern from being completely wiped out of existence.

The case of George F. Bowles and wife of Lynn against the Worcester, Leicester and Spencer Street Railway Company, which has been tried twice and verdicts aggregating $5,983 awarded, not having been appealed, the company will have to pay. The original claims were for $20,000 and $10,000 on account of permanent injuries received by Mrs. Bowles on August 28, 1892.

Personal.

Mr. James S. Humbird, president of the Washington Carbon Company, has been elected a director of the Baltimore and Ohio Railroad at Pittsburg.

General News.

What is Going on in the Electrical World.

San Francisco.—The Market Street Railway Company has decided to encircle the city and county of San Francisco with an electric railroad.

Portland, Me.—The Portland Railroad Company are preparing to do some rapid work after they get permission to change their lines over to electricity.

Charlottesville, Va.—The Electric Street Car Company has purchased the horse car line, and will replace it with electric equipment as soon as the weather will permit.

Croton, N. Y.—Messrs. Freeman & VanDuyne have received permission to erect poles and string wires for the purpose of furnishing electric lights in Croton.

Saugatuck, Mich.—Contracts have been made here for the placing of electric light plants in the steamers Saugatuck and Bon Ami. Both boats will be fitted with Westinghouse engines and dynamos.

Washington, D. C.—Fourteen electric cars were burned by a fire at the Brightwood Street Railway Company's car stables on the night of the 25th ult. The power house and boiler rooms were saved.

Saginaw, Mich.—The Saginaw and Bay City Street Railway Company has been granted a franchise by the common council of Saginaw, and will now press its request at Bay City for a similar favor.

Nyack, N. Y.—The Nyack Traction Company has been granted a franchise for an electric railway in this village and also in Upper Nyack. The River and Valley Traction Company withdrew its application.

Richmond, Va.—The proposition to appropriate $150,000 to establish a city electric light plant, has been defeated in committee. The lighting of the city remains in the hands of a private company.

Fort Clark, Ill.—F. W. Horne, of Chicago, president of the Fort Clark Electric Railway Company, has been appointed receiver of the company under bond of $20,000 with the American Surety Company.

Chicago.—An ordinance has been introduced in the city council authorizing a conduit electric system from Monroe to 69th street and from Halstead street to the lake. It was referred to the committee on railroads.

Readsboro, Vt.—W. S. Kelley, of the General Electric Company, has bought Howe's pond and over 500 acres of land in Readsboro. It is believed that the electric company will build a large electric plant here.

Shelbyville, Tenn.—In connection with the waterworks, the construction of which is under contract, it is now proposed to put in an electric light plant, both arc and incandescent, for the better lighting of this town.

Montreal, Can.—The Royal Electric Company has appointed as general manager in place of Chas. W. Hagar, retired, W. H. Browne, late general manager of the United Edison Illuminating Company of New York.

Allegheny City, Pa.—Mayor Kennedy has signed the resolution awarding the contract for the lighting plant to the Western Electric Company. Mr. Chase, the Western's representative, said work would begin at once.

Bangor, Me.—The promoters of the new Bangor and Oldtown electric road say that "it is worth $10,000 annually to have on their line the city cemetery and the new insane hospital." A rather gruesome consideration.

Weyauwega, Wis.—At the special election held here on the 28th ult., the electric light project was carried almost unanimously. Weed, Gumaer & Company offer to furnish arc lights at $45 per annum each, which proposition will probably be accepted by the village board.

Biloxi, Miss.—At a meeting of the directors of the Biloxi Electric Light plant, E. G. Burklin, the manager, reported that the success of the plant warranted a dividend of 10 per cent. This is more noticeable from the fact that the plant has met with serious drawbacks during the year by accidents.

St. Paul, Minn.—A new electric interurban line is proposed, connecting this city with Minneapolis, either that or to remodel the Fourth Street and Selby Avenue Cable Line and its electric extension and run the whole thing through to Minneapolis.

Jamaica, L. I.—The town commissioners have given the Long Island Electric Railway Company permission to build, operate and maintain a surface railroad, to be run by electricity, on Cherry avenue, Foster's meadow and to and through private property from New York avenue to Springfield.

Kansas City, Mo.—The Gill-Alexander Electric Manufacturing Company has filed a deed of trust with the recorder of deeds, secured on all its property, consisting of patents, contracts, leases, machinery and all fixtures and appurtenances, in favor of A. P. Marty, trustee, to secure a bond issue of $20,000.

Quincy, Ill.—The joint ordinance and light committee have reported an ordinance granting a franchise to the Empire Light and Power Company. The council approved the report. The Empire Company, if it accepts the franchise granted, will enter into competition with the present electric light company.

St. Joseph, Mo.—An ordinance has been presented to the council granting to Walter C. Stewart and his associates the right to construct and operate an electric lighting plant. An ordinance granting Huston Wyeth a similar privilege is still before the council. Mr. Stewart and his associates desire a fifty-year franchise.

Phenix City, Ga.—A charter has been granted the Drake & Stratton Company and the preliminary surveys made for the construction of an electric railroad in this city, and another line along the Crawford road from the Fourteenth street bridge to the Chattahoochee Brewing Company's plant at Columbus.

Brooklyn, N. Y.—The strike of the trolley roads employees is practically ended, the companies having succeeded in filling the places of the strikers on most of their lines. Military protection has been withdrawn, and the lines are now left to the vigilance of the police. The cost of the strike to the city, companies and strikers is estimated at a million and a half.

Stroudsburg, Pa.—Among the latest rumors here is one to the effect that a charter will be applied for for a road to connect at Stroudsburg with the Bangor, Pen Argyl and Wind Gap Electric Railway Company's line, and run over to Lake Poponoming. Henry Fulmer, of Easton, is one of the principal projectors of this new road.

Geneseo, N. Y.—The proposition to build a six-mile electric railroad from Geneseo to Long Point on Conesus Lake to be used during the summer camping and excursion season is being seriously considered by the citizens and the Geneseo Electric Light Company, which has more power than is necessary for lighting the streets and other purposes.

Norwalk, O.—The Norwalk electric light plant, which was placed in the hands of assignees two years ago by request of creditors, has been ordered sold at public auction by Judge Thomas, the sale to take place March 1. The principal creditors are the Huron County Banking Company, who hold $11,000 claims, and R. W. Huntington, of Cleveland, who has claims of about $7,000.

Binghamton, N. Y.—G. W. Davenport, of Boston, and Eugene Griffin, of New York, have been appointed a committee to reorganize the Binghamton General Electric Company. The attorneys of the General Electric Company of Schenectady applied to the court for the discharge of the receiver of the Binghamton Company, and the application has been granted.

Rochester, N. Y.—A new locomotive has just been turned out at the Lincoln Park shops of the B., R. and P. Railway which is fitted with all the modern improvements including an electric headlight capable of lighting the track for nearly two miles. The power for the headlight is furnished by a motor placed back of it and directly in front of the smokestack.

Ottawa, Ill.—The General Electric Company has sold the Ottawa Electric Street Railway to a home syndicate represented by Mayor Schoch, for $40,000 in bonds, the condition of the contract requiring the local men to invest $20,000 additional in improvements. The property will be transferred March 1. It originally cost $115,000 and was the first electric road put down in Illinois.

Elkhart, Ind.—General Manager Myton, of the Indiana Electric Railway, has closed a contract for the purchase of seven miles of steel rails for the completion of the line between this city and Goshen. He has also purchased twenty-five acres of land near the county seat for the purpose of erecting a power house and station.

Hartford, Conn.—The bill forbidding electric railways to cross steam car lines at grade, having passed the Connecticut Legislature, will prove detrimental to the electric roads; but why cannot electric lifts for the cars be erected where the traffic is sufficient to warrant the outlay? Is there not inventive genius enough in the Nutmeg State to devise a method?

New York.—Russell Sage lately, speaking of the future of the Manhattan Elevated Railroad, says: "It is certain that in the very near future we shall replace steam by electricity, and will then be able to accomplish much which for the moment seems impossible. I have always been in favor of electricity; also of elevators at the stations. In time we shall lift passengers to the stations from the streets."

Boonsboro, Md.—A meeting was held last week in the interest of a reorganization of the Boonsboro and Keedysville Electric Railway. It is estimated that it will take $26,000 for its construction. Dr. A. W. Lakin, S. S. Davis, Samuel Knode, A. C. Huffer, J. C. Brining, D. W. Barkman and H. S. Beard were appointed a committee to solicit stock subscriptions.

Pittsburg, Pa.—The Essen Coal Company of Pittsburg has closed a contract with the Independent Electric Company of Chicago for a complete electric plant for mining and hauling the coal in its mines at Hazeltine, Pa. This is said to be the largest plant ever put into a bituminous mine. It will cost between $65,000 and $75,000, and is intended to produce 2,400 tons of mine run coal each day.

Greeley, Col.—A company is being organized for the purpose of furnishing light and power for this city and to operate a system of electric railroads running throughout the country about Greeley, the idea being to transport not only passengers but freight to and from the city. The company proposes to dam the Poudre River several miles up and conduct the water in pipes to the works.

Lambertville, N. J.—Benjamin Mitchell of this place has invented a rat trap from which he expects great things. His idea is that it will find favor with the owners of large buildings who generate their own electric power for lighting purposes. A piece of cheese is attached to the end of a wire. To reach the cheese the rat has to step on a conductor, and when he touches the cheese he completes the circuit—and his career.

Toronto, Can.—Application will be made to the Legislature of Ontario at its next session for a charter for the construction of radial electric railways from this city to different points in the county of Elgin. The company is to be known as the St. Thomas Radial Electric Railway Company, and the applicants are K. W. McKay, Jas. A. Bell, W. R. Jackson, John Campbell, A. E. Domville, James Fulton, John Slacey, C. B. Hunt, E. R. Cameron.

Alexandria, Va.—The Mount Vernon Electric Railway Company is pushing the building of its road from Alexandria City northerly toward the Aqueduct bridge, and the authorities of the road say they expect to reach that point by May or June next. The Washington, Arlington and Falls Church Railroad Company is also grading its road from the Aqueduct bridge to the Arlington estate and surveying and obtaining the rights of way from land owners from Arlington on to Falls Church.

Oxford, Pa.—The prospect is favorable for the early building of an electric railway between Oxford and Newark, Del.—Preliminary movements towards establishing an electric plant at Pine Grove, on the Octoraro, about three miles west of Oxford, have been made. It is stated that 1,000 to 1,400 H. P. can be generated by the water power. The Octoraro flows into the Susquehanna near Rowlandville, Cecil County, Md.

Gilman, Col.—The Tip Top Mining Company has purchased the electric plant on the Eagle River, west of Red Cliff, formerly owned by Charles J. Taylor and others, and will utilize it for the operation of the mill built by it last summer. The plant has been idle for several months because of a disagreement among the owners. Its former use was to furnish the town of Gilman and the mines around it with light. It is operated by water power and is equipped to supply both light and power. The new purchasers paid about $20,000.

Buffalo, N. Y.—A municipal electrical bureau in connection with the Board of Public Works is about to be established here.—The Cataract Construction Company has secured a right of way from Tonawanda to the city line of Buffalo. The route is along the west side of the New York Central's tracks.—The Buffalo Lumber Exchange have passed a series of resolutions favoring generous treatment to the parties who are asking a franchise for the distribution in this city of Niagara Falls power.

Albany, N. Y.—Bills have been introduced in the Legislature having in view the cancelling of the charters of some of the electric railway companies in Brooklyn for violations of their charters in failing to run cars during the strike, and for other reasons that the managers of the strike deem sufficient.—A bill has been introduced in the Assembly compelling street railways to construct on the front of every electric car a guard, fender or sweep raised not more than five inches above the surface of the road.

Gardiner, Me.—The scheme to incorporate the Maine Water and Electric Power Company is said to be one indirect outcome of the building of the Wiscasset and Quebec railway. Mr. Wm. Doe, of Dukesport, Pa., who represents Pennsylvania capitalists, is the principal mover in the enterprise. On the Sheepscot, above Wiscasset, are numerous water powers, and Mr. Doe and his associates have a plan of buying up these privileges and using them to furnish the power to supply electric lighting, and to run street railways in the towns near the river, and also to supply water to the towns.

Herkimer, N. Y.—The formal transfer of the present Herkimer and Mohawk and Ilion street railroads to R. J. McKeever and Jacob L. Hees, supposed to represent the New York Central Railroad, has been completed. The new company will be known as the Herkimer, Mohawk, Ilion and Frankfort Railway Company. J. L. Hees, of Fonda, has been elected president, R. J. McKeever secretary and treasurer, A. D. L. Baker, of Gloversville, J. L. Hees and James L. Stewart directors. The Central Railroad Company has granted the new company the right to cross its tracks in Herkimer. This is regarded as conclusive proof that the Central helped to consummate the deal.

Philadelphia.—The lines of the Philadelphia Traction Company on which the change from horses to electricity will next be made will be the York and Dauphin and Spring Garden and Wallace street lines. In a few days the overhead work will be completed over the routes named.—The new electric machines for softening Harveyized armor, which were built for the navy at a cost of $30,000, have been tried at Cramps' and officially pronounced successful. It has heretofore been found impossible to drill the necessary holes in the Harveyized plates, and work of this kind has practically been suspended for the past three months.

Peoria, Ill.—A bill has been introduced in the Illinois House of Representatives by Mr. Daugherty, of this city, giving cities power to contract with gas or electric light companies for a period of not exceeding thirty years. In cities where such plants are now in operation the authorities may purchase or lease the same. Before the lease or purchase shall be binding, the question shall first have been submitted to the people at a general election—the ballot specifying the yearly rental if a lease or the consideration price if a purchase. If the proposition is defeated at the polls a resubmission cannot be had for ten months. Cities are empowered to borrow money and levy and collect taxes for the purpose of purchasing or leasing plants and maintaining them.

Jersey City, N. J.—The Consolidated Traction Company of New Jersey, has decided to put freight cars on its lines, and in a short time a regular express business will be established. At present the company has three of the proposed freight cars in operation, carrying supplies for the company. They are similar to the express and baggage cars used on steam railroads.—An electric storage battery placed in each car of the Jersey City line of the Consolidated Traction Company crossing the Newark meadows is used as an adjunct in lighting the cars. Under the former system in use, the slipping of the pole from the trolley wire at once put out the incandescent lamps, and left the passengers in the dark. When this happens now, the storage battery at once comes into play and lights the lamps.

Harrisburg, Pa.—Mr. Woodring has introduced a bill in the House which, if it becomes a law, will enable Philadelphia to manufacture its own electric light and likewise to sell it. The bill provides that the provisions of the act of May 20, 1891, shall be extended to cities of the first, second and third classes. The act of May 20 authorized boroughs to manufacture electricity for commercial purposes, and to erect, purchase or condemn electric light plants and apparatus already established. It gives councils the right to purchase electric light works at such price as may be agreed upon by them and a majority in value of the stockholders of the company. In case of a failure to agree the court can be asked to appoint viewers to assess the value of the plant.

Chattanooga, Tenn.—The plant of the Chattanooga Electric Light Company has been sold to satisfy a judgment of the General Electric Company. The plant was purchased by J. H. Levis, of New York, for $75,000. The company had a bonded indebtedness of $145,000, the larger portion of which was held by the General Electric Company. It is understood that a new company will be formed to run the plant.—An application for a charter for the Chattanooga Light and Power Company has been made by F. V. Brown, D. J. O'Connell, F. F. Wiehl, J. B. Nicklin and Frank Spurlock. This corporation, when the charter is obtained, will be the successor of the present electric light company. The application for the charter asks permission to generate and manufacture electricity and sell the same in all its forms, also for power to manufacture and deal in all kinds of electrical machinery and apparatus.

Yuma, Ariz.—A project of grand proportions in electrical plants is being developed here, and is assuming a shape that promises its fulfilment. It is proposed to establish a great electric plant on the Colorado River, to be run by the current of that stream, to supply power for mining, transporting, milling and reducing ores from the great mineral belts that exist on both sides of the river a few miles above Yuma. Also for pumping water with which to irrigate the lands lying along the river and the great valley to the south and west of Yuma, and to run all kinds of manufacturing machinery and a narrow gauge railroad among the mining camps back from the river, which is proposed to be built to a connection with the Southern Pacific Railroad at El Paso and with the San Diego, Yuma and Phœnix Railroad where it crosses the river at that same point, and on to the great deposits of sulphur in the Cocopa mountain range, thence to the gulf at the mouth of the Colorado River, where it will connect with steamers and sailing vessels along the coast.

Telephone and Telegraph.

The Traction Company is putting in a system of private telephones at Middletown, N. Y.

The long distance telephone line between Madison, Wis., and New York and Washington was opened on the 23d ult., with the usual ceremonies.

Galesville, Wis., and North Bend will, it is alleged, be within speaking distance of each other at an early day. A telephone line is projected to connect them.

William Meter—not a common name—has asked for a telephone franchise at Sheboygan, Wis. Mr. Meter sells the instrument at $30 to the users, charges them at the rate of $1.50 per month and promises them a metallic circuit.

The Magneto Telephone Company of Elwood, Ind., has contracted to put in an exchange of fifty telephones at Frankton, and build a toll line connecting that city with Elwood. Work on the exchange and toll line will begin in a few weeks.

Sumter, S. C., has established a telephone exchange. The work was superintended by G. S. Maxwell of Sumter.

The Police Department of Buffalo, N. Y., will in the near future throw out all the telephones it now has in connection with the local telephone company and put in an independent system which, it is alleged, will be "something of a marvel in the way of efficiency and expediency."

High Point, near Greensboro, N. C., is having a telephone system put in.

A telephone exchange has been established at Thomasville, Ga.

A bill has been reported to the West Virginia House of Representatives taxing telegraph, telephone and express companies.

The recent storm at St. Louis was very damaging to telegraph, telephone, electric light and fire alarm wires. Over 1,100 telephone wires went down and many 'phones burned out. Communication with the outside world by telegraph was entirely cut off.

The Chamber of Commerce at Petersburg, Va., have appointed a committee to look into the subject of cheaper telephone service for that city. The committee were to call a meeting for the purpose of giving a hearing to representatives of various telephone companies who are seeking a franchise.

The Century Telephone Company of New York has asked for permission to establish a telephone line in Peekskill, N. Y. It offers to give the Peekskill public a telephone service just as good as the one they now have and at half the cost.

J. Hummel, of J. Hummel & Co., St. Louis, have promised the citizens to put in a first-class system of telephones in Louisiana, Mo., at a monthly rental of $2 for business houses and $1 for residences. Already 100 subscribers have been obtained.

The Hudson River Telephone Company a few evenings ago transmitted a musical programme over its long distance line from the office at Newburg, N. Y., to audiences assembled at Goshen and Middletown, who returned thanks for the enjoyment they had in listening to the selections, every note of which was heard distinctly at both places.

F. L. Humes has applied for a franchise to put in and operate a telephone plant at Oshkosh, Wis. He proposes to use the Berliner patents that are owned by the Bell Telephone Company, which have been rendered void by a recent decision of the courts, but are still subject to the decision of the U. S. Supreme Court.

A telephone war is imminent in Fort Wayne, Ind. The Harrison Telephone Company and the Fort Wayne District Telegraph Company have consolidated their interests, and will unite all subscribers, franchises and systems to fight the Central Union Telephone Company, originally the old Bell Telephone Company. Telephones are to be put in for $1.50 a month.

Three telephone companies have applied for franchises at Bay City, Mich.—the Harrison, the Standard and the Anthony. The Harrison seemed at last accounts to be most in favor with the committee of council having the matter in charge.

The Gloversville, N. Y., Electric Company are about to organize a local telephone company which, though incorporated as a separate company, will co-operate with the electric company to the extent of using their poles for stringing wires.

A telephone bill to regulate charges to subscribers has been introduced in the New York Assembly by Mr. Gerst, of Buffalo, and in the Upper House by Senator Parsons. The bill will be vigorously advocated by the New York Board of Trade and Transportation. A joint committee was appointed to hear the arguments of advocates and opponents of the bill.

The Citizens' Mutual Telephone Company of Lockport, N. Y., consider the franchise which the council committee have reported favorably objectionable in some respects and want the following modifications made in it: They want it optional with the company to renew the franchise at the end of ten years; they object to furnising poles for the city's fire alarm wires in districts outside of the telephone district; they want three years instead of six months in which to complete the plant, on the ground that delays may be occasioned by reason of suits with the Bell Telephone Company; they object to giving any free telephones to the city. It is thought the differences will be adjusted.

The druggists of Chicago, it is said, have guaranteed the Harrison International Telephone Co. 6,000 subscribers, and work on the new system will begin early in the spring. The packers at the Stock Yards propose to put in an exchange of their own. They are arranging for a new system which shall connect all parts of the yards and which will permit a prompt alarm being sent in in the event of a fire breaking out. The present system is owned by a private corporation and it is a matter of considerable expense to the packers.

A rumor was current a few days ago in Minneapolis to the effect that a large corporation, with Mackay, the bonanza king, at the head, would be formed in the near future for the purpose of establishing and operating telephone exchanges in various cities, to compete with those already established. The same rumor connected the name of J. F. R. Foss, of Minneapolis, with the enterprise, as one of the founders of the new company.

The Columbia Telephone Company of New York intends opening an exchange in Salem, Mass., if permission is granted by the authorities and a sufficient number of subscribers obtained.

At Columbia, S. C., the Postal Telegraph Company is now having all the poles in the city painted an olive green. All the poles of the Western Union lines have already been painted white and the fire alarm poles red.

The Michigan Telphone Company has accepted the new underground wiring ordinance passed by the Grand Rapids Council and will put their wires underground in the spring.

The Department of the Interior at Washington, after examining a number of bids for 118 telephones for the Department, has decided in favor of the Western Telephone Construction Company of Chicago, who agree to furnish a Departmental system of telephones for $5,565.76. Edward E. Clement, of the Patent Office, has been designated to superintend the installation of the system.

A new telephone company has been organized at Johnstown, Pa., and will apply at once for a charter. The new company intend to compete with the Bell system now in operation, and will put their rates at a much lower figure.

A Good Fire-Proof Material for Air Shafts, Elevators, &c.

An interesting test was recently made in the presence of the Building Department of Brooklyn, N. Y., to determine if elevators and air shafts could be rendered fire-proof without bricking them up. The method tried was to plaster on Roebling stiffened wire lath and fill the space between the studding behind the lath with Mineral Wool. The results were highly satisfactory, as the 20-foot shaft or chimney was found intact on examination after a brisk fire had burned underneath it for over half an hour. The corrugated copper gaskets manufactured by the United States Mineral Wool Company of New York have enjoyed large sales recently among electric and similar plants, among which may be mentioned the Philadelphia Traction Company, Electric Traction of Philadelphia, Nassau Electric Railroad Company, Brooklyn, N. Y., Allegheny Traction Company, Allegheny, City, Pa., Carnegie Steel Company and Messrs. S. Shoenberger & Co., Pittsburg, Pa. Samples for tests free from the manufacturers.

A New Catalogue.

The old established house of Wallace & Sons, Brass and Copper Rolling Mills, with sample rooms and warehouses at 28 Chambers and 5 Reade streets, New York, and mills at Ansonia, Conn., are about to issue a new Illustrated Catalogue. Their previous efforts in this direction have met with the highest commendation, and we feel sure that their present issue will demonstrate the progressive position this house has for nearly half a century maintained in the Brass and Copper trade.

The proof-sheets show that the book will be a very acceptable addition to the catalogue libraries of hardware merchants, metal workers, etc., etc., and will, on account of its complete price-lists of different articles, as well as its tables of measurements, weights, etc., etc., become a standard book of reference for dealers in their line.

Special attention has been given to details, particularly in revising various price-lists hitherto more or less confusing, and these changes, together with the profuse illustration of the various articles they manufacture, make everything quite clear even to those who may not be thoroughly familiar with the business. The book is also illustrated with cuts showing the improved manner of packing various articles for the convenience and utility of the shelf-hardware trade, such as Star Brand Copper Rivets and Burs, Copper Tacks and Nails, Spelter Solder, etc., etc.

Several pages in the back of the Catalogue are devoted to tables of weights, measurements, etc., etc., of different metals such as Sheet Copper, Seamless Brass and Copper Tubing, Brass and Copper Rods, etc., etc., so as to enable the trade to estimate on goods of this description comprehensively.

The Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, has just taken the agency for the American Carbon Company's products and will carry a full line of this celebrated Carbon. They will have their stock in in a very few days and will be able to meet the demands of the market. This adds another high-class specialty to the Metropolitan Company's list.

RECENT COMPANY ELECTIONS.

Syracuse Street Railroad Company, Syracuse, N. Y. President, G. E. Herrick; vice-president, W. R. Kimball; treasurer, Theo. H. Conderman; secretary, William P. Gannon. Directors: W. R. Kimball, Paul T. Brady and William P. Gannon, of Syracuse; Charles R. Flint and L. R. McClymonds, of New York City; Theo. H. Conderman, of Philadelphia, and W. H. Hazard, H. Clark Ford and G. E. Herrick, of Cleveland.

Berlin Iron Bridge Company, East Berlin, Conn. The following Board of Directors was elected at the stockholders' meeting on January 29: Charles M. Jarvis, Geo. H. Sage, F. L. Wilcox and Burr K. Field, of Berlin, Conn.; S. Howard Wilcox, of Brooklyn, N. Y.; Julius Burr, of East Berlin, Conn., and H. Peck, of Waterbury, Conn. By vote of the stockholders the capital stock of the company was increased from $300,000 to $500,000. The new issue of stock has all been taken by the old stockholders.

Standard Underground Cable Company, Pittsburg, Pa. The Board of Directors held their first regular meeting after the annual stockholders' meeting on January 26, and elected the following executive officers of the company for the ensuing year: President, George Westinghouse, Jr.; vice president and general manager, Joseph J. Marsh; secretary and treasurer, Frank A. Rinehart; auditor, Charles M. Hagen. At the annual meeting of the stockholders Joseph W. Marsh was re-elected as one of the directors in the company. Mr. Marsh is now entering upon the fourteenth year of his connection with this successful corporation, during most of which time he has been its general manager.

Seneca Electric Company, Seneca Falls, N.Y. Directors: S. D. Green, N. S. Wilcox, H. H. Crowell, P. H. VanAuken and B. F. Peach, Jr. A meeting will be held in a few days when it is expected that the reorganization of the company will be completed and important changes made in the management.

Pittsburg Traction Company, Pittsburg, Pa. President, G. W. Elkins, Philadelphia; vice-president, C. L. Magee, Pittsburg; secretary and treasurer, J. G. Traggard. Directors: G. W. Elkins, P. A. B. Widener, W. L. Elkins, C. L. Magee, William Flinn and George C. Wilson.

Mt. Mansfield Electric Railroad Company, Mt. Mansfield, Vt. General Manager, P. D. Pike; auditors, A. C. Raymond, H. W. Barrows and J. A. Stafford. Directors: P. D. Pike, F. O. Burt, W. P. Dillingham, C. L. McMahon, L. C. Moody, C. E. Burt and E. D. Blackwell.

Central Wisconsin Electric Railway, Oshkosh, Wis. Directors: George H. Ketcham, George J. Kobusch, Otto von Schrader, F. M. Ohl, T. E. Ryan, C. T. Lewis and M. L. Campbell.

People's Traction Company, New York City (organized last week). Directors: Franklin A. Wilcox, Edward H. Hobbs, John A. Bensel, Martin J. Keogh, Daniel F. Cohalan, Charles B. Hobbs, John Foley, Jr., Edward Hassett and J. Clarence Davis.

Mascoutah Electric Light Company, Mascoutah, Ill. President, George Postel; vice-president, Philip Henry Postel; secretary, Henry R. Hagist; treasurer, J. E. Postel.

Harrisburg Electric Company, Harrisburg, Pa. President, E. Z. Wallower; secretary and treasurer, H. W. Stone; general manager, C. H. Kinter; superintendent, W. R. Fitzpatrick. Directors: E. Z. Wallower, John I. Beggs, W. O. Bishop, Harris Cohen, T. H. Heist, E. B. Mitchell, H. T. Ross, H. J. Stewart, Joseph Strouse, B. M. Nead and Horace B. Mitchell.

Wissahickon Electric Railway Company, Philadelphia. President, Peter P. Liebert; vice-president, William Flanagan; secretary and treasurer, John Flanagan. Directors: Peter P. Liebert, William Johnston, James Christie, L. M. Jones, John Kenworthy, Benjamin Kenworthy and W. H. Flanagan.

City and Suburban Railway Company, Baltimore, Md. Directors: Nelson Perin, George C. Jenkins, George A. von Lingen, Wm. P. Harvey, Wm. A. Marburg, B. F. Deford and Edward L. Bartlett. The three last named are new members of the board and take the places of John K. Cowen, E. J. D. Cross and Frank Perin, who declined re-election. The stockholders voted to increase the capital stock from $3,000,000 to $4,000,000.

Edison Electric Illuminating Company, Brooklyn, N. Y. Directors: Frank L. Babbott, Le Grand Beers, Charles E. Crowell, Ethan Allen Doty, Julian D. Fairchild, C. N. Hoagland, Darwin R. James, J. G. Jenkins, Martin Joost, Lowell M. Palmer, Edwin Packard, George Foster Peabody and George H. Southard.

Clyde Electric Light Company, Clyde, N. Y. President, D. M. Wright; vice-president, Nathan Shaw; secretary and treasurer, Edward M. McIntyre. Directors: D. M. Wright, Nathan Shaw, Calvin McIntyre, Charles H. Ford, E. M. McIntyre.

Centralia Electric Light and Gas Company, Centralia, Ill. Directors: C. C. Davis, E. S. Condit, G. L. Pittenger, F. Kohl, Jacob Kohl, Seymour Andrews, G. E. Eis and S. Warner.

Brodie Electric Company, Manchester, N. H. President, J. Brodie Smith; treasurer, Walter G. Africa; general manager, Albert L. Clough.

INCORPORATIONS.

The Compton Electric Service Company (incorporated in W. Va.), New York, N. Y.—to manufacture and vend electrical and mechanical devices, appliances, etc. Capital stock, $300,000. Promoters: Geo. L. Thomas, Baltimore, Md.; Melvin Compton, Newark, N. J.; J. Fred. Glasby, Elizabeth, N. J.

The Fort Madison Water Company, Jersey City, N. J.—to construct, maintain and operate water works, gas works and electric light works. Capital stock, $275,000. Promoters: Alfred C. Brown, Louis Hallock, Jr., Rob't H. Dillingham, Herbert F. Hatch, East Orange, N. J.; Charles B. Brown, Jersey City, N. J.

The Westchester County Central Electric Railway, White Plains, N. Y.—to build and operate a street surface road in the county of Westchester. Capital stock, $75,000. Promoters: F. H. Reed, C. A. Johnson, C. M. Nichols, New York City.

The Frederick-McCabe Construction Company, Baltimore, Md.—to carry on a general contracting and engineering business, making a specialty of constructing electric railways and plants, and to manufacture and sell dynamos, motors, lights, accumulators, etc. Capital stock, $50,000. Incorporators: James F. McCabe, Lawrence N. Frederick, Frank H. Sloan, Lawrence P. McCabe, Francis E. Yewell, William G. Stocksdale and Frank Slingluff.

The Mountain Stream Water Company, San Diego, Cal.—to deal in water and water rights; operate water works; operate electric light and power plants. Capital stock, $10,000,000. Promoters: J. M. Howells, Chicago, Ill.; Jno. D. Works, Lewis R. Works, San Diego.

The Lorain and Wellington Railway Company, Lorain, Ohio—to construct and operate a street railroad, to be operated by electricity or other motive power, between Lorain and Wellington, Ohio; to furnish electric light, power and heat, etc. Capital stock, $100,000. Promoters: H. C. Redington, E. M. Pierce, Jno. Staug, Q. Gillmore, J. W. Steele, O. F. Carter, Jas. Nicholl, Jr.

The York Light and Power Company, York, Neb.—to furnish light and power by the use of gas or electricity. Capital stock, $12,000. Promoters: H. C. Page, Geo. W. Shuck, S. H. Sedgwick, Geo. R. Reed.

The St. Louis and Jefferson Barracks Railway Company, St. Louis, Mo.—to construct and operate an electric railway line between St. Louis and Jefferson Barracks. Capital stock, $30,000.

The Nikola Tesla Company, New York City—to manufacture and sell machinery, generators, motors, electrical apparatus, etc. Capital stock, $5,000. Directors: Edward D. Adams, Ernest K. Adams, Alfred S. Brown and William B. Rankin, of New York City, and Charles F. Coaney, of Summit, N. J.

The Boynton Multivolt Battery Company, Brooklyn, N. Y.—to manufacture and sell electrical apparatus, batteries, etc., photographic supplies and materials, etc. Capital stock, $10,000. Directors: Edward S. Boynton, of Brooklyn; Abraham Strauss, Peter Kemble and Charles H. Brigham, of New York City.

The Central Wisconsin Electric Railway Company, Oshkosh, Wis.—to build an electric railway in Oshkosh, and an interurban road between Oshkosh and Kaukauna. Capital stock, $1,000,000. Incorporators: T. E. Ryan, of Waukesha, and M. L. Campbell and W. F. Gruenwald, of Oshkosh. James K. Tillotson, of Toledo, was the promoter of the enterprise.

The People's Traction Company, New York—to build and operate about twenty miles of electric railways in the Annexed District. Capital stock, $1,500,000. Incorporators: Franklin A. Wilcox, Edward Hobbs, John A. Bensal, New York; Martin J. Keogh, of New Rochelle; Edward Hassett, Charles Mobbs, Brooklyn; John Foley, of Sewaren, N.J.; Eugene G. Blackford, Clarence Seamens and a number of other well-known business men.

The Clintonville Electric Light and Power Company, Clintonville, Wis.—to operate an electric light and power plant at Clintonville. Capital stock, $8,000. Promoters, D. S. Stewart, L. M. Stewart, Clintonville; P. A. Stewart, Morris, Wis.

The Suburban Telegraph Company—to operate a line between Westchester villages, New York and Brooklyn. Capital stock, $10,000. Incorporators: William Bryant, James McCullom, T. P. Tighe, Michael McGonigle and George E. Shepherd.

The Ballston Electric Railroad Company—to operate an electric street railway for passengers, express and freight for a distance of ten miles from Ballston Spa to Middle Grove or Jamesville, in the town of Greenfield, N. Y. Capital stock, $200,000. Directors: Thos. Craig and Robert J. Brace, Trenton, N. J.; Charles E. W. Smith, Roland F. Hill, of New York City; J. H. Burke, F. R. Barnes, Thomas Kerley, of Balston Spa; John Leggett and Joseph A. Leggett, of Troy.

The Seneca Light and Power Company, Seneca Falls, N. Y. Capital stock, $100,000. Directors: A. C. Mercer, C. T. Silsby, N. T. Wilcox, J. W. Hammond, of Seneca Falls, and P. M. Kendig, of Waterloo, N. Y.

The Guest-Bates Marine Life Saving Appliance Company, Hoboken, N. J.—to manufacture and sell all kinds of marine life-saving apparatus and especially the electric lighting thereof, etc. Capital stock, $100,000. Promoters: Jas. A. Guest, Edward C. Chew, Washington, D. C.; Jas. H. Bates, Hoboken, N. J.; Chas. J. Bates, Englewood, N. J.

The Oakland Railway Company, Royal Oak, Mich.—to prosecute a general railway business. Capital stock, $50,000. Promoters: Geo. Hendrie, Strathearn Henrie, Crosse Pointe, Mich.; Jno. C. Donnelly, Detroit.

Woven Wire Brushes.

The Belknap Motor Company of Portland, Me., are the patentees and manufacturers of the best Woven Wire Brush on the market.—[*Adv.*

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JANUARY 29, 1895

ELECTRIC RAILROADS AND APPLIANCES.

533,154. Circuit-Closer for Railway-Rails. Edgar C. Wiley, Bristol, Tenn., assignor to the Wiley Railway Electric Signal Company, same place. Filed May 29, 1894.

533,259. Electric Locomotive. S. Lloyd Wiegand, Philadelphia, Pa. Filed Oct. 23, 1890.

533,261. Bonding Device for Electric Railways. John J. Zimmele and Antoine Bournonville, Philadelphia, Pa.; said Bournonville assignor to said Zimmele. Filed Nov. 30, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

533,100. Electric-Arc Lamp. Hans Swoboda, New York, N. Y., assignor to the General Incandescent Arc Light Company, of New York. Filed March 2, 1894.

533,196. Combined Portable Stand and Wall-Bracket for Incandescent Electric Lamps. Herman Horn, Philadelphia, Pa. Filed Feb. 15, 1892. Renewed June 29, 1894.

533,211. Electric-Arc Lamp. Eugen Conrady, Keighley, England. Filed Dec. 16, 1893.

533,223. Incandescent Electric Lamp. George R. Lean, Cleveland, Ohio. Filed Nov. 29, 1893.

DYNAMOS, MOTORS, ETC.

533,083. System of and Apparatus for Controlling Electric Circuits. William B. Potter, Lynn, assignor to the General Electric Company, Boston, Mass. Filed July 24, 1893.

533,084. Rectifying-Commutator and Method of Making Same. Henry G. Reist, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 19, 1894.

533,108. Electric Motor. Charles Wirt, Chicago, Ill. Filed April 23, 1894.

533,146. Apparatus for Smoothing Currents of Dynamo-Electric Machines. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 16, 1892.

533,244. System of Distribution by Alternating Currents. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed April 2, 1894.

533,245. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 13, 1894.

533,246. Winding for Dynamo-Electric Machines. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed July 14, 1894.

533,248. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Sept. 24, 1894.

533,318. Controller or Switch for Electric Motors. William J. Pohlman, Woodbrook, assignor of one-half to J. Edgar Orrison, Baltimore, Md. Filed Nov. 17, 1894.

533,323. System for and Method of Electrical Distribution of Energy. William Stanley, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Nov. 3, 1894.

533,378. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed April 5, 1894.

533,379. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N.Y., assignor to the General Electric Company of New York. Filed April 11, 1894. Renewed Dec. 24, 1894.

BATTERIES.

533.078. Primary Battery. Richard O'Toole, Mechanicstown, assignor of one-half to George W. Smith, Baltimore, Md. Filed Aug. 3, 1893.

TELEPHONE AND TELEGRAPH APPARATUS.

533,142. Telephone System. John I. Sabin and William Hampton, San Francisco, Cal.; said Hampton assignor of one-fourth of the whole right to said Sabin. Filed April 14, 1894.

533,147. Telephone-Switchboard Apparatus. Charles E. Scribner, Chicago, Ill. assignor to the Western Electric Company, same place. Filed May 13, 1892.

533,148. Spring-Jack for Telephone-Switchboards. Chas. E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 23, 1892.

533,254 Signaling-Telegraph. Frank A. Turner, Chelsea, Mass., assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed July 27, 1893.

MEASURING INSTRUMENTS.

533,107. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed March 11, 1891.

533,269. Recording Ampere Meter. William H. Bristol, Hoboken, N. J. Filed July 26, 1894.

533,270. Electrical Measuring-Instrument. William H. Bristol, Hoboken, N. J. Filed Sept. 24, 1894.

MISCELLANEOUS.

533,130. Combined Curb, Gutter and Conduit for Electrical Conductors. William Kingsley, St. Paul, Minn. Filed Feb. 1, 1893. Renewed Nov. 15, 1894.

533.183. Automatic Electric Signal. Henry C. Stores, Hartford, Conn., assignor of one-half to Edward R. Faxon, same place. Filed April 20, 1894.

533,398. Automatic Electric Safety System for Railroads. Rene R. Snowden and Albert C. Ives, Ocala, Fla. Filed Jan. 26, 1894.

ELECTRICITY.

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N. E. L. A.—The next annual meeting of the National Electric Light Association will be held at Cleveland, O., February 19-21, 1895. Every concern interested in either lighting or railway work should be represented in the membership of this body, and should have at least one representative at the Cleveland meeting. The Secretary is Mr. Geo. F. Porter, 136 Liberty street, New York.

EDITORIAL NOTES.

Researches Relating to Electro-Magnetic Oscillations. In another place we reproduce an editorial on this subject, from the London *Electrical Review* of January 25, which consists chiefly of a review of the work of Prof. Minchin on the conductivity of films of metallic powders, and the effects thereon of electro-magnetic oscillations. The results obtained recall to mind the investigation by Mr. Nelson W. Perry of the effect of electro-positive gases upon similar films, in which almost identical results were in many cases obtained.

Mr. Perry published the results of his investigations in the issues of Electricity of December 16, December 23, and December 30, 1891, under the title, "Some Unexplained Electrical Phenomena." Mr. Perry's method consisted in breaking an electric circuit and then bridging over this break by thin films of non-conducting substances, such as pulverized glass, metallic powders, a thin film of shellac, etc., etc. Usually one or both terminals of the conductor were covered with these films, and then brought mechanically together, but not with sufficient pressure to destroy the insulating character of the film. Taking hydrogen gas as a type of electro-positive gases, he applied this, or an atmosphere containing it, to the junction, and obtained results so similar to those obtained by Prof. Minchin that if the word "hydrogen" be substituted for the expression "electro-magnetic field," the editorial in question would in many particulars apply equally well to Mr. Perry's work. He found that after subjecting this bridge for a considerable time to an atmosphere of hydrogen it became highly conducting, but returned to the non-conducting state again upon standing in pure air. The bridge had, however, undergone some change by this treatment, a change apparently exactly similar to that observed by Prof. Minchin; for it was now exceedingly sensitive to hydrogen gas, and would resume its conducting state almost instantaneously upon being subjected to an atmosphere containing as little as .1 per cent. of hydrogen. "In other words, once we have succeeded in driving a current through the metallic powder surface, it responds to very feeble electro-magnetic impulses, whereas it previously failed to respond to strong impulses," has its counterpart in Mr. Perry's article in this: "Such a tube having passed satisfactorily through the preliminary stage (viz., brought to the conductivity state by pure hydrogen and then allowed to go back to the non-conductivity state), which I designated as the process of 'forming,' would respond to the most minute traces of hydrogen. In an atmosphere containing less than one-tenth of one per cent., it would almost instantly change from a resistance so high that several Laclanche cells in series acting through it would fail to show the slightest current on an ordinary galvanometer, to one so low that the deviation of the needle did not perceptibly differ from that obtained when the instrument was not in circuit."

The editorial says: "Let its conductivity now be destroyed, and it will be found after this to respond very easily to the actions which previously produced no effect upon it." Mr. Perry noticed that with his instruments there was a sort of fatigue. They lost their sensitiveness to hydrogen after a large number (40 or 50) applications, and finally refused to respond even to pure hydrogen. He tried a very large number of powders, and found them all to possess this peculiar property in a greater or less degree, but each one seemed to evince some characteristic peculiar to itself. He also studied the behavior of electrodes of different metals, with the same pulverulent material, and noticed some peculiar effects due to these. One of the most peculiar was that when one electrode was of copper and the other aluminium, and the pulverulent material the black oxide of palladium, the combination after having been sensitized or "formed" showed marked æolotropic qualities. Such a combination would always conduct better in the direction in which the current was passing during the forming process, but the difference of conductivity in the two directions varied considerably in different instruments. In some it would conduct *very* well in one direction, while in the opposite it would not pass sufficient current to give any indication on an ordinary galvanometer. This æolotropism also showed fatigue, for it gradually disappeared on repeated reversals of current.

Mr. Perry's phenomena and those described by Prof. Minchin, while very similar in many respects, cannot both be due to the same cause, unless it be to some as yet not understood property of films. Mr. Perry offers no explanation of his results, since no theory that he has advanced seems adequate. In looking for an explanation, he adopted the method of exclusion, and thus one by one his various hypotheses have been abandoned. It would seem that this subject of the electrical behavior of films offers a wide field for research and study.

* * *

The "Progressive Age" and the Welsbach Light.

Our esteemed contemporary, the *Progressive Age*, in its issue of February 1, in replying to a recent editorial in these columns, says: "We decline to continue further in a discussion which is rapidly degenerating into a battle of words more or less sarcastic and bitter." We are not surprised at this announcement for it is the usual refuge of those who, in endeavoring to sustain an argument, have the very ground upon which they stand knocked from under them. It goes on to say: "If there be a kernel to the attack it makes upon us, it is the statement that we make 'absolutely no reply to our (Electricity's) arguments against the Welsbach light.'"

Now our contemporary seems to be laboring under a false impression, which we desire to remove, viz., that our attack has been directed against itself. Nothing has been further from our thoughts than an attack upon such an excellent publication as the *Progressive Age*. Our attack, if such it can be called, has been against the Welsbach light purely and solely. The *Progressive Age*, which seems to be the official organ of the Welsbach, undertook to laud the new light to the skies. So little attention was paid to what it had to say on this subject that it began to take itself seriously, and finally in a leader expressed surprise that its statements had up to that time gone unchallenged. We were at that time looking into the merits of the Welsbach light, and in our issue for November 28 published the first of our editorial comments upon it. We intended to be fair, and gave the truth as we saw it then, and have seen no reasons since to change our opinion. In this editorial we made no reference whatever to the *Progressive Age*.

On December 1 it published the testimony of Profs. Renk and Bunté and Dr. Kruger, and upon this we commented in our issue of December 12 in a way that displeases our contemporary. It says: "We do not recognize any arguments." Well, what can be done with a person who will not recognize arguments? It goes on: "We published the tests of Profs. Renk and Bunté, men of such standing that to criticise their technical methods in the case in point would be presumptuous on the part of any journal." Well, now, if these men are such high authorities that it is presumptuous to criticise them, what is our contemporary going to say when these authorities criticise one another? That is practically what they do. The statements of any one of the three *may* be true, but if the statements of any *one* of the three *are* true, the statements of the other two, or some of their statements, *must* be false.

Our contemporary by publishing these statements puts itself between the two horns of a dilemma, and our *presumption* consists simply in pointing out to our contemporary that the tips of these horns are both equally sharp. It evidently sees that this is true and says, "I won't sit between the two horns because it is dangerous. I won't sit on either one of them because it would hurt. I have been using the Welsbach light until I am blind, and I don't see any horns, and I won't play anyway. So there, now!"

In its last issue it devotes two columns to a report, copied from the London *Lancet*, on incandescent gas lighting, which it fondly imagines settles all the vital questions except that of the expense and trouble attending the light which it champions. It is evidently a firm believer in the adage that "figures won't lie," forgetting that other equally credible assertion that on certain occasions "liars will figure."

Had we not learned from the publication of the testimony of Profs. Renk, Bunté and Dr. Kruger that our contemporary's judgment as to what constitutes good argument to its cause was fallible, we should have expected it to see how shallow, and in some cases erroneous, the conclusions of the *Lancet* report are. As it is, we are not surprised that it publishes it without comment. For the benefit of the *Progressive Age* and our other readers, however, we reprint in this issue the comments of our London contemporary, the *Electrical Review*, on this report, which show how valueless some of its claims are.

The *Progressive Age*, referring to this report, says:

"The further scientific testimony which we publish in this issue is cumulative." [Yes, cumulative.—Ed.] "As these authorities are *also* beyond impeachment by Electricity, . . . it is evident that conviction on our contemporary's part is impossible. We therefore beg to drop the subject."

Our contemporary is again wrong in stating that "conviction" on our part is impossible. On the contrary, the conviction is very rapidly growing that our contemporary made a very poor defence of the Welsbach light. Poor as the light is as a competitor of electricity, it is capable and deserving of a better defence than it has received. Its well wishers should try to save it from its friends, for they, in this instance at least, are doing it more harm than could be credited to its most bitter enemy.

Under the Searchlight.

Views and Opinions on Timely Topics.

All Ready for the Convention.

The management of the Hollenden Hotel at Cleveland have made thorough preparation for the comfort of their guests next week.

A large basement has been newly painted, brilliantly lighted, and fitted for the use of exhibitors.

Owing to the increased liability to illness at Convention times, it is proper to announce that Dr. Charles Betzler, the resident physician of the house, has no superior in his line, and that he can prescribe sure cures in four doses for almost every known ailment. He is an expert in the cure of melancholia.

* * *

THE ROLL OF HONOR.

What it Means if Correct.

There are at present four weekly electrical journals in this country other than the *Electrical World*. In order of age they are the *Electrical Review*, the *Western Electrician*, the *Electrical Engineer* and Electricity. Each has, in its own way, contributed important service in the interests of the development of the art and of the commercial side of the business. Each has a respectable constituency, and is conducted by respectable men. Each is to-day supplying to the workers in the field something which they want. Each has thousands of warm friends. These are truisms.

A few weeks ago Mr. W. J. Johnston issued a pamphlet containing what he termed a Roll of Honor—a list of concerns who advertise only in the *Electrical World*. It was inaccurate, containing many concerns who are regular patrons of other papers; but it contained the names of some concerns who do advertise only in that paper.

So far as we know, however, none of the firms has protested against the situation in which it is placed.

What is the full meaning of this publication? Plainly nothing else than that the companies appearing in this so-called roll of honor have allowed public notice to be served that they have no use for the four papers mentioned above, nor for the men connected with them.

Is it supposed that the publishers and advertising solicitors of these four papers are angels or saints? Are they not just like other men, peaceable when possible, but ready to resent an insult of this nature?

Laying aside the direct value of advertising in the *Electrical Review*, the *Western Electrician*, the *Electrical Engineer* and Electricity, is it good policy to allow an insult of this nature to pass without protest?

* * *

F. W. Horne, of Chicago, was appointed receiver of the Fort Clark Street Railway Company at Peoria, January 24, 1895, representing the Street Railway and Illuminating Properties of Boston. $175,000 stock held by the General Electric Company has gone to find McGinty.

* * *

Brother Johnston says each copy of his paper costs him two cents more than the subscription price. On this basis his weekly loss on 2,500 paid subscribers is $50 plus the loss from those who do not actually pay.

* * *

Every company placing business with the *Electrical World*, after the developments of the last few weeks, offers direct encouragement to methods which would disgrace a Baxter street clothing man.

London Notes.

(From our London Correspondent.)

AN IMPORTANT LONDON INSTALLATION.

Among the first buildings connected to the supply mains of the City of London Electric Lighting Company were the Guildhall Banqueting Hall and the Council Chamber where the governing body of the metropolis meets every week. From time to time the original installation has been added to by the wiring of the Museum, Art Gallery and other premises connected with the Guildhall, so that at the present time there are more electric lights in regular use here than in any other set of buildings in London.

The total number of lamps now fitted is about 1,650, some of these being of 8, 16, 25, 32, 50 and 100 candle power. The total candle power of current consumed when all the lights are on is equal to nearly 25,000.

The following are some details regarding this installation: In the Banqueting Hall there are 14 fittings with 36 lamps of 16 C.P. each. These fittings were designed by Sir Horace Jones. Each is controlled by two switches to turn on alternate lights. The galleries of the hall are lighted by 24 lamps on brackets and pendants. The lighting of the roof of the hall is somewhat novel. It is effected by means of eight 100 C.P. lamps fitted in inverted shades, designed to throw out the beautiful lines of the Gothic roof.

In the Council Chamber, however, is found the chief feature of the whole installation. From the center of the chamber hangs a magnificent bronze electrolier, about 13 feet in diameter. This was formerly used for gas lighting, but it is now arranged with 60 25 C.P. and 18 16 C.P. lamps controlled in sections by 6 switches. On either side of the Lord Mayor's chair there is a standard carrying 9 lights, while looking down upon this chair is another standard carrying 9 lamps which light the press gallery. The corridor around this exquisitely furnished Council Chamber is lighted by 12 pendants. The light has a very brilliant effect upon the variety of colors used in this chamber, and shows up well the pieces of statuary and the gorgeousness of metropolitan officialdom.

The Art Gallery is lighted by means of 2 15-light electroliers and 40 pendants of 50 C.P. each enclosed in cut glass globes. This lighting is so arranged that in no case does the glare from the lamps fall on the varnished surfaces of the pictures.

The Library is lighted by means of 14 3-light pendants (32 C. P. lamps), 56 brackets (16 C. P. lamps), and 120 8 C. P. lamps on special 6 light pendants.

The Museum is lighted by means of 36 3-light bronzed brackets and 50 pendants.

In addition to the above there are nearly 600 lamps arranged on handsome fittings in the various committee rooms, public courts, etc.

The main switchboard is a splendid piece of work, carrying 6 3-pole circuits, 2 armatures and 1 voltmeter to read in each parallel. The current supplied is alternating. The whole of the wiring is carried out on the 3-wire system, viz., 6 (3 pole) circuits from main board to 3-pole branch distributing boards, and then distributed on the parallel system to the fittings, etc. The work has been very creditably carried out by the firm of Lund Bros. & Co. under the supervision of the consulting engineer, Mr. W. H. Preece.

Sight to the Blind.

D. A. Reardon, the superintendent of the printing office in the Perkins School for the Blind in South Boston, has almost perfected an apparatus by whose use the blind can actually see.

Light from Noise.

If that be possible, how much light we ought to have! There is an old saying that "talk is cheap." Will the alleged discovery detailed below extend the meaning of this saying so that it will read "light is cheap?" But if the quality of the light thus produced is of the same character as the talk that is cheap it is probably worse even than the Welsbach light.

According to an Associated Press despatch that is going the rounds of the papers, a convict at the Ohio State Penitentiary has invented a battery that needs only some one to talk to it to set it into action. We do not know whether or not the sending of this despatch around to the editors of the various daily papers was intended as a reflection on the talking abilities of the average reporter, but it looks very much that way. We notice that among the claims made for this acoustic battery is one that by its use a clock might be made to wind itself by its own tick. Now there is nothing so very remarkable about that, but if it could be arranged so that a man could clear up his indebtedness to his butcher or tailor by the tick which the latter had given him, the invention would be one of real and lasting utility. The acoustic battery is described as follows:

"If two dissimilar conductors of electricity which are subject to slight atomic change under the influence of sound are joined together after the manner of a pair of thermopile bars, and the open ends are insulated by a suitable non-conductor of both sound and electricity, a current is generated when sounds are made in the vicinity of the exposed ends. If two or more such elements are connected together we have an acoustic battery, and by increasing the number of elements it is possible to operate an ordinary call bell by simply clapping the hands in front of the exposed ends of the battery."

Thus it would seem to be a device working on a principle very similar to that of the thermo-electric pile, the sound vibrations being in this case substituted for the heat vibrations as a motive force. Levity aside, there is theoretically no absurdity in this, and it seems rather probable than otherwise that a battery capable of converting the energy of sound into electrical energy could be built acting on a principle entirely analagous to that to which thermo-electric currents are due. It will be remembered that Edison in the early days actually patented a device for accomplishing this same conversion, and it worked too, but was of no value whatever commercially. He constructed a huge tuning fork which was to be caused to vibrate in a magnetic field by resonance with its fundamental note sounded on another instrument, and still later Alexander Graham Bell invented the telephone, which is an adaptation of the same idea. The magneto receiver, when used as a transmitter, is a very familiar example of the facility with which sound may give rise to electric currents. The convict's idea, however, does not involve this principle. It would be a more direct method in which magnetism was not essential at all.

If this announcement is authentic, it is one of considerable interest. As a method of generating current for power or lighting purposes, however, it is of course highly absurd.

The Harrison Telephone Co. in the West.

Davenport, Ia., has granted a franchise for twenty years to the Harrison Telephone Company, under these conditions: The wires shall be carried on the poles already erected; the city shall have the use of the company's poles for fire-alarm and police lines; the city shall have use of ten telephones free of charge and the further right to purchase any number of telephones for its fire and police telegraph service at $30 for each telephone; the annual rental shall not exceed $30 per year for business houses or $20 for residences.

Researches Relating to Electro-magnetic Oscillations.

The question of employing impulsion cells, metallic films, and bodies of similar behavior, for detecting the nodes, &c., of electro-magnetic vibrations, has frequently been raised, and we are glad to see it engaging the attention of the Physical Society. Some time ago, Mr. Rollo Appleyard read at one of the meetings a paper describing the electrical properties of rods composed of metallic filings and gutta-percha, which we duly noticed. This has suggested to Prof. Minchin an inquiry into the behavior of certain bodies in the presence of electro-magnetic oscillations, the result of which appeared in a recent issue of the Physical Society. Prof. Minchin has made a few observations on films and metallic surfaces formed by embedding fine metallic powders in thin layers of gelatine, shellac, and sealing-wax, spread out upon plates of glass. Taking the case of sealing-wax, we find that although the prepared surface presents the appearance of a continuous metallic surface, yet when it is placed in circuit with a battery and galvanometer, it behaves as a non-conductor, so much so that if the electrodes connected with the surface are also connected with an electrometer it is found that the surface has an infinite resistance. Now if feeble electro-magnetic oscillations are produced in the neighborhood of the non-conducting surface, it will refuse to respond and remain a non-conductor. Let the field around it be greatly increased, however, or let one of the electrodes be actually touched by a charged body, and then the surface becomes a conductor. Let its conductivity now be destroyed, and it will be found after this to respond very easily to the actions which previously produced no effect upon it. In other words, once we have succeeded in driving a current through the metallic powder surface, it responds to very feeble electro-magnetic impulses, whereas it previously failed to respond to strong impulses. It appears that the behavior of the surface depends upon certain conditions, *e. g.*, in the case of gelatine, if this substance retains any plasticity, breaking of the contact is fatal to its conductivity, or if the substratum be hard, as in the case of sealing wax, and if strong electro-magnetic impulses have been communicated to it, the surface may remain a conductor for a long time, whilst if they have been small, it rapidly reverts to its non-conducting state. In his experiments, Prof. Minchin has observed the following constant relation:—If the surface is in the non-conducting state, and a feeble electro-magnetic field is produced around it, it becomes a conductor; but if, while it is conducting, a strong field is produced around it, its conductivity is destroyed. He thinks it possible that a law of this kind holds for all such bodies. The nature of the change produced in them depends either on the amplitude or on the frequencies of the incident impulses; but, in order to verify the relation, we should be able to deal with a film which from a definite state of non-conductiveness, changes always to a definite state of conductivity; and this, so far, has been impossible. So far this interesting subject has not been investigated very thoroughly, although in addition to these experiments and those of Mr. Appleyard, to which we have alluded, we have read of several described in papers recently communicated by Mons. Branly to the Academy of Science at Paris. The subject is particularly inviting, and, indeed, promising, since the establishment of laws having an important bearing may result from deeper investigation; and it is to be hoped that Prof. Minchin and others who have approached it will be able to see their way to carrying the matter through.—*The Electrical Review, London.*

THE ELECTROPOISE.

We Never Take A Dare.

The following communication speaks for itself, and since it would lose much of its force and beauty if modified in any way, we abstain from tampering with it and give it *verbatim et literatim et punctuatim.*

While the contribution is a gem as a whole, it is dotted here and there with those whose lustre makes them foci of rays of such scintillating beauty as to give added lustre to that which, even without them, would be of incomparable beauty. One of the brightest of these unmatchable gems is the inference broadly stated that the animus of our attack on the Electropoise is that we are in the same business, and that the Electropoise is making more cures than we are:

Phila. Feb. 5th 1895.

B. E. Greene, Prest.
Dear Sir

A pamphlet Book called Electricity, Published Dec. 12th, 1894, on Page 262 the Electropoise. Permit me to say I have an instrument called oxdoner victory Patented by Dr. Sanshe originally It was called Electropoise. permit me to say I am not an agent or interested In its magement In no way but I believe in fair play to every person and thing. of course this instrument may, and does make great inroads to your Electricity. Now if you are a fair business man you will publish this in your Book as you have published other communications, as follows; I James Coleman No. 1,727 Sydenham St., Phila., Pa., after the use of the oxdoner victory of nearly three years use proclaim It the greatest thing I ever struck. I have cured Every case of sickness that has came up in my family In a very short time some cases the doctor could not cure. I was a compleat wreck my self from Blood Poison and I cured my self. as your Book states many cases resulted in death. So does Death result under all circumstances. But I believe the oxdoner victory Is the greatest cure I Ever had the the privilege to have any Expearance with. I have known persons whom have tried Electricity and failed to be cured, But by the use of the Electropoise, now called Oxdoner victory. All your correspondence are perhaps not well posted in the use of Oxdoner victory commonly called (Electropoise) of course any sensible person getting one of these Instruments and using it according to instructions will never trouble your Electricity as a cure reccolect this is from a person that has had the constant use of this instrument for three years reccollect none of your correspondence claim to have made a use of them Now Mr. President dont condem a thing that has not been tried. I dont say there aint no Merit In your Electricity that would be wrong for me to do. So try and be fair to a good thing which I have found Oxdoner victory to be. It cost me $25.00 to get one and I know It has been the best investment I Ever made in my life. I never have to now call in a doctor It cures in a few hours Now Mr. Greene you are at liberty to publish this in your book. But I dont think you will, you aint fair enough to do that.

very Respectfully
James Coleman, 1,727 Sydenham St.,
Philada. Pa.

An Electro-Medical Fraud.

From the Western Christian Advocate.

Electricity, in its issue of November 21, prints an exposé of the "Electropoise," an extensively advertised panacea, with certificates of its effects from men in high places. It turns out, by scientific demonstration, to be the veriest cheat, achieving its magic healing through the imagination of its patrons. It claims to cure by "thermo-electric induction"—a conceit that has no scientific basis, there being no such thing known to electricians—to so polarize the body as to attract the oxygen to its surface and diffuse it through the system. The expert affirms that "neither magnetic nor electric polarization has any effect upon the atmosphere, except to abstract from it the dust; that, if the body were polarized to a million volts, there would be no such attraction," while this "little joker" has but "one-thousandth of a volt." The proprietor alleged that the closed cylinder contained two rare metals no chemist could analyze, while there are no metals which cannot be analyzed.

The exposé is scientific and thorough, and no candid mind can escape the conclusion that the device is devoid of merit, and that "the Electrolibration Company" is advisedly palming off on the afflicted a worthless nothing at an exorbitant cost to the purchaser.

The cheat ranks with the electric brushes, soles and "Perkins Tractors" exposed by Dr. Oliver Wendell Holmes.

As a psychological imposture on the infirmities of cultured minds it is the 'cutest fake of the age. We do our readers a practical service by forefending any tempted to try this costly fraud from losing their money and execrating themselves for their credulity.

Phosphorescence and Photographic Action.

A discourse on "Phosphorescence and Photographic Action at the Temperature of Boiling Liquid Air," was given by Prof. Dewar before the Royal Institution recently. The lecturer showed experiments to prove that bodies which at ordinary temperatures are very faintly, if at all, phosphorescent glow very brightly if, after being cooled to the temperature of boiling liquid air they are stimulated in the light of an electric lamp. Among the substances he experimented upon were cotton-wool, feathers, flowers, egg shells, quinine, acetic acid, and some of the complex platino-cyanides, the latter giving very brilliant effects. He proved experimentally that the stimulating power of the electric lamp lies chiefly, if not altogether, in its ultra-violet rays, and he showed the curious fact that the luminous and heat rays are able to dissipate the luminosity of a phosphorescing body in those parts upon which they have fallen. The latter part of the lecture was devoted to showing how greatly photographic action is diminished at exceedingly low temperatures—even to the extent of 80 per cent.

Economy of Electricity in the Scattered Distribution of Power.

The *Practical Engineer*, in an editorial on this subject, makes the statement that in using electricity as a means of conveying power, regard must always be had to the nature of the power which it is to replace. We are all familiar with shops of one sort and another in which from one or two sets of boilers there are steam pipes carried long distances and individual machines driven each by its own small engine. Now, it is not simply that small engines in themselves are so very wasteful; they rarely have the chance of showing what they can do with good dry steam, and they are rarely indicated to show what amount of fuel they are really consuming. It is, however, to the use in them of steam cooled by exposure in long lengths of pipe that a large proportion of their inefficiency is due. They are employed because steam pipes can be run easier than shafting, and once fixed require no attention, whereas a shaft calls for continual attention in oiling and maintenance. As between a high-class steam engine and short well-protected pipes, and an electric motor taking current from a distant dynamo, it is held that no one would doubt the superiority of the engine. But when the superior engine drives a dynamo, and current is led off to motors at a distance, there is no question but that this is superior to the use of small steam engines.

Can They Economize?

Mayor Blee of Cleveland is endeavoring to create a sentiment in favor of the city putting in an electric plant to light the city buildings.

At Harrisburg a bill has been introduced in the Legislature looking towards the establishment of a State plant for lighting the State buildings.

LEGAL NOTES.

In a suit for damages brought at Newark, N. J., by Sarah Goldberg, a brushmaker, against the Consolidated Traction Company, the amount sued for was fixed for her by an insurance expert at $10,188.86. The girl's hand was twisted and her thumb broken at the joint by a fall caused by the sudden starting of a trolley car she was in the act of getting on. The insurance man, with the aid of tables employed in his business, calculated the sum named as the exact amount at 4 per cent. required to recompense the plaintiff for her injury which, it was claimed, rendered her incapable of ever again working at the brushmaking business. The figures were based on the probability of the plaintiff's having thirty-nine years' producing power. The case is still before the courts, but it is doubtful whether they will consider the producing power of the girl destroyed for thirty-nine years by the loss of a thumb joint.

The deposition of Marcel Deprez, plaintiff in the case of Deprez against the Thomson-Houston Electric Company of Lynn, Mass., taken by United States Consul Frank E. Hyde, at Lyons, France, was filed a few days ago in the United States Circuit Court at Hartford, Conn., having been received by mail. The deposition was taken by Consul Hyde as commissioner, he having been appointed such by Judge Townsend, before whom the motion of the defendants for such deposition was argued. Marcel Deprez is a Frenchman, whose suit against the Thomson-Houston Company, originally brought October 10, 1892, is for an infringement of a patent on an improvement in the art of transmission of electric energy to a distance.

In the United States Circuit Court at Hartford, Conn., on the 4th inst. two bills of complaint were filed against E. S. Greeley & Co. of New Haven by the Western Electric Company of Chicago. The first alleges an infringement of a patented spring-jack switch, and the other alleges the infringement of patents on magnetic bells and telephone call boxes. An injunction and an accounting is prayed for in each case.

Judge Pennypecker has decided in a telegraph case at Philadelphia that the only damages recoverable for failure to deliver a cipher message as promptly as open messages are the telegraph company's charges for transmittal.

In the case of Lizzie A. Woeckner vs. The Erie Electric Motor Company, at Erie, Pa., the jury gave a verdict of $15,000. The little girl was run over by a street car and lost both legs in consequence.

Judge Arrington of the City Court of Montgomery, Ala., has appointed W. B. Rommee, receiver of the electric car line formerly known as the Seelye line. The appointment was made on application of the Westinghouse Electric Company and Wright & Lindsley, of New York, creditors. The operation of this road was suspended recently, but the receiver expects to commence running the cars again in a few days.

Utilization of Peat Bogs.

The peat bogs of Great Britain and Ireland are roughly estimated by P. F. Nursey at 6,000,000 acres, having an average depth of 12 feet, and being capable of yielding 3,500 tons of dried peat per acre. In Ireland there are 2,830,000 acres, or nearly one-seventh of the entire area of the island. More than half of the Irish peat is of the best quality, and, reckoned at one-sixth the value of coal, the total supply in Ireland is thought to be equivalent to 470,000,000 tons of coal. Here is a vast store of energy, points out J. Munro, which like the power of Niagara, may be converted into electricity and applied to many industries—especially those of manufacturing various possible products from the peat itself—in factories established near the bogs. Neighboring towns, moreover, could be lighted from the dismal moors, and railways worked.

THE FUTURE OF ELECTRICITY.*

BY SYDNEY F. WALKER.

Whenever one engages in conversation with anyone not in the ranks of electrical engineering, it rarely happens that one's friend does not remark very early in the conversation that "electricity is still in its infancy," usually prefacing the observation by the statement that he personally knows nothing of the subject. The observation has been made so often that one really becomes very tired of its incessant repetition, and we feel strongly inclined to beg our friends not to repeat the old saying too often. Yet after all, when we consider the question, is it not true in spite of what has been done during the last sixty years, and particularly during the last twenty?

Judged by the age of other branches of science electricity is still an infant, with all its manhood's work yet to accomplish—work that none who are now its servants can hope to take part in; work that few of us can even venture to foretell. It is by the use of steam and of electricity that the modern world of the nineteenth century is distinguished from the older worlds that have gone before. What might not those mighty races of bygone ages have accomplished had they been blessed with such servants as these? And even now, while steam is young, as the universe judges time, the handwriting is on the wall, not, as at the Eastern monarch's feast, in strong condemnation of the empire that is passing away—for steam has been a faithful servant, and will be for many years to come—but as a warning that its days are numbered, nevertheless. And may it not be also in the future that even the young giant we serve, whose infantile deeds are so prodigious, will have to give place to another agent as yet unknown? If it be that electricity and electro magnetism, with sound, light and heat, are merely varying forms of the same thing, varying rates of molecular motion, can we suppose that there are not other rates of motion possessed of other properties possibly still more wonderful than those that have surprised the present generation? Between the molecular motion we know as sound and the slowest of the motions we know as invisible heat, there is room for many other rates.

But what may we hope for in the future from electricity itself? First, then, the gradual utilization of the forces of nature known as wind and water power, to the gradual displacement of power from the combustion of coal. At irregular periods the world is startled by the cry, What will become of us when our coal fails? We are turning out an increasing number of millions of tons yearly, and the supply is limited. We are squandering our national wealth. What is to become of us as a manufacturing nation? Long before the supply of coal approaches exhaustion its price will increase and our other industries will be crippled. What are we to do? The reply is, in my opinion, that long before the price of coal rises from this cause coal itself will have to fight for its life as an industrial product, just as gas is now doing, the antagonists being wind and water power, delivered where required by the aid of electricity.

And what about gas? Only twelve months since it was safe to prophesy, as far as could be seen then, that gas was doomed to extinction at no distant period. The perfection and adoption of the Welsbach incandescent gas burner will probably give it a new lease. If the Welsbach apparatus becomes universally adopted, and the gas companies are able to carry out their threatened revolution, the supply of a heating gas only—necessarily a much cheaper gas—electricity will have received a very serious setback, the most serious it has received during the last twenty years. Once the price is reduced gas will be used much more for heating and for power than it is now, and while at present the running cost of an incandescent lamp is twice that of an ordinary gas burner in any district, and power costs four times as much when taken from any town's electric supply mains as it costs when taken from the gas service, the proportion when cheaper gas is supplied will be very much greater. But a little consideration will show that the setback will be only temporary, can be only temporary, unless electrical engineers alter very considerably during the next few years. The principle of the Welsbach burner, or its equivalent, must be adopted in the electric incandescent lamp of the future. In the Welsbach burner we have a substance capable of withstanding a high temperature with the necessary heat applied to the substance from outside by means of the combustion of gas. When electric lamp-makers find a substance that will stand very much higher temperatures than the present incandescent lamp filaments do, the Welsbach burner will again have to take a back seat, and electricity will have made another stride, and a very long one, in its progressive fight with its rivals, since in addition to reducing the running cost of the lamp itself, its greater efficiency will enormously increase the earning power of the plant and cables.

In the matter of power, too, the gradual education of consumers in the use of higher voltages will gradually decrease the running cost. There is one use of electric power, however, for which the present outlook does not seem very hopeful, viz., for tramcar driving.

Notwithstanding all that has been done in America, and the special cases in this country where electricity has been successfully employed, apparently it must be some years, many years, before it can be generally applied to the ordinary street service, unless some unforeseen discovery should be made very shortly. America is not England, and the Black Country is not England; and no matter what may be tolerated there, no English town of importance would be likely to allow the hideous arrangements necessary for the overhead system in any of its principal thoroughfares. The conduit system and the accumulator system await the march of invention. Both are barred by the excessive cost of running.

Heating by electricity, though only recently introduced, has already made rapid strides; and although where the current to be used for heating is taken from the town supply the cost is still so excessive that it can only be regarded as a luxury, yet there are now many cases where the extra convenience is well worth the extra cost, and there will be many more as time goes on, and as the natural development of the lighting industry produces the usual effect, viz., gradual reduction of cost.

Telephones are daily becoming more and more used, and hence more and more useful. The future for them should mean still further usefulness by reason of more perfect service. In the future, too, we may hope to have communications by telephone without wires. Shall we also see by electricity without wires? In mining and general industrial work the progress of electricity in the past and the hopes for the future leave nothing to be desired.

Whether Messrs. Thwaite and Swinburne's idea of burning the coal and the gas generated in coal mines at the pit's mouth, and distributing to centers of industry, is ever realized will depend on how soon the developments of wind and water power are made. Possibly some such scheme may come in to assist coal in its battle, in the same way that the Welsbach burner has come in to assist gas now.

Local conditions, too, will largely rule whether coal, wind, or water shall be used, since the initial outlay will be approximately the same, and the voltages used may be the same. But, since for both the economical consumption of coal at large centers and the utilization of wind and water power, high voltages will be necessary, and the higher the voltage that can be employed the more economical will be the working of the system, may not engineers indulge in a yet bolder dream?

The dream of ages, the utilization of the gigantic energy of Niagara, is now, in part at least, an accomplished fact; is it too bold to dream of using the energy of the agent that creates Niagara, the sun itself, by the aid of electricity, to neutralize some of the effects created by the absence of the sun's rays? Daily, hourly, the whole year round, enormous quantities of energy are delivered directly to the earth within the tropical zone, yet during the whole year large tracts of land are rendered absolutely valueless to man owing to the want of the heat so abundant in the tropics, while even yet larger tracts are deprived of a considerable part of their fertility from the same cause. Is it too bold a dream to imagine a portion of the superfluous heat of the tropics delivered within the icebound regions by the aid of electricity? What would our ancestors have thought if anyone had foretold in their days the present use of Niagara?

Once more, too, if what we know as electricity be a form of molecular motion at a lower rate than the slowest of the invisible heat waves, the day on which it becomes possible to reduce the rate of the molecules, when vibrating under the influence of heat, directly until their motion corresponds with the rate we know as electricity without the at present necessary repeated transformations, an enormous stride will have been made towards neutralizing the inequalities of climates on our globe. And there is even yet another manner in which we may hope that electricity may help us in our battle with the inequalities of nature.

It is now some years since Lord Rayleigh discovered that the large raindrops we are so familiar with in thunder showers are due to electrification, and consequent aggregation, of the fine particles of moisture present in the atmosphere. It is also some years since Prof. Oliver Lodge added to Lord Rayleigh's work the discovery that floating dust particles might be aggregated in the same manner as the raindrops are by discharges of static electricity. Yet beyond an apparently crude experiment on lead dust, no use has been made of either of these brilliant discoveries.

Is it too bold, wickedly bold, to hope that in the future, by means of electricity, we may be able, at least in part, to control our seasons? Why need we have a dry summer, as in 1893, when the moisture is present in the atmosphere, and can be made to descend? Why need we have superlatively wet seasons if the atmosphere is not allowed to retain a superabundance of moisture, when it may be caused to discharge its cargo when desired? Why should not our Government vote a large sum to working out these problems? Can we doubt that if the discoveries had been made by French physicists the French Government would not have given every assistance, instead of standing coldly by, supremely indifferent until the time arrived when the discovery may bear taking? Is it too much to hope that the coming year may see some little thing done in this direction?

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* "The Electrical Engineer" (London).

A French railway has recently arranged its telegraph lines so that at a prearranged signal the wires are switched from the telegraph instruments to telephones, thus enabling the operators either to talk verbally or to communicate by the telegraphic code at will.

Low Rail Joints of Street Railways and Their Prevention.

BY N. S. AMSTUTZ.

Recent conditions of street railroad traffic have developed one thing above all others needing careful attention, viz., poor rail joints. With the old equipments, the rail joints were able to withstand the traffic much longer than very heavy rails do under the impositions of recent traffic requirements.

The horse car traveled slowly, its weight was but little compared to the modern "motor," and in consequence where a low joint existed the trouble was not aggravated to the same extent as it now is. Then the change from good to bad was so gradual that the patronizing public made small note of it. Now the changes are so rapid that they cry out against them, and the loudness of the complaints keeps pace with the speed of the vehicles of transit.

A difference of level between the adjoining ends of rails, that under the old regime was negligible, under the new is of the gravest importance. This is not due alone to the heavier equipments used, but also to the greater speeds at which the cars are run. The blows at slower speeds, as the car wheel dropped but a thirty-secondth of an inch from one rail to another were but "tack hammer" forces in contrast with the "steam hammer" effects produced by the heavy motors of to-day at their higher speeds.

The steam railroad does not have the same conditions to contend with, since the rails themselves are not imbedded in the earth, as street railway rails invariably are where the track is laid in a public highway.

The street-railway practice makes possible the most disastrous combination of circumstances, which becomes a constant drain upon the resources of t.e tramway company. These causes are chiefly due to—

1st. Allowing water to accumulate at a rail joint between the rails and the paving or the adjacent earth during rainy weather. This implies the retention of water at a rail joint after the rest of the street is comparatively dry.

2d. Joints becoming loose.

3d. Allowing loose joints to remain so until the rails have a decided "set" downward at each end. This usually follows when the joints occur between ties.

4th. Allowing the puddling chambers at joints to exist whereby the tamping under the adjoining ties is removed, and the most favorable conditions are created for producing "set" rails.

5th. Allowing the differences in level between rail ends to continue to exist, wherein seems to lie the prime cause of most all of the street railway track ailments.

In the construction of new track it is almost impossible to get perfect alignment even though the rails are all rolled from the same rolls. Where the rails are placed in position at once after being received from the mills, there is not so much liability of a difference existing in the levels of their tread portions, but if they are allowed to lie along the roadway in all kinds of weather, some ends exposed more than others, it certainly would seem as though the absolute sameness of cross section at the ends would be destroyed, because of the scale formations, etc.

When rails are laid with an expansion space between their ends, the plans herein outlined would not be so efficacious, but with rails laid without the expansion space, which recent experiences with welded rails seem to show is not necessary, the proposed remedies would, I believe, be specially pertinent.

Just as surely as a difference of $\frac{1}{64}$ inch exists between the levels of adjoining rail ends, so surely will the heavy motors find this difference and aggravate it.

If the weight of the car comprised only pig iron, then the disastrous results would bear heavily only upon the tracks, but unfortunately the greater portion of its weight is made up of electrical machinery, worthy of better treatment.

The ultimate effects of hammering on single track roads would not be so great as in double track systems, where the traffic is all in one direction; but when it is considered that under a 5-minute headway an aggregate of 840 blows per week are delivered by a car operating ten hours a day, each succeeding blow being slightly heavier because of the increase of drop which is constantly produced, the seriousness of this influence will be appreciated. Even with the heavier rails and "channel" fish-plates which are now being used, the damage due to this cause is not entirely removed. It is therefore of the utmost importance that a preventive should be used, so as to insure the maintenance of the best possible conditions for the preservation of the track and the car equipments.

Directly along this line I would propose the following procedure for old as well as new track. These deductions are based upon a number of years of careful observation of the older horse car and the more recent electric track constructions.

For old tracks, it would be most expedient to—

1st. Carefully inspect the track, and locate all the loose joints.

2d. Re-tamp the ties located adjacent to a low joint.

3d. Cement or otherwise fill in the space which exists between the web of the rail and the paving up to and beyond the adjacent ties. This would prevent accumulation of water, and in a great measure be beneficial in preventing the open spaces between the ties and the earth beneath, which are formed by constant vibration when water is present.

4th. Carefully surface up the rail ends where they meet, in the manner hereafter described.

With new tracks the plan proposed would be somewhat as follows, viz.:

a. Using the new track for at least a day before the track is finally aligned.

b. After the day's use, re-tamp the ties, and finally align the track.

c. Surface the rails before paving.

d. Cement the spaces under the rail head, as set forth in the division (No. 3) preceding.

e. Re-surface the rail joints after one or two weeks' use.

f. After a few months inspect the track with the indicator to locate defective joints.

The maintenance of a repaired or new track is much the same, and it is a case where eternal vigilance becomes the price of good track. All the troubles recounted can usually be traced to a a slight inequality of the rail ends.

A slight drop sets the rails into vibration, and if the process is continued for a time, the fish-plates will surely become loose at one end or the other, and then the matter goes from bad to worse until both ends are loose, when it is but a question of a short time when the rails will be "set" and the track almost irreparably ruined.

Numerous attempts have been made to re-align old tracks having "set" rails therein, but the result has invariably been unsatisfactory. No amount of doctoring short of straightening the rail (which is impracticable) will remedy the matter. The old adage, "An ounce of prevention is worth a pound of cure," is certainly as true when applied to street railway track preservation as elsewhere.

The watchword of the day is *prevention;* this is the key to the present propositions, in that the conditions which make possible all the ills to which a street railway track is subject might be eliminated by timely preventive measures far more easily than they can be cured after having once come into existence.

The surfacing car which I would propose for the purpose may be described as follows:

It may consist of an ordinary truck with a special housing built thereon, with tool box conveniently placed at each end, on the outside, so as to be easy of access. It should have suitable couplers, and a single motor connected to the front axle with an ordinary car controller directly in front and a brake located within easy access. A lamp should be placed under each canopy, and a cluster of three lamps placed on the inside. The surfacing mechanism is made in two units, one on each side of the car, so as to serve both rails simultaneously if necessary.

This mechanism may be described as follows: It consists of a rapidly rotating emery grinder having bearing at the end of the short arm of a bell crank lever; the long arm carries a pivoted nut which is moved laterally by a worm shaft, having one or two hand wheels thereon; the worm shaft is supported upon a suitable frame which rests on the car floor. The lever is fulcrumed at the "knee" in a hanger secured beneath the car floor, and the emery grinder is connected to a stationary motor by a flexible shaft in any suitable manner.

If desired, the flexible shaft could be connected to a counter shaft through the medium of a clutch; this latter arrangement in some respects would be preferable, because either of the grinders could then be disconnected at pleasure without affecting the other one. The usual starting box, etc., would be provided for the stationary motor.

The operator is enabled to see the progress of the work through a slot in the car floor, and the speed of travel could be as fast as the special requirements would call for.

In order that the surfacing might be done at night time, so as not to interfere with the ordinary day traffic, lamps are hung under the car floor, near the grinders, in suitable protecting guards. The reflection on the cleanly ground surfaces of the rails would very readily indicate the progress of the work.

A very little grinding at each joint will suffice, and this can be repeated as occasions demand.

The "grinding car" would be of special importance in surfacing down new work, such as switches, cross-overs, etc.

In addition to the surfacing or grinding car, I would also propose a mechanical track inspector, on the plan described below. This could be drawn over the track by an ordinary motor or the surfacing car. Its function would be to automatically indicate the location of low or defective rail joints, so that they might be repaired as early as possible. This car consists of a four-wheeled truck with any suitable frame, provided with two indicating wheels mounted upon the same axle. The bearings of this axle are free to slide up and down in the central housings, as the inequalities of the track are passed over, while the end axle bearings are held rigidly upon the truck frame.

The central axle bearings have connected therewith a bell crank lever which has its fulcrum pivoted on the central bearing housing, and its longer arm is connected by a link to a sliding valve. This valve regulates the flow of any coloring matter which is contained in a tank placed for the purpose on the truck. Two spouts lead from the tank, one on each side of the truck, terminating so as to deliver the coloring matter as near the rail joints as deemed desirable.

The action of the device is as follows: When either one of the central wheels passes over a low joint it moves downward in relation to the truck frame; this moves the belt crank lever, and opens the valve in the spout and allows the color to discharge upon the paving or the ground, or the rail if this be thought best.

As soon as the central wheel moves from off the low portion of the track, the valve is closed.

If the coloring matter in the tank is in liquid form, the valve should simply be perforated. If in the form of powder, the opening should be ample to guard against clogging.

The valve can be actuated as delicately as desired by changing the link connection to the bell crank lever.

Results of the Elihu Thomson Competition.

The Elihu Thomson electrical energy meter, having obtained at the meter competition organized by the city of Paris a first prize of 5,000 francs, Prof. Elihu Thomson generously devoted this sum to facilitating the study of certain theoretical questions of great interest.

This competition is now ended, but before stating the conclusions of the jury we will give a brief sketch of the history of the competition. Towards the end of the year 1889, the city of Paris organized a competition of electrical meters, and placed at the disposal of the jury a sum of 20,000 francs to be given in prizes. But the result of the little time allowed the competitors in which to submit their instruments was that very few meters were sent in and none of them entirely satisfied the conditions of the programme.

Nevertheless, at the request of the jury, a sum of 7,000 francs was distributed in prizes of encouragement, and a second competition was organized.

The conditions of this second competition were as follows:

Article 1.—A competition is open to all inventors of electrical meters that can be applied either to continuous currents alone, to alternating currents alone, or to both forms simultaneously.

Article 2.—The meters submitted may be either electricity meters (ampere-hour meters) or energy meters (watt-hour-meters).

Article 3.—The readings of the meter must be direct and the consumer must be in a position to ascertain for himself the quantities consumed.

Article 4.—The meters must be suited to small consumptions; the electricity meters must register from $\frac{3}{10}$ths of an ampere, and the energy meters from 20 watts.

Article 5.—The meters, together with an explanatory note, must be deposited in a sealed package, at the Halles Municipal Station, from the 25th to the 31st of August, 1890, without fail. A receipt will be given for them.

Article 6.—The meters will be submitted to a committee consisting of nine members, five of whom will be appointed by the Municipal Council and four by the Administration.

Article 7.—The instruments will be subjected to comparative experiments bearing upon:

(*a*) Their accuracy throughout the scale of outputs that they are capable of recording.

(*b*) Their practical value (regularity, simplicity, cost, etc.)

(*c*) The energy expended in their working.

(*d*) The amount of trouble entailed by their employment in the distribution of current.

Article 8.—A sum of 13,000 francs will be distributed in prizes under the following conditions:

10,000 francs to the inventor who will produce a meter giving every satisfaction, and applicable either to continuous or alternating currents.

If the meter is only applicable to one of these forms the inventor would only be entitled to half the prize.

Prizes amounting to 2,000 francs for meters intended for both alternating and continuous currents, and to 1,000 francs for meters applicable to only one of the two forms of current, will be awarded to those inventors whose apparatus shall have realized any important improvement.

The Elihu Thomson meter, which was not ready for the first competition owing to the little time allowed, obtained a first prize of 5,000 francs, as entirely fulfilling the conditions laid down.

Prof. Elihu Thomson then wished that other scientists should profit by the generosity of the city of Paris, feeling that the distinction he had gained was sufficient for himself, and he therefore charged M. E. Thurnauer, the general European agent of the Thomson-Houston Company, to organize a competition having for its object the advancement of science.

In September, 1892, the following programme was put before the scientific world through the medium of electro-technical journals.

THE ELIHU THOMSON COMPETITION.

Prof. Elihu Thomson obtained, at the last competition instituted by the city of Paris for the best electrical energy meter, a prize of 5,000 francs. Wishing this sum to be employed for the development of theoretical electrical science, he charged the undersigned, who is the general European director of the Thomson-Houston system, to form a committee for the organization of a fresh competition, the object of which should be the study of theoretical questions, the prize offered being the sum of 5,000 francs. The committee was composed of the following persons, who readily accepted the position of member. Messrs. J. Carpentier, president of the Société Internationale des Electriciens; Hippolyte Fontaine; E. Hospitalier, professor at the Ecole de Physique et de chimie industrielles of the city of Paris; E. Mascart, of the institute; A. Potier, of the institute, reporter to the competition committee; B. Abdank-Abakanowicz, consulting engineer, secretary to the competition committee.

The committee decided that the competition should bear upon the following subjects:

1. The study of the heat generated by the successive charges and discharges of condensers, varying the magnitude of the charges, the frequency, and the nature of the dielectric.

2. Theory indicates that when the armatures of a condenser have been connected by a conductor, the condenser becomes the seat of alternating currents whilst its resistance falls below a certain limit. The formula which enables the period of these oscillations to be calculated has not up to the present been fully verified. The problem set is to find this period experimentally under conditions in which the exact measurement of the resistances, capacities, and co-efficients shall be possible, so as to arrive at an accurate and complete verification of this formula.

3. When a condenser formed of an imperfect insulating material has been charged and then left to itself, the charge of the armatures is progressively dissipated; the time required to reduce this charge to a certain fraction of its initial value depends only on the nature of the insulating material. It is asked whether, as certain recent theories assume, similar phenomena occur in metallic conductors, whether there are experimental reasons for thinking so, and what is the rate of time for conductors of this kind.

4. The establishment, by co-ordinating and generalizing facts at present known, of graphic methods of solving electrical problems proceeding on the same lines as in graphic statics.

The papers presented may be written in any of the following languages: German, English, Spanish, French, Italian or Latin. They may be either written or printed.

Each of the papers presented must be marked with a certain device, and accompanied by a sealed envelope bearing on the outside the same device as the paper, and on the inside the name and address of the candidate.

The papers must be sent in before September 15, 1893, to M. B. Abdank-Abakanowicz, secretary, 7 Rue du Louvre, Paris, who will furnish any information required.

(Signed) E. THURNAUER.

Four papers were sent in in response to this appeal:

1. "Die Bewegung der Erde ist die Quelle des Lebens."

2. "Vigentia." "On dielectric hysteresis."

3. "*ηλεχτρου.*" "An examination on the absolute accuracy of the formula for calculating the period of free oscillation of a discharge condenser under circumstances such that the resistance of the circuit has no appreciable disturbing effect.

4. "*Οντις εμοι γ ονομα.*" "An experimental determination of the period of electric oscillations."

The members of the committee, after examining these papers, came to the following conclusions:

The first paper, "Die Bewegung der Erde ist die Quelle des Lebens," does not treat of the subjects specified in the programme.

No. 2 contains some very interesting facts, but does not throw any new light on the question of the hysteresis of dielectrics.

No. 3 is devoted to the verification of the formula giving the period of the oscillating discharges of a condenser. This is a very exhaustive paper accompanied by several photographs, and in it the writer has endeavored, by means of profound calculations to estimate all the corrections entailed by his method.

The verification is only approximate; the principle of the method is open to some criticism, the circuit of the discharge being closed periodically by a spark which introduces disturbances impossible to foresee.

Paper No. 4 treats of the same subject, studied by a method new in its details, and which has enabled the writer to attain and to measure periods of some hundred thousandths of a second. The influence of the principal causes of error appears to be very slight, although some doubts still remain as to the influence of the capacity belonging to the self-induction coil. The formula has been verified to within about 1 per cent. The writer had not time to complete his researches by varying the conditions of his experiments.

The report of the committee is as follows:

The committee is of opinion that paper No. 4 has gained the prize offered by Prof. Elihu Thomson, and hopes that this tribute to his ability will encourage the writer to continue his splendid researches. At the same time the committee regrets not having at its disposal two prizes of equal value to be awarded to papers 3 and 4.

The success of this competition is a matter for congratulation, for, besides the two papers referred to, others of considerable merit have been sent in.

In compliance with the wishes of the committee and in consequence of the steps taken, M. Thurnauer, Prof. E. Thomson, of Lynn, the French company for working the Thomson-Houston methods, the Meter Manufacturing Company, the chief agents for the Thomson meter in Europe, and the British Thomson-Houston Company, Limited, of London, have contributed to offer a second prize of 5,000 francs.

The envelopes containing the names of the prize papers were opened, and the committee awarded one prize of 5,000 francs to Dr. A. Webster, of Clark University, Worcester, Mass., U. S. A.(paper No.4), and another prize of 5.000 francs to Dr. Oliver Lodge. of University College, Liverpool, who collaborated with Mr. Glazebrook, of Trinity College, Cambridge, (paper No. 8).

The Secretary of the Committee,
B. Abdank-Abakanowicz.

The "Lancet" on Welsbach Lights.*

A scientific report, whether made by an expert or by a commission, is very properly expected to be strictly accurate in its conclusions, precise in its methods; and the tests applied to ascertain the facts ought to be above suspicion, and for that reason they are usually very minutely detailed in a report.

A *Lancet* Commission has just issued a report on incandescent gas lights, a copy of which we have before us. In many respects it is unsatisfactory and disappointing, and we fail to find any support in the report itself for the expressed admiration for this form of lighting, and the laudatory terms therein contained regarding incandescent lighting by gas are somewhat incomprehensible in the face of the figures given.

This remarkable production of the *Lancet* Commission begins with a long and altogether superfluous notice of the early history of gas lighting, and the subsequent discoveries of valuable products in the tar residue. Then follows a brief history of incandescent gas lighting, mentioning by the way, and recalling the fact, that there have been many previous attempts made to introduce this kind of illuminant. We have seen the "Clamond," "Lewis," "Sellon" and "Fahnejelm" systems come and go, all of them on the same principle as this last comer. The ideas of the *Lancet* Commission regarding light and heat are somewhat hazy, for they talk of the incandescent mantle converting heat rays into light rays, and say that this system of lighting is "probably the best ever obtained for the conversion of heat into light rays." Yet nowhere in the report can we find the slightest evidence to warrant such an opinion. Welsbach burners consuming 7 cubic feet per hour we find, from the figures given by the Commission, raised the temperature of a room 10·5° in one hour. Batswing (Bray's) burners, burning 12 cubic feet per hour, raised the temperature 15.5° in an hour, so that the Welsbach gave the greatest increase of heat per cubic foot of gas burnt, the ratio being $\frac{10{\cdot}5}{7} : \frac{15{\cdot}5}{12} = 1{\cdot}5$ for Welsbachs, and 1·3 for common gas burners.

The heat produced per candle-power is given for Welsbach at 0·116°, and for common burners at 0·807°; but the candle-power is doubtful, so that the figures are of but small value. We shall further on consider this question of candle-power.

There can be no mistake, however, about the heat per cubic foot burnt, as the cubic foot measurement is reliable, and so far the common burner, producing less heat, is superior. So much for the heating question; now for the production of C. O_2.

Here again the Welsbach shows to advantage; if we accept the candle-power as the basis of comparison, $\frac{CO_2}{C.P.}$ gives a good result; but as we shall presently show, it is fallacious.

The significant figures are those giving = the CO_2 increase in the atmosphere per cubic foot of gas burnt. On this basis of comparison, again, the common gas burner is better, for it gives an increase of CO_2 per cubic foot of 4·6 against the Welsbach 4·8.

We think the Commission ought to have given the measurement of the candle-powers of the lights some little attention, considering they lay such stress upon the heat and CO_2 per C. P. The statement that the light of a Welsbach burner is 50 C. P. has been accepted as correct by the commissioners, but we insist that it should be clearly defined what C. P. is meant, whether mean spherical or maximum. We must also know by what method and against what standard the light was tested. The report entirely neglects these most important essentials, and therefore the candle-power estimates and the deductions made from them are hardly worth consideration.

We have already alluded in our previous article to the errors liable to enter into candle-power measurement of lights having a high luminosity and a low diffusive power like the incandescent gas light.

Luminosity is of no value; it is diffusive power we want in an illuminant. But granted that the candle-power is greater per cubic foot burnt in a Welsbach than in a common gas burner, the arguments based upon that fact by the Commission are again fallacious.

The argument that Welsbach burners consuming 7 cubic feet instead of 12, as in the common burners, must necessarily produce less heat and less poisonous gas, only holds good in one case, and that case is not met with in practice. It holds good only if a consumer is content with the same quantity of light and a reduced gas bill. But that is not what the consumer wants; he desires to get the great increase of light promised by the Welsbach burner. This is indeed the only reason why he should make the change.

It is obviously impossible to secure both advantages. As the old saying goes, "you cannot eat your cake and have it." The increase of light is got by burning nearly the same quantity of gas in a Welsbach as we do in a common burner. We cannot get this increase of light if we wish to secure the other advantages promised by the *Lancet* Commission, namely, less heat and less CO_2. Indeed the arguments of the *Lancet* amount to this: that by means of the Welsbach we can vastly increase the light and materially reduce the gas consumption at the same time.

But that is wrong. The fact is we may obtain the same light with less consumption, or more light with the same gas expended; but it is misleading to argue that the great increase of light and the great reduction in gas consumed can both be secured simultaneously.

Another important point not touched upon by the commissioners of the *Lancet* is the minimum light practicable with Welsbach mantels. The common size, nominally 50 C. P., we have been informed, is the smallest practicable. That being so, it is evident that consumers must go in for increase of light instead of reduction of gas consumption, for as a rule they do not reduce the number of jets when the new light is adopted.

To secure all the supposed benefits of the sanitary class so much dwelt upon by the commissioners, 16, or even 12 candle-power Welsbach lights would be required to replace the common batswing burner, instead of the so-called 50-C.P. light; but the incandescent gas people know only too well that such a small light would be an utter failure with the low diffusive power at their disposal.

We have spoken of the luminosity and diffusive power of an illuminant, and perhaps it would be well to explain the distinction between the two in a physical sense. We may find a light of high luminosity which has a low diffusive power, and vice versa, and perhaps the most familiar analogy can be found in musical sounds; there may be a sound produced of high pitch, but so weak as scarcely to be heard, which corresponds to high luminosity and low diffusive power; and again, a sound of low pitch but of great loudness corresponds to low luminosity but with great diffusive power.

In light, as well as in sound, we must consider amplitude of vibration as well as frequency. Common gas burners and electric incandescent lamps, although producing light of lower frequency, have great diffusive power owing to the greater amplitude of vibration, and this is the reason why a gas light can be seen further through a fog than an arc light. The same effect is easily noted on Welsbach lights in a fog, for they become invisible long before the common gas light is obscured, thus ocularly proving their low diffusive power.

It has now become necessary in measuring lights from different sources to measure diffusive power instead of simply comparing luminosities as has hitherto been practised, as these comparisons are reliable only when the lights compared are composed of rays similar in kind and in approximately the same proportional parts. To compare two so entirely different lights as the Welsbach and an electric incandescent lamp is unfair and absurd.

All these important points are passed over in this report of the *Lancet*, and the figures widely advertised by the interested parties are accepted and put forward as if they were carefully ascertained and verified by direct tests. Against this way of examining and reporting on such a simple affair, we protest most strongly.

Now we come to the matter of the existence of carbon monoxide in the products of combustion.

The commissioners say that they found no carbon monoxide during an eight hours' test of two Welsbach lights. We are not surprised at this, for the tests were too short in duration, and the blood solution is not the most reliable test for carbon monoxide; as a conclusive test it often fails.

The carbon monoxide is not always a product of the combustion, but is often produced when the mantels become sooty; the hot free carbon then splits up the CO_2 into carbon monoxide. This reaction take place chiefly at the upper and cooler end of the incandescent mantel.

On the whole, the Commission has failed entirely to prove anything, except that from a sanitary point of view the new light is not much better than a common gas burner, and for the reasons here given we trust that the report will not in any way be taken as authoritative and conclusive.

Complete, thorough and unbiassed tests would reveal very different facts and figures from those given by the rough, brief and unsound investigation made by the *Lancet* commissioners.

Finally, we may quote some measurements and estimates made by Heim, of Hanover (*Lumière Electrique*, Vol. XXVI, page 219). A batswing burner gave 16 c. p. in a horizontal plane, with a consumption of 14·8 liters per hour per candle, and at an inclination of 45° to the horizontal, 17·2 candles with the same consumption.

An Auer-Welsbach gave 14·4 candles in a horizontal plane, and only 10·5 at an inclination of 45° with a consumption of 9.8 liters per hour per candle in the horizontal plane, the consumption being the same in the 45° plane when giving only 10·5 candles. These figures do not show the same high economy as those given by the promoters of the new light and accepted by the commissioners, and prove that only in one plane is the higher luminosity obtained from the incandescent mantel.

At the inclination of 45° the consumption in old and new lights is, according to these estimates nearly equal per candle-power hour, being, approximately, 13 liters for the Welsbach, and 14 for the batswing gas burner.

The candle power per cubic foot of gas is the rock upon which the *Lancet* splits; upon its correctness depends the whole value of the conclusions arrived at, yet upon this important point the Commission has no tests to describe nor results to give, but it ought to have formed the most important determination in the investigation.

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*Editorial from the London "Electrical Review."

BOOK REVIEWS.

HOW TO BUILD DYNAMO-ELECTRIC MACHINERY. By EDWARD TREVERT. 8vo. 330+ix pp. Price $2.50. Lynn, Mass.: Bubier Publishing Company.

This is another attempt, and withal a very successful one, to bring within the scope of the amateur the art of constructing for his own use electrical machinery that will be of real service. The author has at the outset disclaimed the idea that it is a practical treatise, but in order that his readers may attack the problem intelligently he has been compelled to deal with the technical side of it, as well as that which by way of distinction he calls the "practical side." He seems to have handled this somewhat difficult task judiciously, thus avoiding the two rocks upon which authors sometimes wreck—empiricism on the one hand and severe technicism on the other. As explanatory and in extension of the main subject—that of electrical construction for amateurs—he has given chapters on commercial dynamos and motors. This portion of the book is less satisfactory than the rest, for little discrimination seems to have been used in selecting the "commercial" apparatus described: thus side by side are placed apparatus which has never come into commercial use and that which is regarded as standard everywhere. This juxtaposition of the two, without comment, is likely to convey the idea of equal merit for both, whereas, if public approval be any criterion, they stand far apart.

The book is well printed on heavy tinted paper, and the illustrations of the commercial machines are usually excellent, but the diagrams, which are profuse and ample, are some of them very cheap and crude. The book as a whole is well conceived, and should supply in a very satisfactory manner, the want which it is intended to fill. About the worst thing that can be said of the book is that its cover is a bright, glaring red—not the shade that is reputed to attract white horses, but of the kind that would be most aggravating to an undomesticated bull, or to the followers of Herr Most. There is nothing anarchistic between the covers of the book, but why the publishers should offend against all dictates of good taste by binding it in ugly anarchistic red is beyond comprehension.

ELECTRIC LIGHTING PLANTS—THEIR COST AND OPERATION. By W. J. BUCKLEY. 8vo. 275+iii pp. Price, $2.00. Chicago: Wm. Johnston Printing Company.

This book is unique in electrical literature, and its scope will be best defined in the author's own words:

"The purpose of this pamphlet is to give to intending purchasers of lighting plants such details as may aid them in forming a fair estimate of the cost of construction and operation of their proposed station."

The writer is neither electrician, engineer nor expert, but a salesman, identified since 1885 with what is now the Fort Wayne Electric Corporation, and, in a noble effort to deserve his salary, has mentioned no other lighting apparatus but the "Wood," as manufactured by them. For this an apology is offered, as a well-intended impartiality is otherwise observed.

"Many books are written for the engineer, fireman, dynamo tender and wireman, but few for the buyer, whose investment gives them employment, and it is the hope of the writer that the data given may aid the purchaser in the prevention of some of the usual mistakes in the first construction of his lighting plant, or assist him in the increase of the economy of its operation."

After this introduction, which is as unique as the book itself, criticism would be disarmed, but we find little cause for criticism, further than that from the introduction one is led to expect to find a trade catalogue, which this book distinctly is not. In turning over its pages we find them filled with commercial data which are valuable to every business man contemplating an investment in electrical plant, and this has been so carefully and judiciously collated as to make reference useful and satisfactory. We believe the book will fill a want not hitherto filled, and find acceptance among a wide circle.

In its make-up it lacks a table of contents, but this is probably best in a book covering such a wide variety of subjects as this, yet the full index which we should expect under these conditions is also wanting—that given being very meager. We would also like to have seen fuller data in regard to direct current incandescent lighting, but perhaps this will be supplied in a succeeding edition.

N. E. L. A.

Programme of the Cleveland Meeting.

TUESDAY, FEBRUARY 19.

Meeting of the Executive Committee at 9 A. M., Parlor 138, Hollenden Hotel.

Morning Session, 10:30 *o'clock* (*Army and Navy Hall.*)

Address of welcome by Mayor of Cleveland.
President Francisco's address.

Paper by N. W. Perry: "The Storage of Energy Essential to Central Station Economy: How It May be Accomplished and the Economies Resulting."

Discussion—John W. Langley, W. M. Stine, M. J. Perry.

Report of Committee on Relations Between Manufacturing and Central Station Companies, Frederick Nicholls chairman.

Afternoon Session, 2 *o'clock*.

Paper by E. J. Houston and A. E. Kennelly: "A New Method of Measuring Illumination."

Discussion—W. A. Anthony, C. D. Haskins, W. S. Howell, Edward Weston, L. Stieringer.

Report of Committee on Data, H. M. Swetland chairman.

Discussion—W. R. Gardener, E. L. Powers, H. W. Sexton.

Paper by Walter E. Harrington: "Correct Method of Protecting Electric Circuits."

Questions and Answers. What is it you wish to know?

Executive session.

WEDNESDAY, FEBRUARY 20.

Morning Session, 10 *o'clock*.

Paper by Edward Weston: "Some Economies in Electric Light and Power Stations."

Paper by C. N. Black: "Large Arc Dynamos."

Discussion—S. M. Hamill, J. J. Wood, F. W. Rollins, E. R. Weeks.

Topic: "How to Light Large Cities."

Discussion—Frederic Nicholls, George A. Redman, James I. Ayer, E. F. Peck, C. R. Huntley, Robert Lindsay, F. H. Clark, T. C. Smith, J. F. Morrison.

Report of Committee on Finance, John A. Seely chairman.

Questions and Answers. What is it you wish to know?

Executive session.

Afternoon Session, 2:30 *o'clock*.

Paper by E. A. Leslie: "The Operation of High Tension Currents Underground from a Physical and Financial Standpoint."

Discussion—H. J. Smith, W. H. Browne, C. H. Wilmerding, John A. Seely, C. L. Edgar.

Paper by L. B. Marks: "Arc Carbons and the Rating of Arc Lamps."

Topic: "Incandescent Lighting vs. Other Methods."

Discussion—H. T. Edgar, E. F. Phillips, W. S. Barstow, E. A. Armstrong, J. Gwynne, B. P. Holmes.

Questions and Answers. What is it you wish to know?

Executive session.

Evening Session, 8 *o'clock*.

Topic by A. J. Wurtz: "Practical Demonstrations of Protecting Lines from Lightning."

THURSDAY, FEBRUARY 21.

Morning Session, 10 *o'clock*.

Paper by Dr. Louis Bell: "The Monocyclic System."

Discussion—A. E. Kennelly, L. B. Stillwell, A. F. Kelly.

Report of Committee on Rules for Safe Wiring, Wm. J. Hammer chairman.

Topic: "Underwriters' Rules vs. National Electric Light Association Rules."

Discussion—Wm. Brophy, C. H. J. Woodbury, J. J. Burleigh, A. W. Field.

Afternoon Session, 2:30 *o'clock*.

Executive session.
Report of secretary and treasurer.
Executive Committee.
Election of officers.

Transportation Arrangements.

Mr. C. O. Baker, Jr., master of transportation, makes the following announcement:

"The various passenger associations have granted the rate of a fare and one-third for the round trip, on the certificate plan, from all points east of Chicago, Burlington, Peoria and the Mississippi River to Cleveland. Ask the ticket agent from whom you purchase your ticket for a delegate's certificate to the National Electric Light Meeting, which, when properly filled in and indorsed at the Association headquarters in Cleveland, will entitle you to return for one-third the regular fare.

"A special vestibuled train, composed of parlor cars, will leave via the New York Central and Hudson River Railroad at Grand Central Station, New York, at 9:30 A. M. Monday, February 18. Leave Albany at 1 P. M; Utica 3:17; Syracuse 4:40; Rochester 6:30; Buffalo 7:25 (Central time); Erie 9:33; arriving at Cleveland at 11:55 P. M.

"Seats for this train can be procured from C. O. Baker, Jr., 136 Liberty street, New York City, at the following rates to Cleveland: From New York and Albany, $3; Utica, $2.25; Syracuse, $2; Rochester, $1.50; Buffalo, $1.

"The passage rate from New York to Cleveland is $13; rate returning, with certificate properly indorsed, $4.35.

"As the Wagner Parlor Car Company decline to charter their cars it makes it necessary for us to pay the full rate for the entire space; therefore it is very important that the applications for space should be made at the earliest possible moment."

Personal.

Mr. Charles F. Brush has consented to deliver an address covering his reminiscences of early arc lighting at the Cleveland Convention of the N. E. L. A. It should be one of the leading features of the meeting.

The List Grows.

Among the concerns who have resented in an expressive manner the impudence of the publisher of the *Electrical World* may be mentioned, we believe, the Western Electric Company of Chicago and New York.

An Enlarging Business.

The Electrical Installation Co., the largest construction concern in the West, are about to move from their present quarters on the ninth floor of the Monadnock Building and will occupy the entire suite on the Jackson and Dearborn street front on the eleventh floor.

Standard Underground Cable Company.

The Standard Underground Cable Company has just closed a contract with Mr. J. R. Wiley to represent them in the West. with headquarters in the Rookery Building, Chicago. Mr. Wiley is well known in electrical circles, having been connected with electrical enterprises for many years, including eight years in the Metropolitan Telephone and Telegraph Company as superintendent of private lines. He is a brother of Mr. Geo. L. Wiley, who has represented the Standard Underground Cable Company in New York and the East for the past ten years. Mr. J. R. Wiley assumes the management of the Western sales department made vacant by the untimely death of the well-known and popular Fred. E. Degenhardt and was Mr. Degenhardt's personal friend. Mr. Wiley is a Western man and his family are Chicagoans.

General News.

What is Going on in the Electrical World.

Waco, Texas.—The electric street car systems and the electric light companies of Waco are to be consolidated.

Richmond, Mo.—An electric light franchise has been given by public vote to the Richmond Electric Light Company.

Mexico, N. Y.—This village has voted to have electric lights and will put in a plant as soon as arrangements can be made.

Mayfield, Pa.—A committee is communicating with several companies in regard to electrically lighting this entire borough.

Louisville, O.—Mr. Wilson, of Orrville, has asked the council for a franchise to put in an electric light plant in Louisville.

Freeport, Ill.—Meetings have been held at Cedarville to consider the question of an electric road between Cedarville and Freeport.

Peoria, Ill.—The Prospect Heights Electric Railroad Company expect to begin the building of an electric road here within six weeks.

Milwaukee, Wis.—The contract for wiring the new city hall has been given to the Western Electric Company, whose bid for the work was $14,370.83.

Wells, Minn.—The village council has let the contract for putting in an electric light plant, all complete, to Clausen & Bonwell, of St. Paul, for $6,936.

Canisteo, N. Y.—The electric railway connecting Canisteo with Hornellsville has proven so great a financial success that a rival line is to be built.

Sing Sing, N. Y.—At the coming charter election the voters will be asked by the village trustees for an appropriation of $5,000 for an electric fire alarm and other purposes.

Washington, Ill.—A boiler explosion at the local electric light works recently shattered the engine and dynamo, destroyed the building and injured five persons, one fatally.

Jacksonville, Fla.—The Board of Works announces in an advertisement that the city proposes to supply the citizens with electric lights—incandescent and arc—from its new plant.

Palatka, Fla.—The Palatka Gas, Light and Fuel Company has closed a five years' contract with the city to furnish 100 32 C. P. incandescent electric lights, and 15 2,000 C. P. arc lights for public lighting.

Ottawa, Can.—Several thousand strangers visited Ottawa during the late carnival. The electric railway carried over 125,000 people during the week without an accident and without a single hitch.

Tampa, Fla.—The Old Dominion Electrical Construction Company's bid of $8,837.50. for furnishing 250 32 C. P. lamps, and 31 2,000 C. P. arc lamps, with the necessary wiring, has been laid before the council.

Claremont, N. H.—A charter has been applied for enabling the applicants to run a line of electric cars from Claremont Junction to West Claremont, thence through the village to Newport and Sunapee Lake.

Florence, Col.—The Arkansas Valley Electric Company has started its works here and are supplying electric light to the business houses and many residences. A number of arc lights are to be erected on the streets.

Seneca Falls, N. Y.—A franchise acceptable to the company having been granted by the Board of Trustees, the construction of the electric railway to Cayuga Lake from this village will begin early in the spring.

Richmond, Va.—The city council is unanimously in favor of a city lighting plant, and it is believed the board of aldermen will be brought to vote in favor of the measure. The opposition, however, is very strong.

Kilbourn City, Wis.—There appears to be a strong probability of the electric road between Devil's Lake and Baraboo being built next summer. Parties are pushing the enterprise vigorously and with apparent success.

De Land, Fla.—The electric light company has just completed its power house. New machinery will be put in for arc lights, with which the streets are to be lighted instead of the incandescent lights used for the past two years.

Pittsburgh, Pa.—The Coraopolis and Neville Island Electric Railway has been sold to the syndicate operating the West End and the Grand Avenue Traction roads. The Carnegie branch of the West End system is nearing completion.

Kansas City, Mo.—An electric light race-track will be opened in Kansas City in the near future. Robert J. Holmes has leased the Exposition Driving Park and is negotiating for the purchase of an electric light plant with which to illuminate the track.

Athens, Ga.—The movement to convert the 1,400 H. P. of Tallesee shoals into electrical power and run it into Athens to be sold cheaply to the different manufacturing interests is still progressing. The surveyors have nearly completed their work.

Martinsburg, W. Va.—The city council has decided to ask the Legislature for permission to issue $15,000 in bonds for the purpose of securing funds to build an electric light plant. The plant is to be used in supplying light for the corporation only.

Pottsville, Pa.—A mortgage from the Schuylkill Electric Railway Company to the Real Estate Trust Company of Philadelphia, trustee, for the sum of $500,000, secured by the roads and franchises of the company, has been placed on record at the recorder's office here.

Sea Isle City, N. J.—The Sea Isle City Electric Light, Water and Power Company intend to change the present incandescent electric light system to an arc light plant. The same company are endeavoring to secure a franchise for a trolley road on Landis avenue.

Hillsborough, N. H.—A syndicate of local capitalists have purchased land and water power on the Contorcook River, about two miles below Hillsborough bridge, with the purpose of erecting an electric plant there, from which power will be transmitted to this village and also to Hermicker.

Ellsworth, Me--A gentleman of means has made a proposition to furnish two thirds of the capital necessary to build an electric road from Ellsworth Falls to deep water, or below the bar, providing one-third the total capital be raised in this city. The capital required is about $60,000.

Peekskill, N. Y.—The consents of property owners to the laying of rails of the new electric railroad in Peekskill from the railroad station to the State Camp of Instruction and to Lake Mohegan have been obtained and the company will begin the laying of rails as soon as the weather will permit.

McKeesport, Pa.—Messrs. C. H. Lloyd, Peter Shields, H. Davis, J. M. Shuck, O. C. Hartley and John J. McCloskey, of Pittsburg, stockholders in a company organized to manufacture the Borland-Fritz electric coal mining machinery, last week visited W. H. Brown's Sons' mines at Boston, where a satisfactory test of the machine was made.

White Plains, N. Y.—The New York, Elmsford and White Plains Railroad Company has received the franchise for a trolley road in this village; $2,500 is to be deposited in the White Plains Bank as a forfeit if the road is not completed by August 1. It will run to the Fair Grounds and to Silver Lake.

Lockport, N. Y.—The Standard Construction Company of New York have offered, in a communication to the mayor, to build an electric road in Lockport. to be ready for use next summer, if the city would give them a franchise guaranteed against litigation. The city officials were to consider the matter.

Iowa Falls, Iowa.—A local company has just been organized to put in an electric light plant and is capitalized at $15.000. The officers are: President, L. B. Bradley, Peoria; vice president, J. D. McKay; secretary and treasurer, H. C. Miller. The directors are these and G. A. Courtney and Z. K. Hoag.

Beaver Falls, Pa.—Arrangements are now being made by which in a few months the entire Beaver Valley, including the towns of College Hill, Beaver Falls, New Brighton, Sharon, Bridgewater, Beaver, Rochester, Freedom and Conway, will be connected with Pittsburgh by a complete line of electric street railways.

Amesbury, Mass.—It is stated here upon good authority that a deal has been made whereby the Haverhill and Amesbury electric railway and the Newburyport and Amesbury electric railway are to soon pass under the control of the Lowell Street Railway Company. For several weeks negotiations have been in progress looking toward the deal.

Morristown, N. J.—The common council at their last monthly meeting had a proposal made to them to put Welsbach lights in the park in place of the present electric arc lights, and were disposed to accept the offer on the score of economy, but the mayor thought the matter should have further consideration and on a tie vote the proposal went over.

Springfield, O.—In connection with the proposed electric railroad from this city to Urbana the promoters are considering the purchase of the beautiful property called Aberfelda, west of town, on Mad River, for the purpose of building a magnificent summer hotel for the accommodation of guests from Cincinnati, Dayton, Columbus and other places.

Buffalo, N. Y.—"It is reported on reliable authority," says the *Commercial*, "that a number of local capitalists are planning to build a new electric railway to connect Buffalo and Niagara Falls. It is understood that about two-thirds of the capital stock has been promised, and that there is every probability that the line may be built early this year."

Paw Paw, Mich.—Detroit capitalists have submitted a proposition to build a standard gauge electric railway with a 60-pound rail, fully equipped, from Paw Paw to Lawton, for a $20,000 bonus, 30 years' exclusive franchise of the streets, and a 10 years' pledge of all Paw Paw business. A committee has been instructed to continue the correspondence concerning the matter.

Fall River, Mass.—A bill before the Legislature for an electric railway is that of the Fall River and Providence Street Railway Company, of which the incorporators named are Charles F. Shaw of New Bedford, Frank S. Stevens of Swanzey, Robert T. Davis, George W. Slade, Frank W. Brightman, William F. Thomas and Benjamin Cook of Fall River. The capital stock is to be $250,000.

Grafton, Mass.—The Grafton Electric Company's new plant has been put in operation and gives great satisfaction. The lines extend over five villages—Grafton, North Grafton, Saundersville, Fisherville and Farmersville. The dynamos are of 1,000 lights capacity, of the alternating type. The station equipment was supplied by the Fort Wayne Electric Corporation of Fort Wayne, Ind.

New Orleans, La.—The St. Charles Street Railroad Company are having their roads changed to an electric system under the supervision of P. J. Partenheimer of the contracting firm of C. E. Loss & Co. of Chicago. Electricity is to be introduced also on the lines of the Canal and Claiborne Company.—There is talk on the other side of the river of building a trolley road connecting Algiers, Gretna and Harvey.

New Brighton, S. I.—The village trustees have granted franchises which in effect give three companies the privilege of constructing and operating electric roads in this village. These companies are the Staten Island Electric Railroad Company (Thomas syndicate), the Midland Company (Nathaniel Niles, president), and the Staten Island Interior Electric Railroad Company, a creation of Erastus Wyman.

Brooklyn, N. Y.—The aldermanic committee on gas and electricity has been directed to thoroughly investigate the subject of electric lighting, including contracts, specifications and the manner of carrying out the same by the different companies; also their mode of measurement and tests of lights.—The Kings County Electric Railroad Company are said to be seriously considering a change from steam to electricity as a motive power on their road.

Brockton, Mass.—The Edison Electric Illuminating Company's plant has changed hands. The purchase was made by a syndicate of capitalists, most of whom are Boston men. The majority of the new stockholders are interested in the stock of the Brockton Street Railway Co. A. A. Glasier, treasurer of the Brockton Street Railway, was elected president. E. S. Webster of Boston, J. P. Morse and H. B. Rogers of Brockton, and B. A. Reed of Boston will constitute the board of directors.

Lynchburg, Va.—Bids for building a plant capable of furnishing 300 arc lights and about 2,000 incandescent lights, and also for lighting the city by contract, will be advertised for at once. All bids must be in by February 26th, when they will be opened. Each bidder will be required to send a certified check for $500 as a guarantee of good faith. In case the city decides to build a plant, the successful bidder will have to put up a forfeit of $5,000 to guarantee the faithful carrying out of the contract.

Chicago.—The North Side and West Side trolley railway ordinances, after amendment by the mayor, have passed the council.—The Chicago Belt Line Street Railway Company have applied to council for a franchise for a street railway upon certain of the streets named in the ordinance of the General Electric Railway Company now in process of incorporation, and requests that action on said ordinance may be deferred until the Belt Line ordinance may be considered with it."

Northampton, Mass.—Lyman D. James, Alvan Barrus and others have applied for a charter as the Western Hampshire Street Railway Company to enable them to construct and operate an electric railway in the towns of Williamsburg, Goshen, Chesterfield, Worthington and Cummington, in the county of Hampshire, Mass. The applicants ask for capitalization at $150,000 and $50,000 bonds, and promise to build in five years or forfeit charter as to each town not built in. Water power will be used in generating electricity for the road, and freight will be carried.

Albany, N. Y.—The promoters of the proposed electric railway from Albany to Castleton, via Greenbush, have secured the right of way for the line. The railway will be for the accommodation of passengers and freight.—By a unanimous vote of the common council, the question of the city doing its own lighting is to be submitted to the popular vote at the next election.—A bill has been introduced in the Assembly providing that motormen and gripmen on electric roads shall be given an examination as to competency by the officers of the road before employment.—A bill has been introduced in the Assembly providing that all trolley cars shall have an appliance to determine the rate of speed, and that the maximum provided by law shall not be exceeded under severe penalties; also a bill forbidding electric cars in cities of over 500,000 to run faster than eight miles an hour.

Indianapolis, Ind.—The electric light companies of several cities in the State have united in forming an organization, to be known as the Indiana Electric Light Association, for mutual benefit "derived from an interchange of ideas born of practical experience, to the end that they may not alone cheapen the production of electric light, heat and power and protect themselves from imposition from whatever source, but also render better service in all branches of their business, thus benefiting their patrons while furthering their own interests in a legitimate business way." Meetings will be held in Indianapolis every year on the first Wednesday in February. The following officers have been elected for the first year: President, J. W. Roney, Richmond; vice president, W. K. Smith, Union City; secretary, Dallis Edwards, Decatur; executive committee, H. A. Smock, Martinsville; C. C. Perry, Indianapolis; J. W. Morrison, Frankfort; H. W. Frund, Vincennes, and J. D. Edwards, Decatur.

Telephone and Telegraph.

The contractor, James Scull, has begun work on a telephone line from Jackson, N. C., to Gumberry.

The Central New York Telephone Company have asked the common council of Utica for permission to construct underground conduits for their wires on such streets as may be deemed advisable to use.

At Berlin, Wis., there is considerable talk among stockholders of consolidating the Waushara Telephone Company with the Badger Telephone Company.

A twenty-five years' franchise has been granted to Geo. P. Eaton and associates by the city council of Tacoma, Wash., empowering them to carry on a telephone business. The ordinance provides that the company shall not charge more than $4 per month for business houses and $2.50 per month for residences, and that the company shall give the city twenty telephones at $1 each per month, and must spend $10,000 in one year after accepting the franchise.

Lawyer Simon Sterne, of New York, who is one of the most active protestants against the increased rates of the Metropolitan Telephone and Telegraph Company, has obtained a temporary injunction from Judge O'Brien restraining the company from moving the telephone instrument from his office. Mr. Sterne refused to pay the increased charge.

J. T. Foley and H. R. Winn expect to have a full Bell telephone exchange in operation in Martinsville, Ind., by June 1.

General Manager Gifford, of the Ohio Valley Telephone Company, promises to have shortly the finest telephonic lay-out in the country at his exchange in Indianapolis, and states that the American Long Distance Telephone Company will run a splendid line to Louisville from Indianapolis as soon as the weather will permit, and while that company is doing that work his company will be building a long distance line through the bluegrass fields of Kentucky to Cincinnati by way of Versailles, Lexington and other large towns in that part of the State.

E. K. Baker, superintendent of the Austin division of the Southeastern Telegraph and Telephone Company, lately stated to the Houston *Post* correspondent that his company is now engaged in making improvements in Texas that will involve an expenditure of $500,000. They are pushing the construction of their new metallic circuit for long distance speaking purposes with all possible speed. The new circuit has been completed from Dallas and North Texas to Waco. The new line from Waco to Taylor will be completed by March 1, and by April 1 will be built into Austin and pushed on to Houston and Galveston without delay.

A telephone line is being put up between Wellington and Lewiston, N. C. There will be five stations on the line—at Wellington, at Howards, Windsor, and at the telegraph station at Lewiston, where it will connect with the Western Union telegraph line, and one in the village of Lewiston.

Over 1,200 persons attended the ball of the telephone girls at Boston on Tuesday night of last week. The exchanges in the city were represented almost en masse. Many of the girls proved excellent dancers and gay and handsome ones were numerous enough to ameliorate the classical frigidity of a Boston ball room.

The Marseilles Telephone Company, composed of H. R. Adams, T. J. Neff, L. M. Jennings and R. F. Knott, just incorporated with a capital of $2,000, will set up a telephone plant in Marseilles, Ill.

The Philadelphia councils' electrical committee have reported favorably on ordinances granting privileges to the Drawbaugh Telephone and Telegraph Company and the Central Telephone Company. The ordinances had been amended and made identical at a previous meeting, and with the exception of reducing the bond from $500,000 to $100,000 the committee made no further changes in their provisions.

The Central Union Telephone Company has announced a big reduction in rates to local subscribers at Decatur, Ill. The charges henceforth will be $18 per year instead of $36 for business telephones and for residence telephones within a half mile radius of the central office $12 a year. There will be no reduction in the toll line services.

The Atlanta Bell Telephone Company are about to establish a telephone exchange at Tallahassee, Fla.

The Business Men's Association of Brookville Ind., have organized a telephone company whose operations will reach out to surrounding towns and systems.

The ordinance committee have recommended to the city council of Springfield, Ill., the passage of an ordinance reducing the per cent. of gross earnings which the new telephone company shall pay into the city treasury from 3 to 2½ per cent. A proviso was also inserted that the new company cannot sell its franchise within a year.

Preparations are being made to extend the telephone line from Pinetown, N. C., to Plymouth.

The Northwestern Telephone and Electric Company of Milwaukee will ask a franchise of the Green Bay and Fort Howard common councils for a telephone system in the two cities. The company is a rival of the Wisconsin Telephone Company and is putting in systems at Appleton, Neenah, Menasha and other Fox River Valley cities, which will be connected by a toll system.

The common council of Jamestown, N. Y., has granted the Phœnix Telephone Company of New York permission to erect a telephone system and operate the same in Jamestown.

A fire at the telephone exchange at Henderson, Ky., a few days ago burned out the city's telephone service.

A bill has been introduced in the Illinois Legislature fixing telephone rates as follows: The rate for telephones in cities of 1,000,000 inhabitants and over shall not exceed $78 per annum; in cities of 500,000 and less than 1,000,000 not to exceed $66 per annum; in cities of 100,000 and less than 500,000 not to exceed $48 per annum; and all cities less than 100,000 not to exceed $36 per annum.

In the Assembly at Albany a bill has been introduced reducing telegraph rates to 15 cents for ten words in day time and twenty words at night, and one half cent for each additional word either day or night.

Prominent members of the Minneapolis board of trade confidently assert that by this time next year the Stockholm plan of a mutual telephone company will be in force in Minneapolis. They expect to reduce the annual expense of telephones to $10 or less per subscriber after the company is once on its feet. Every one having a telephone will be a stockholder, the initiation fee being $100, and after that the expense to be levied in periodical assessments.

The Mason Telephone Company is about to remove its shops from Sumter, Ga., to Richmond, Va.

There are now twelve transatlantic cables connecting Europe with the United States and Canada, and steps have been taken to lay a cable across the Pacific from British Columbia to Australia by way of the Fiji Islands. The circle of the earth will then be completed, but not so directly as it would be by a cable from America to Japan.

An effort is being made to establish a plant of the Bell telephone in Camden, S. C.

Lincoln, Neb., is subscribing liberally for a new telephone service proposed to be given there by a company which is to use a new Chicago company's instruments.

A bill is now pending in the Missouri Legislature, and is likely to pass, which reduces the annual rental of telephones in St. Louis to $60; in all cities of the State having a population of less than 200,000 but more than 50,000 to $48 per year; in cities having a population of less than 50,000 but more than 25,000 to $30 per year, and in cities having less than 25,000 inhabitants to $20 per year. The annual rental for the use of telephones to private residences is reduced to $30 in cities having more than 50,000 inhabitants, and in cities having less than that population the price is reduced to $20 per year. The penalty for each offence is a fine of not more than $500 nor less than $100.

A telephone company is about to be organized in St. Louis, with a proposed capital of $600,000. One of the promoters states that the company proposes "to give St. Louis an up-to-date underground system in line with Eastern cities at a cost to business men of not over $60 per year and residences $48. This stipulation is embodied in the franchise we ask for and if it is possible we propose making the tariff even less. The board of directors will consist of J. J. Schultz of the Schultz Belting Company, now acting president; E. W. Stann, secretary to August Busch; Moses Greenwood, Jr., real estate; Thos. J. Ward, contractor; August A. Busch of the Anheuser-Busch Brewing Company; Clark H. Sampson. T. J. Hennessey, ex-Railroad Commissioner; Andrew Haley, real estate; J. M. O'Shea, chief grain inspector, and ex-Congressman Chas. F. Joy."

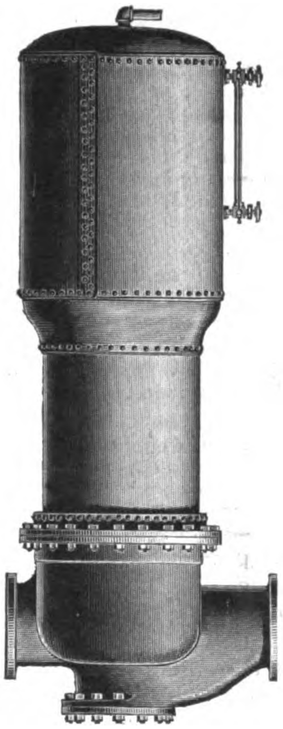
Efficiency Test of the Stratton Steam Separator.

The following report of a test of the Stratton Steam Separator, manufactured by the Goubert Manufacturing Company, 14 and 16 Church street, New York, will doubtless prove interesting to all steam users:

SIBLEY COLLEGE,
CORNELL UNIVERSITY,
R. H. THURSTON, Director.
DEPARTMENT OF EXPERIMENTAL ENGINEERING,
R. C. CARPENTER.
ITHACA, N. Y. Jan. 5, 1895.

GOUBERT MFG. CO., 14 and
16 Church Street, New
York City:

GENTLEMEN: I send you with this letter a short summary of the test which we have made on the Stratton Separator. The results show that the Separator is practically perfect, and removes all the moisture which can possibly be taken out by mechanical means. I think we will make another test in which we inject water into the steam pipe, thus increasing the percentage considerably of water in the steam supplied. This latter will not be of any great practical interest, but will bring out, of course, the capacity of the Separator for extraordinary conditions. If you have no objection I will publish a copy of this report in the next number of the Sibley *Journal*, and for that purpose would be pleased to have you loan us an electrotype showing vertical section.



STRATTON SEPARATOR.

Test of Stratton Improved Separator.

For this test the steam pipe leading to the Separator was surrounded for a portion of its length with a jacket which could be filled with water to any desired height, the purpose of the water jacket being to condense as great a per cent. of the steam as possible. The discharge of steam from the Separator was led to a surface condenser, where it was condensed and the amount carefully weighed. The drip or water discharged from the Separator was led to a barrel standing on a pair of scales and accurate weighings were made of the water taken out from the steam by the Separator. A throttling calorimeter was placed in the steam pipe directly after the steam left the Separator. Pressure gauges were placed either side of the Separator. Observations were taken and the results reduced by Messrs. Collins, Hubbard and Thomas of the Class of '94. The following is the general summary of the results: The steam supplied to the Separator contained moisture the percentage of which varied from a little over 5 to nearly 21. That discharged from the Separator was in every case nearly dry, it containing in every instance less than 1 per cent. of moisture. The Separator was worked up to its full capacity and there was no appreciable reduction of pressure. The summary of the results of different runs is given in the appended table. During these runs the water was kept at a constant height in the Separator:

No. of run.	Pressure of steam.	Moisture in steam supplied Separator. Per cent.	Moisture in steam leaving Separator. Per cent.	Quality of steam leaving Separator. Per cent of dry steam.
1	60	6.55	0.95	99.05
2	61	17.2	0.94	99.06
3	62	15 31	0.9	99.1
4	76	15.6	0.6	99.4
5	61	20.9	0.8	99.2

Respectfully submitted.
(Signed) R. C. CARPENTER.

New Catalogue.

We are in receipt of the new catalogue of Railway Material just issued by the Central Electric Company of Chicago. It is a handsomely gotten up pamphlet of 164 pages, with flexible cloth covers, and contains everything imaginable in the electric railway construction line. It is profusely illustrated with wood cuts of the various fixtures and appliances, and thus constitutes the most complete compendium of electric railway goods that has ever been called to our attention. It will prove of great value to the electrical fraternity at large, and aside from its intrinsic merit is too good to throw away. Unfortunately, there are many catalogues of which this cannot be truthfully said. Copies may be had on application to the Central Electric Company, 173-175 Adams street, Chicago, Ill.

The Hart & Hegeman Manufacturing Company of Hartford, Conn., have ready for circulation their catalogue "B," which contains descriptions, dimensions, capacities and prices of their celebrated switches, etc., with illustrations of the various sizes from 5 to 50 amperes, single and double pole. There are also illustrations of the flush plates used with the regular Hart switches, and explanations of the various features that have commended the switches and appendages to users and the trade.

RECENT COMPANY ELECTIONS.

The West Shore Telephone Company, Kingston, N. Y. Directors: Dr. C. O. Sahler, F. D. Winne, Henry Abbey, Enoch Carter, Dr. R. Thompson, Clarence Schoonmaker, Kingston; H. C. Tillson, M. A. Presler, Highland; W. S. Ransley, G. S. Clark, Dr. W. B. Snow, Milton; Davis Winne, The Corner; A. L. F. Deyo, Gardiner.

Hamilton, Grimsby and Beamsville Electric Railway Company, Hamilton, Can. President, C. J. Myles; vice-president, Thomas W. Lester; secretary and treasurer, Adam Rutherford. Directors; John Hoodless, C. J. Myles, Thomas W. Lester, A. H. Myles, Walter Grieve, John Gage and Robert Ramsay.

Carbondale Electric Light Company, Carbondale, Pa. President, E. Clarkson; vice-president, E.W. Mills; treasurer, Joseph Birkett; secretary, George Herbert. Directors: Joseph Birkett, J. Edwin Watt, E. W. Mills, C. O. Mellen and Edward Clarkson.

Molyneux Electric Manufacturing Company, Buffalo, N. Y. President, Edgar Van Etten, of New York; vice-president, H. Walter Webb, of New York; treasurer, Frank Hammond; secretary, Walter P. Trible; general manager, J. W. Cobb; electrical superintendent, Barton S. Molyneux.

Detroit Electric Light and Power Company. All of the old board were re-elected and the directors elected officers as follows: F. F. Palms, president; George M. Vail, vice-president; William S. Crane, treasurer; William H. Fitzgerald, secretary and manager.

Baltimore Traction Company, Baltimore, Md. President, Frank Brown; vice-president, J. S. Hagerty; treasurer, Frank S. Hambleton; secretary, J. Clarence Bowerman; general manager, W. A. House, Jr. Directors: P. A. B. Widener, William L. Elkins and Sidney F. Tyler, of Philadelphia; and Howard Munnikhuysen, John A. Hambleton, Henry A. Parr, T. Edward Hambleton, James S. Hagerty and Frank Brown, of Baltimore.

Trenton Passenger Railway Company, Trenton, N. J. President, Henry C. Moore; vice-president, Thomas Barr; treasurer and secretary, John L. Kuser. Directors: Henry C. Moore, Thomas Barr, E. J. Moore, Col. A. R. Kuser and Ferdinand W. Roebling. Two of the old directors, S. K. Wilson and Barclay Stokes, were dropped.

The directors of the Ballston Spa Electric Railroad Company have elected the following officers: President, Thos. Craig; vice-president, Thomas Kerley; treasurer, Chas. E. W. Smith; secretary, Frederick R. Barnes.

Owego Electric Light and Power Company, Owego, N Y President, Dr. C. R. Heaton; vice-president, E. W. Stone; secretary and treasurer, George F. Andrews; manager and superintendent, Horace Yothers. Directors: Wm. Phelps, Hon. George F. Lyon, Binghamton; Wm. S. Truman, George F. Andrews, E. W. Stone, Dr. E. A. Mayor and Dr C. R. Heaton.

INCORPORATIONS.

The General Electric Railway Company, Chicago.—to deal in railway appliances. Capital stock, $1,000,000. Incorporators: Daniel M. Simmons, William A. Youmans and George Pfleger.

The Electric Light Photographic Company, Chicago. Capital stock, $5,000. Incorporators: Oscar L. Sturtz, Robert E. Brown and Chris Florup.

The Rahway Electric Light and Power Company, Rahway, N. J.—to furnish light and power, especially power to operate the new electric railway in Rahway. Capital stock, $200,000. Incorporators: Capt. C. W. Boynton, of Woodbridge; Henry Mourer, Robert W. De Forest and Frank A. Patterson, of New York City; H. W. Thiele, of Brooklyn; H. W. Douty of Asbury Park, and Jackson Jacques, of Rahway.

The Newton Light and Power Company, Newton, Kan. —to furnish light, heat and power to the city of Newton and its inhabitants. Capital stock, $50,000. Promoters: Lewis B. Gawtry, N. Y. City; Julius A. Bailey, Philadelphia; John C. Nicholson, Newton.

The San Antonio Electric Company, San Antonio, Texas. —to manufacture and sell electric light, heat and power for all purposes. Capital stock, $100,000. Promoters: Ronald T. McDonald, Edward J. O'Beirne, Wm. H. McGaw.

The United Switch Company, Newark, N. J.—to buy, sell, lease, license and manufacture electrical machinery and apparatus in Newark and New York. Capital stock, $100,000. Incorporators: Henry C. Hines, William C. Morton and Robert D. Beatty, all of Newark.

The Llanerch Heat and Light Company, Llanerch, Pa.—to supply light, heat and power, or any of them by means of electricity. Capital stock, $25,000. Promoters: Edw. Worth, Mercer Strong, Wawa, Pa.; Frank A. Hays, Lansdowne, Pa.

The Electric Kindling Wood Company, Jersey City, N.J. —to manufacture, buy and sell "electric kindling wood," etc., and buy and sell all kinds of lumber. Capital stock, $10,000. Promoters: Chas. L. Netting, Jr.; Fred. W. Aldrich, Pittsburg, Pa.; C. Blake Garrison, Bayonne City, N. J.

The Stadacoma Water, Light and Power Company, Montreal, Can.—to furnish water and electric light to towns and villages in the province of Quebec. Capital stock, $40,000. Incorporators: Louis H. Tache, advocate; Joseph O. C. Mignault, Ernest Belanger, Edouard Charles Amos, civil engineers, and Charles de Bellefeuille Macdonald, of Montreal.

Woven Wire Brushes.

The Belknap Motor Company of Portland, Me., are the patentees and manufacturers of the best Woven Wire Brush on the market.—[*Adv.*

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED FEBRUARY 5, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

533,447. Electric Railway. John G. Douty, Williamsport, Pa., assignor of two-thirds to James N. Kline and William G. Elliot, same place. Filed May 17, 1894.

533,598. Running-Gear for Electric Cars. Charles A. Jackson, Reading, Mass. Filed Sept. 15, 1893.

533,610. Conduit Electric Railway. Alfred Rosenholz, San Francisco, Cal., assignor of one-half to Samuel J. Clarke and Harvey S. Brown, same place. Filed May 22, 1894.

533,627. Conduit Electric Railway. William H. Baker, Pawtucket, R. I. Filed May 18, 1894.

533,631. Subway for Electric Railways. Frank E. Button, Rochester, N. Y. Filed June 6, 1894.

533,772. Trolley for Underground Conduits. Charles M. Yost, Washington, D. C., assignor of forty-one eightieths to Gabriel Edmondston, Lemuel F. Burner and Georgianna T. King, same place. Filed Nov. 3, 1894.

533,836. Conduit System, Charles M. Yost, Washington, D. C., assignor of forty-one eightieths to Gabriel Edmonston, Lemuel F. Burner and Georgianna T. King, same place. Filed Nov. 3, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

533,434. Rosette for Electric Lighting. Elisha W. Buffington, Fall River, Mass., assignor of one-half to Albert F. Dow, same place. Filed Oct. 6, 1894.

533,459. Electrically-Lighted Buoy. Ira W. Henry, New York, N. Y. Filed May 29, 1893.

533,502. Method of and Means for Testing Incandescent Lamps. Frank S. Smith, Pittsburg, and James A. Vandegrift, Allegheny, Pa. Filed July 9, 1894.

533,670. Lock for Electric Lamps. Warren A. Saul and Jacob H. Peck, Steelton, Pa. Filed March 13, 1894.

533,853. Cover for Electric-Light Globes. Hans Johansen, Chicago, Ill. Filed June 30, 1893.

DYNAMOS, MOTORS, ETC.

533,445. Electric Dental Motor Apparatus. Francis N. Denison, Toronto, Canada. Filed May 26, 1894.

533,583. Brush for Dynamo-Electric Machines. Joseph W. Dickey, New York, N. Y., assignor of one-half to Charles E. Chapin, same place and Milford, Conn. Filed Dec. 8, 1894.

533,833. Rotary Brush. Harold A. Webster, Haverhill, assignor to the Globe Buffer Company, Boston, Mass. Filed April 27, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

533,427. Automatic Telephone-Switch, Henry D. Bayne, Brooklyn, N. Y. Filed May 31, 1894.

533,619. Telephone Arm-Rest and Receiver-Holder. William Steubing, Cincinnati, Ohio, assignor of one-half to Frank A. Leininger, same place. Filed Oct. 30, 1894.

533,729. Telephonic or Analogous Electrode. Thomas McCoubray, New York, N. Y. Filed Aug. 9, 1894.

533,785. Telephone-Exchange. Morgan Brooks, Minneapolis, Minn. Filed Oct. 17, 1894.

MISCELLANEOUS.

533,490. Electric Fire-Alarm and Police-Signal Box. George E. Paynter and William H. Thompson, Richmond, Va. Filed May 4, 1894.

533,607. Insulated Conductor. Henry G. O'Neill, Boston, Mass., assignor to Edward Jewell, same place, and Charles W. Welch, Stoughton, Mass. Filed March 22, 1894.

533,657. Device for Starting or Stopping Time-Indicators. Charles F. Marvin, Washington, D. C., and Julien P. Friez, Baltimore, Md. Filed Aug. 10, 1894.

533,698. Safety Connection for Electric Conductors. Ralph E. Bates, Brooklyn, N. Y., assignor of one-half to Jas. S. Topham, Washington, D. C. Filed June 20, 1894.

533,751. Separator-Plate for Storage-Batteries. Pedro G. Salom, Philadelphia, Pa. Filed May 9, 1894.

533,791. Electric Bathing Apparatus. Charles Doehring, New York, N. Y. Filed June 22, 1894.

533,795. Electric Broiler or Toaster. Levi T. Edwards Haverford, Pa. Filed March 2, 1894.

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&c. &c.
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Insulation Co.
New York

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ELECTRIC LIGHT CONVENTION
CLEVELAND,
1895

THE

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Extreme Simplicity,
Most Flexible.

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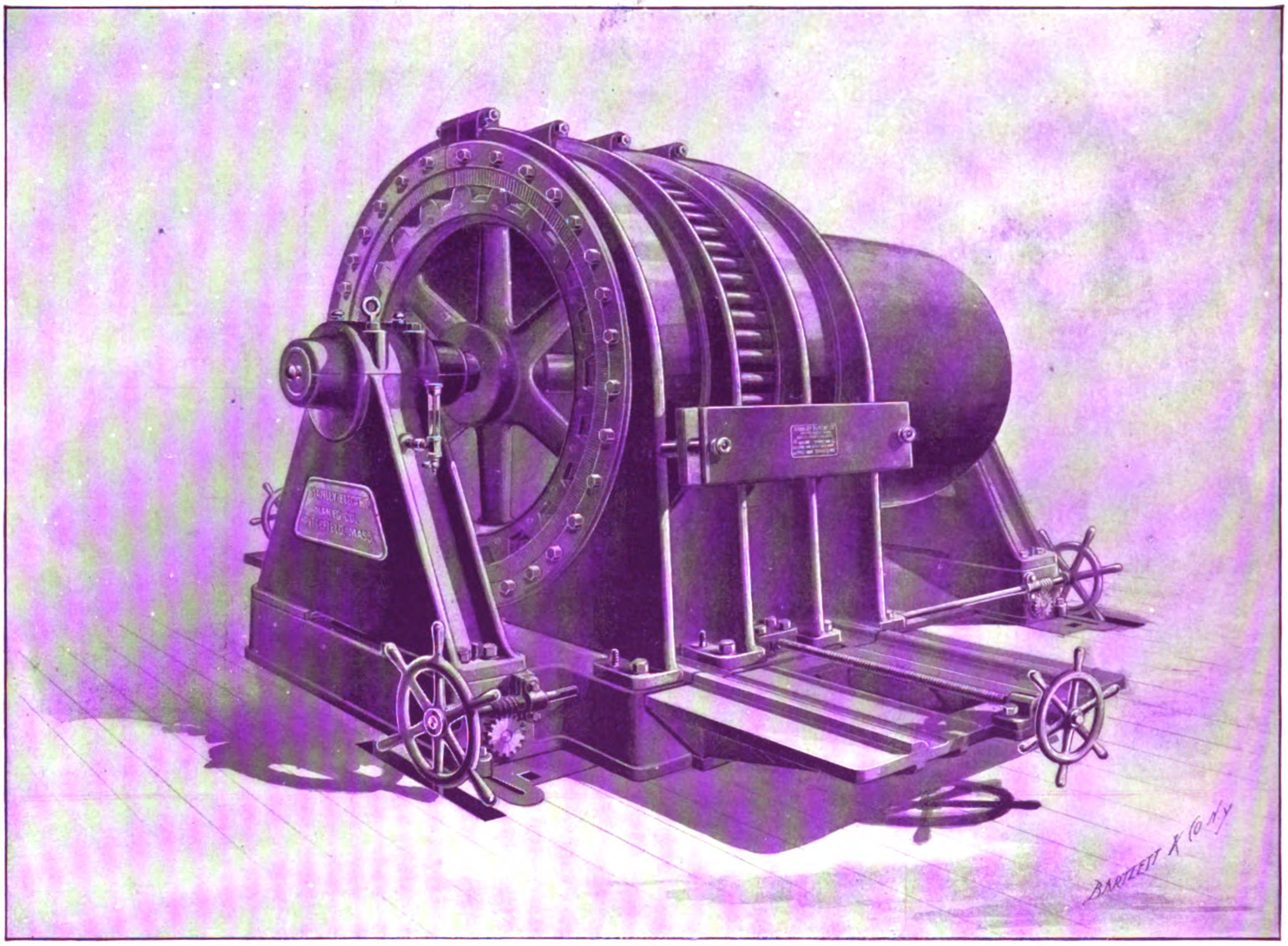
FOR LIGHT OR POWER.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ELECTRICITY.

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EDITORIAL NOTES.

Central Station Economy. The supply of gas and electricity for illuminating purposes involve nearly identically the same engineering problems. In both cases the pressure at which distribution may take place is limited by the pressure at which it can be most economically used at the lamps and the drop in line. That is to say, the initial pressure cannot exceed that at which the lamp burns most economically plus the loss in pressure in transmission. In both cases the best consumption pressure is low, in both cases the distribution is at constant pressure, and since the character of the service is the same, the load lines of the gas company and of the central electric lighting station will, under similar circumstances, be subject to the same wide variations from the straight line which would indicate a constant load extending throughout the twenty-four hours. Both commodities are produced from the same crude material, viz., coal, both go through somewhat similar transformations in the course of manufacture, are distributed under similar conditions and finally come in direct competition in the same service. In this competition the gas light is sold at a figure considerably lower than the electric light—with gas at $1.25 and electricity at 1 cent per lamp hour, assuming that a 16 C. P. incandescent lamp is the equivalent of a 5 foot burner, the price of gas light is but 62½ per cent. of that charged for electric light. That there can be any competition with this disparity in cost implies an intrinsic merit in the electric light that is gratifying to those who have made electricity and electrical methods their life work.

Let us see how the profits of the two at these prices compare. Picking up a recent gas journal we checked off the prices bid for common stock of twenty-four gas companies in nine of the leading cities of this country and found them to average $223.46 on a par value of $100. Seven of the most prosperous electric lighting companies in this country, representing six cities, give an average value for their stocks of $86.86 on a par value of $100.

This is to say that the gas company which sells its product 87½ per cent. cheaper than electricity is sold and can get for its stock 2.57 times as much as the electric light manufacturer can get for his stock. It is very evident from this that the gas manufacturer is not selling his product below the cost of production, and it behooves us to inquire wherein lies the secret of his cheaper production.

It has been frequently stated that a given quantity of gas burned in a gas engine, through the intermediary of the dynamo will produce more light than can be obtained by burning that gas direct in the ordinary batwing or fishtail gas burner. At first blush such a statement seems extravagant to the highest degree, but a glance at the figures will show that it is well founded in fact.

Gas engines showing a thermal efficiency of 20 per cent. and a mechanical efficiency of 85 per cent. are to day well known, and higher figures than these are obtained under test conditions.

Incandescent lamps consuming 3.5 watts per candle power are no longer considered high efficiency lamps. Such a lamp converts about 6 per cent. of all the energy it receives into luminous rays—its true light efficiency is therefore 6 per cent.

Dynamos with a guaranteed efficiency of 95 per cent. are manufactured by all the leading electrical concerns in the business.

All of the gas engine manufacturers guarantee the production of 1 brake H. P. with a consumption of less than 20 cubic feet of ordinary illuminating gas per hour.

Let us assume 15 per cent. loss between engine pulley and dynamo pulley and 5 per cent. to cover other losses in getting the current to our lamps, assumed to be near at hand. We then have the following chain of efficiencies:

20 per cent. thermal efficiency of gas engine.

85 per cent. mechanical efficiency of gas engine.

85 per cent. efficiency of mechanical transmission between engine and dynamo.

95 per cent. electrical efficiency of dynamo.

95 per cent. efficiency of electrical transmission between dynamo and lamps.

6 per cent. luminous efficiency of lamps.

This gives us as the final efficiency between our gas and electric lamp :

20 p.c. X 85 p.c. X 85 p.c. X 95 p.c X 95 p.c. X
6 p.c. $=\frac{748}{1000}$ of 1 per cent.

Prof. Tyndall gives the light efficiency of the ordinary gas burner as $\frac{317}{1000}$ of 1 per cent.

Allowing nothing for losses in transmission of gas to the burners, which are also assumed to be close at hand, we see that notwithstanding the losses incurred in the several transmissions and transformations involved in producing light from gas through the intermediary of the gas engine, dynamo and incandescent lamp, we still have over 2¼ times (2.344) the light efficiency that we have in burning gas direct. Or in other words, we can produce from a given quantity of gas, by burning it in a gas engine, 2¼ times as much light as we can by burning it direct in the ordinary way.

The figures upon which this calculation is based are all so conservative that the results cannot, we think, be successfully refuted. As a matter of fact gas engine manufacturers, both in this country and abroad, will guarantee the production of better than ten 16 c. p. incandescent lamps on a consumption of 20 cubic feet of ordinary illuminating gas per hour, which would give a ratio of 2½ to 1 in favor of electricity, and we have ourselves seen a 10 h. p. gas engine working at about half load produce 56 full candle power 16 c. p. lamps on a consumption of 160 cubic feet of New York City gas per hour. Since 160 cubic feet would supply 32 five foot burners, the ratio under these very uneconomical conditions of working of the engine was 1.75 to 1.

These results show most conclusively that so far as the conditions of *manufacture* are concerned the electric light can be produced far more cheaply than gas light as usually produced.

We have thus far in speaking of gas light been careful to qualify it as that produced in an ordinary batwing or fishtail burner, thus excluding from comparison the incandescent gas burners which produce light much more efficiently. If, however, we compare the best electricity can do with the best that gas can do, using the arc lamp and the Welsbach burner as our units for comparison, the qualification which was necessary before becomes no longer necessary. For if we assume a 500 watt (nominal 2,000 c. p.) arc lamp to produce an illumination equal to 1,000 candles, 20 cubic feet of gas will produce $\frac{746}{500}$ X 1,000 X .80 per cent. (allowing a loss of 20 per cent. between engine pulley and lamp)=1,193.6. Extravagant claims have been made for the Welsbach light, but assuming the highest figures claimed by the American manufacturers, viz., 55 c. p. from 4.6 cubic feet of gas, we have for 20 cubic feet an illumination equal to $\frac{20}{4.6}$ X 55=239.1 or a ratio of 4.99 to 1 in favor of electricity.

From this it will be perfectly clear that electric light can be *manufactured* at a fraction of the cost to manufacture gas light, and this statement requires no qualification whatever.

That it *is not* manufactured at this price we all know, and this is due to several causes, many of which are wholly or partially remedial. In the first place our central stations have cost too much. The fixed charges are out of all proportion to the working expenses. This is partly correcting itself, for any of the stations erected two or three years ago could be duplicated to-day at half what they then cost.

In the second place there is the unsatisfactory load line which requires us to install two, three, and sometimes four times the amount of machinery required for the mean output. The load line we cannot correct, but we can minimize our fixed charges and operating expenses by a judicious storage of energy. This seems by far the most fruitful field for improvement in central station practice and we are glad that the subject is going to attract attention at the Convention.

* * *

Our Convention Number. Electricity gives greeting to the members of the National Electric Light Association on this the tenth anniversary of its birth. In recognition of the occasion we appear in gala garb and with special inward features which we trust will prove no less attractive than the graceful figure which adorns the outside page. Since some space within the covers is devoted to the use of the electric light in church symbolism and adornment, it seemed not inappropriate that symbolism should find a place on the outside also. In casting about for an idea that should be most fitting for the occasion, we sought that which most truly typified the benign influences which the electric rays have shed upon mankind. The progress of the art has not been one of carnage or of force; hence Ajax defying the lightning, nor his reputed wife with lamp aloft looking for burglars, nor forked lightning annihilating the Quaker kite, that have so often done duty, seemed appropriate. Rather has her progress been one of gentleness, conquering by force of beauty and of grace. These are her attributes, and these are the attributes of the female figure whose beauty is most adorned when unadorned. What more appropriate then than the personification of Hogarth's curves, which our artist has so attractively depicted, holding aloft, in a novel way to be sure—for all her ways are novel—the soft and gentle light which dispels the clouds of darkness that until her advent enveloped us all. This is the good genius of Electricity, and with this introduction she also bids you greeting.

It seems eminently fitting on this occasion that we should present the portraits of those who from the beginning, or from near the beginning, have both by precept and example, while enlightening their benighted brethren as to the inherent merits of a blue dynamo, a red motor, a barber pole insulation, or an arc light that saves current by going out, inspired respect for the truth—it seems meet (and drink) that this noble adherence to the strictest truth, which has not been equalled since the days of the elder Ananias, should at this time be commemorated, and it is done. We only ask our readers to gaze upon these faces in which there is no guile and realize how fully virtue is its own reward. For what else on earth have they ? And if this, too, be gone, what have they?

It seems fitting also that the fountain head whence is drawn all the inspiration on electrical matters that has made life worth living to the electrical business man since the real birth of Electricity on July 22, 1892, should be presented for our beneficiaries to gaze upon. Modesty forbids us from saying much of ourselves—we prefer to let the light of our countenances as here depicted speak for us. But this we will say, we do not pride ourselves on an ancestry hidden in the dim vistas of the past. Unlike the patient mule whose pedigree is enveloped in doubt, ours is certain and sure, and no stain rests thereon. We are not of the past but of the present. We never invented a new geometrical figure whose ratio of perimeter to diameter was unity. We never tossed up pennies with the electrical fountains at the World's Fair to see whose turn it was to thrill and whose to throb, or described their 8 foot high caissons as tall enough to permit of a man walking around in them erect. Although we did come from Chicago, and it is to our credit that we *came* instead of *remained*, we never, when reading the beautiful story of Pygmalion, assumed it to be an allusion to the chief source of wealth of the Western metropolis. Nor did we ever, when our candidate for treasurer of the Institute was assailed on the heinous charge of not being himself an electrician, hurl back the unanswerable argument that *he* was because his father before him was engaged in electrical pursuits. In all these things we have failed, but we plead in extenuation our extreme youth—such honors only come with age. Yet are we content.

* * *

The Policy, Not The Men. As usual at Convention times, the G. E. Company will be represented by a corps of bright and gentlemanly young men, any one of whom, in personal matters, would be worthy of full confidence.

But central station men and others in choosing the manufacturing company with which it is most desirable to do business must look behind the character and personality of the salesmen, and consider the policy of the company, with which the salesmen have nothing to do.

The policy of the G. E. Company cannot be made clearer than by reprinting the following from our issue of January 2 :

> At the time of the G. E. consolidation the Denver Consolidated Company was buying everything from the G. E. Company, its purchases amounting to several thousand dollars monthly. The company was prosperous and had declined several overtures to mix itself up in financial deals with the Eastern people. Soon after coming to New York, Mr. Coffin called one of his agents into his private office and said to him :
>
> "You are pretty well acquainted at Denver and we want some special work done there. You remember a few years ago we decided to start a small opposition company there, and they finally bought us out. We made a handsome profit. Now the Denver Consolidated Company has a capital of $1,000,000 and we must have some of it; it is good stock and pays 10 per cent. annually. We think you ought to go to your friends there and organize a new company. The Consolidated people would probably prefer not to be hostile to us and might give us about $250,000 of that stock. You see, I know all of Mr. Rawlins's (president of the Denver Company), financial friends in the East, and might have some influence on them in future deals of his if

he chose to be unreasonable. Now, you go out to Denver and scorch them at that end and I will burn them up at this end."

Few companies desire to be either scorched at one end or burned up at the other.

* * *

A Vicious Policy. Soon after the final victory of the General Electric Company in establishing the legal validity of the Edison lamp patent, there was a meeting of the various heads of departments, district managers, etc., to discuss the changed situation. Mr. Coffin, the president, presided. Before the meeting closed one of the district managers asked:

"What will be our policy toward previous users of infringing lamps, and what will be your policy towards the makers of those lamps?"

Mr. Coffin was silent for a few seconds and replied:

"**Vicious!**"

The word was hissed out with inexpressible malignity, and among those present there were some who could see from that minute the final doom of the company and its policy.

There have been many expressions of opinion as to just who was responsible for the evil policy which has done more, perhaps, than any other one feature of the mismanagement to wreck a great enterprise. Some have placed the responsibility on Mr. F. P. Fish, others upon Mr. Twombly and Mr. Coster. It is not surprising that none of these gentlemen has come forward to claim the honor.

It is apparent that the honor must rest with Mr. Charles A. Coffin, and the downfall of the company can be dated back to the utterance of that one word—VICIOUS!

Under the Searchlight.

Views and Opinions on Timely Topics.

Special Issue No. 2.

The artistic cover which adorns this week's issue of ELECTRICITY will be continued on the issue containing the Convention report. Advertisers who have not availed themselves of the opportunity of being in the first special issue may place their orders for space in No. 2. at Parlor 139, Hollenden Hotel.

* * *

When the time comes we shall enjoy the explanation which the G. E. Company gives of the methods employed in securing its blanket charter at Albany. Who got the $50,000 *or* $60,000 *which was paid at that time to Mr.* F. *Worked-'em-all Webster for mica which has not yet been delivered?*

ELECTRICITY *has several things on ice.*

* * *

New York for the Convention.

If the members of the Executive Committee of the N. E. L. A. act with perfect wisdom New York will be chosen for the next annual meeting place. An opportunity for exhibits such as has never before been offered is at our disposal. We can entertain the guests in a way never to be forgotten. New York is the place.

* * *

EVERY solicitor ever employed by this paper has been forbidden to recommend any concern to take its advertisement out of any other paper and give it to ELECTRICITY. We want business as much as any paper published, but we want it on the merits of our own paper.

* * *

A PHENOMENON.

A Tiffin House Chock Full of Electricity.

(Tiffin, O., despatch to Cincinnati Enquirer.)

One of the most peculiar things that has ever come to light in this city is the presence of electricity in the front room of Dr. H. K. Hershiser's residence on Monroe street in this city. Any one touching a metallic substance in that room, be it the chandelier, stove or trimmings on the piano, instantly receives such an electric shock as to almost knock him down. The instant the hand touches the metallic substance the electric snap is heard, and the electric spark, as from a dynamo, is quickly felt. People have been flocking to the Hershiser home for several days to witness the peculiar phenomenon. A person holding his fingers within an inch of another person's face would see a spark and feel a shock as if he had touched the stove. An individual putting two fingers together on either side of a chandelier gas jet would quickly light the gas. The cause of the presence of the immense amount of electricity can only be surmised. Some attribute it to possibly some electric substance in the coal which is burned in the stove in the room, the stove diffusing the electric substance throughout the apartment. Some say that electricity is always more or less present in a room in which the floor is covered with moquette carpet, but as this room is covered with ingrain carpet it makes it the more strange.

Some also say that the average reporter, in writing of electrical fakes, falls down far short of the climax. The above, from a critical point of view, is like Falstaff without a stomach or Trilby without feet. If the writer had been a true artist he would have added that the local light and railway companies had abolished steam and were now getting all their power direct from a connection with Mr. Hershiser's chandelier, or stove, or ingrain carpet.

* * *

It is reported from Boston that a director of the Davidson Fan Motor Company recently entertained a prominent New York man at lunch at a Boston club. Later the company sent a bill to the gentleman for $6.90 for the entertainment.

* * *

MR. L. E. MYERS, of Chicago, recently received a proposition to put in an electric light plant in Missouri in exchange for some Tennessee farm land—some of the land, we suppose, which the Eastern delegation saw on its way to Atlanta. The gentleman's business card read as follows:

F. M. Miller, Lathrop, Mo., real estate and exchange commission merchant. For sale or trade: all kinds of real estate or personal property; farms—improved and unimproved; all kinds of city property; store buildings, with or without stocks of goods; stocks of goods of all kinds; fire proof safes, soda fountains, billiard and poo tables, mill property, novelty works, livery stables, blacksmith shops, hotels, opera houses, electric light and ry. works, pop factories, patent rights. In fact everything. Send me a list or description of your property—it don't matter what it is, I will sell it. No sale or trade no charge. My charges are very reasonable.

* * *

HIS REMARKABLE TROUSERS.

A Well-known Electrical Man Creates a Sensation in Broadway.

(From a Daily Paper.)

Pedestrians in Broadway near the City Hall park yesterday were startled by a vision of peculiar brightness, which, at a distance, seemed like a halo of myriad colors surrounding the legs of a gentleman who was plodding along, all unconscious, apparently, of the fact that even the horses were blinded as he approached. With the aid of a sun-glass it was discovered that the shock was produced by the most wonderful pair of trousers ever seen in our streets.

Who was he? 'Tis needless to answer. He is, as it were, too well known to need description. These trousers may be seen at the Cleveland Convention.

* * *

IF Mr. Brobst will engage W. J. Johnston to pass through his cold storage room on the way to breakfast every morning he will not need to buy any ice during the Cleveland meeting.

INTERESTING INFORMATION.

Late Circular Letter Not Intended for Publication.

SCHENECTADY, N. Y., Jan., 1895.

Dear Sir:

Enclosed herewith I send you the monthly summary of isolated and central station lighting business secured by the various local offices for the month of December. The total amounts to $118,585. which is somewhat less than the record for the previous month. The opposition again come very close to us with $106.312. This amount would be increased to nearly the same figure as the business secured by us if all the reports had been received. As it is, we have been obliged to hold several over until next month.

Isolated Lighting.—We have closed fifty-three contracts, amounting to $76,825, while our competitors have taken twenty-six, amounting to a little over $52,000. This includes two large bids of about $9,500 each; one for the Library of Congress at Washington, and the other a revised bid for the American Surety Company, which was reported in my October letter. In five cases the opposition's figures have been reported, and we note that the average is only 8 per cent. below us, which is too small a difference to account for the large amount of business they have secured, and there can be no doubt that the OPPOSITION ARE SECURING A LARGER AMOUNT OF BUSINESS THAN IS INDICATED BY THESE REPORTS. There must be instances of small plants where purchasers consider that the General Electric Company is "too large" a concern to care for such "small business," but I would remind you that it is the sales where we sell the apparatus outright for cash that are the profitable ones, as they do not entail any large amount of office work, neither is there any delay caused by construction work. I would also like to impress upon the agents the advisability of following up such installations as are secured by our competitors, to see how the purchaser is satisfied with his apparatus, and also, if possible, to gain some knowledge as to how the apparatus itself behaves under working conditions. Although it is not always advisable to refer to a competitor's plant that is giving poor satisfaction, it is often advantageous to know how they work, so that comparisons may be made.

Central Station.—Owing to the loss of our proposal to the Citizens' Electric Company of Springfield, Ill., which amounted to $46,488, the amount of business ($54,299) secured by our competitors is considerably more than that secured by us, which amounts to $42,260. We are advised by our Chicago office that the erection of this plant depends upon their ability to secure the contract for lighting the city. While increase in amount of business reported as secured by our competitors is, no doubt, due to more care being taken in our local offices in reporting the same, *we still feel that some of our offices are not reporting small business* taken by our competitors upon which we do not have *an opportunity to bid.* I wish to impress upon you that cases of this kind should be embodied in your weekly report to each department manager (copy of which you send to the First Vice-President), as they are of as much interest as those cases where we have also put in bids.

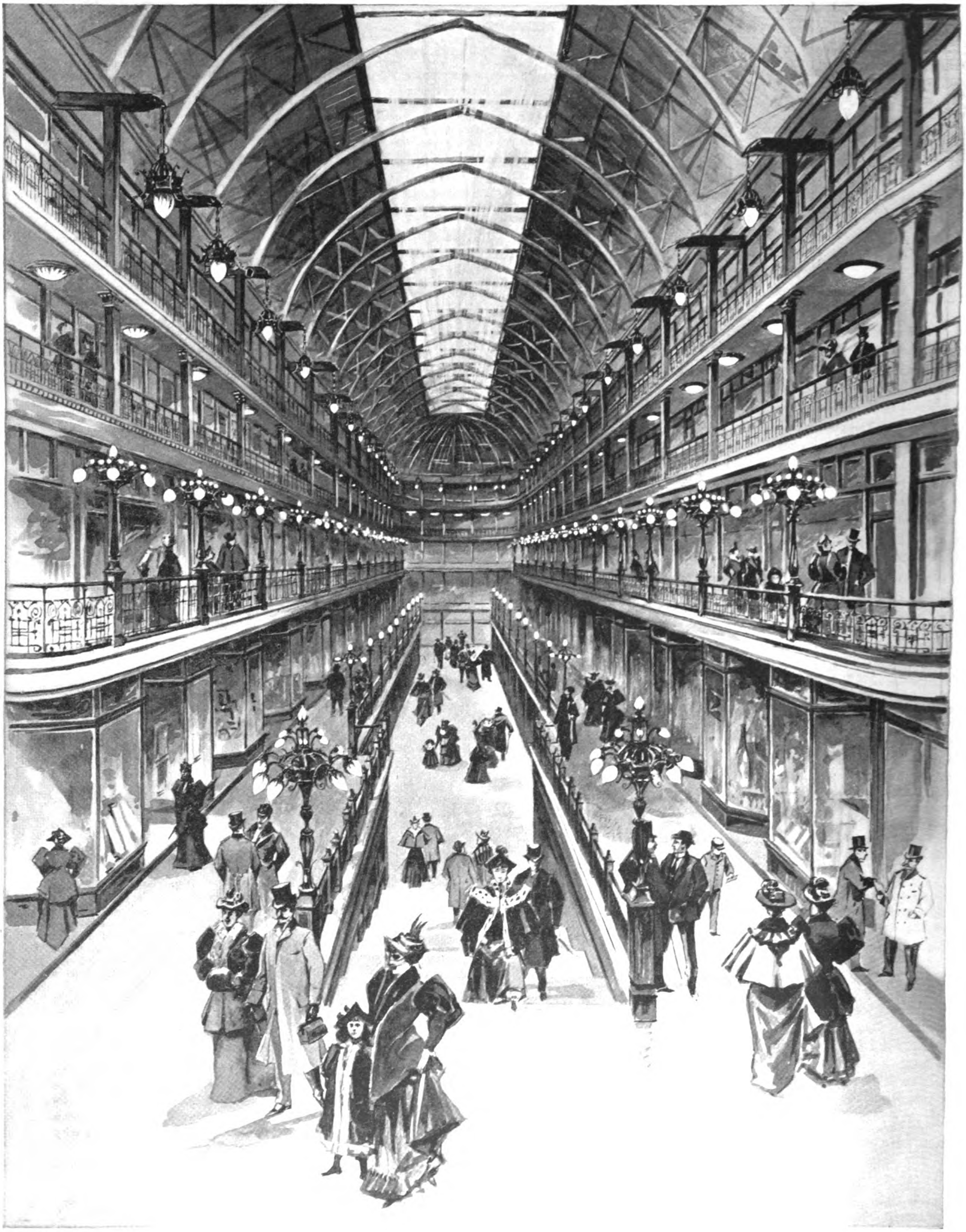
I have noticed that some of the local managers do not seem to understand the instructions issued by the First Vice-President contained in Circular Letter No. 4, regarding the reporting of business secured by our competitors. It is desired that each manager shall send to me each week a letter stating what lighting business has gone to the opposition during the week, with a brief review of the circumstances of each case. A copy of this letter should be sent to the First Vice-President. Those offices who have neglected this matter heretofore will please take particular pains in the future. I might add that this should be done for each department.

Yours very truly,
(Signed) S. D. GREENE,
General Manager Lighting Department.

Mr. Greene is entirely correct in supposing that his agents have not reported *all* the business closed by the independent companies. If the actual figures were attainable it would be seen that the great $50,000,000 corporation is a very poor second in the race.

The fact which stands out clearly from the statements above is that the independent concerns are doing the *profitable* part of the business and leaving the tailings to the G. E. Company.

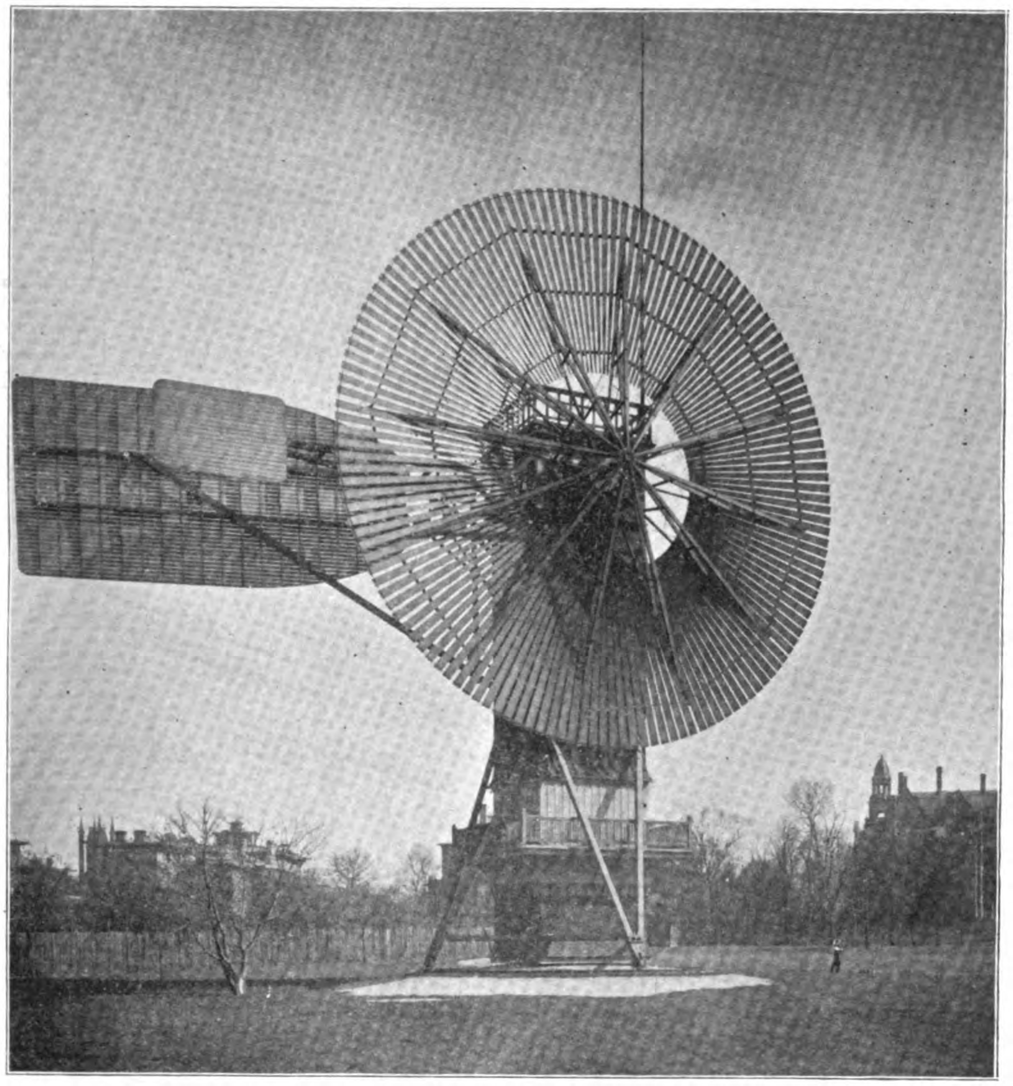
A Lighting Suggestion for the Cleveland Arcade Building.



THE GREAT BRUSH WINDMILL LIGHTING PLANT.

There is probably no electric light man in the country that has not heard of the great windmill plant employed by Mr. Chas. F. Brush to light his residence on Euclid avenue, Cleveland, nor any that has not promised to avail himself of the first opportunity of visiting it; and now that the National Electric Light Association is holding its Convention in Cleveland that opportunity, so long delayed to many, seems to present itself in a most attractive form. It seems appropriate, therefore, to give the subject some attention in this issue, and in connection with the accompanying engraving, reproduced from the most recent photograph, especially taken for Electricity, the following data will be of interest.

The history of windmill power as applied to ctric lighting begins in this country with this plant, which was erected by Mr. Chas. F. Brush in 1887 and which without question constitutes the most unique private electric lighting plant in America. Every contingency is provided for, and the entire apparatus from the huge 56 ft. wheel of the mill down to the most delicate electrical device is automatic.



The Brush Windmill Plant.

The tower, 60 ft. in height, is pivoted upon a single wrought iron gudgeon, 14 inches in diameter, which extends some 8 feet below the level of the ground in solid masonry. The tower as a whole, with its complete equipment of shafting, pulleys, belts, dynamo, etc., weighing more than 80,000 pounds, not only rests upon this gudgeon, but revolves about it as a vertical axis.

In the upper part of the tower is journaled the main wheel shaft of steel, 20 feet long and 6½ inches in diameter, with self-oiling bearings 26 inches in length. This horizontal main shaft carries the main drawing pulley, 8 feet in diameter, with a face 32 inches wide. A countershaft, arranged just below and parallel with the main shaft, carries three pulleys, the middle one receiving the main driving belt, while the two end pulleys are belted directly to smaller pulleys, one at each end of the armature shaft of the dynamo. The relative diameters of these different pulleys are such as to make the armature speed of the dynamo 50 times that of the mill wheel. The dynamo does not rest upon a solid support, but by a novel arrangement of counter-weights it is partially suspended by the two driving belts, only so much of its weight being allowed on the belts as is necessary to prevent them from slipping.

The dynamo, one of Mr. Brush's own design, is provided with an automatic switch to throw the machine into effective action when the speed reaches 330 revolutions per minute, and an automatic regulator which prevents the voltage rising above 90 volts at any speed. The working circuit is arranged to close automatically at 75 and open at 70 volts. The brushes of the dynamo rock automatically as the load changes. The field is slightly compounded. The normal electrical output at full load is 12 kilowatts, which requires the mill to develop at least 24 H. P.

The current generated passes to steel contact shoes, which slide upon annular plates surrounding the gudgeon as the tower turns with the changing direction of the wind, and thence by underground conductors to the storage battery in the basement of Mr. Brush's house.

The battery consists of 408 cells of 100 ampere-hours capacity, arranged in 12 groups of 34 cells each. These groups are charged and discharged in parallel. The containing jars are of glass, and the liquid in each is covered with a film of oil thick enough to prevent evaporation and spraying. The basement room containing the battery is a veritable electrical laboratory. The list of electrical instruments in daily use, besides the usual voltmeters, ammeters, switches, fuse blocks, etc., includes a series of potential indicators, one for each group of cells; an electrically operated switch, by means of which the current may be turned on or off the house mains by pressing push buttons in different parts of the house; a ground detector for the battery; a leakage detector for the different lamp circuits; and finally, and most ingenious of all, a compound relay which controls automatically, by means of varying hydraulic pressures, a powdered carbon resistance, placed in the charging circuit between the dynamo and the battery, which keeps the charging voltage practically constant. The house is supplied with 350 incandescent lamps, varying in candle power from 10 to 50 each, two arc lamps, and three fan motors. Current is also supplied to Mr. Brush's private laboratory. The plant has been in constant operation for the past six years, and it is found after continued use that the amount of attention necessary to keep it in working condition practically amounts to nothing.

An important feature of this experiment is the good behavior of the storage battery. Of the 408 cells in constant daily use, Mr. Brush informs us that not one shows serious signs of failure, and that all are in good, serviceable condition. He has never renewed a plate since the battery was first set up. One could scarcely ask for stronger proof of the ability of storage batteries to meet the requirements of this service.

Put a Penny in the Slot.

In response to Mr. Newman's toast, "Engineers' Views of Professors," at the Tenth Anniversary jollification of the Institution of Junior Engineers, Prof. W. E. Ayrton parried the bright sallies of the toastmaster in a way that only Prof. Ayrton could do. A good deal of fun was poked at professors in general in the toast, and every one knows that when he attempts to have fun at Prof. Ayrton's expense it is best to commence very early in the morning on a very cold day if he wants to escape without a blistered skin.

Prof. Ayrton's wit, however, was of a subtler kind on this occasion, which our English contemporaries seem not to have been able to grasp as yet, but give them time, and they will doubtless see the point eventually. As if the bright points of Mr. Newman's sallies were not sufficient, Prof. Ayrton came to his assistance (it is always unkind to help out another one's joke), and among other things read the following poem, which was written by a young lady—his ward—and also illustrated with pen and ink sketches of himself and Prof. Perry. We cannot reproduce the illustrations, which are good, but the poem speaks for itself sufficiently without them:

It is rumored that Ayrton and Perry
A wonderful system have got
For the teaching of practical science
By putting a coin in the slot.

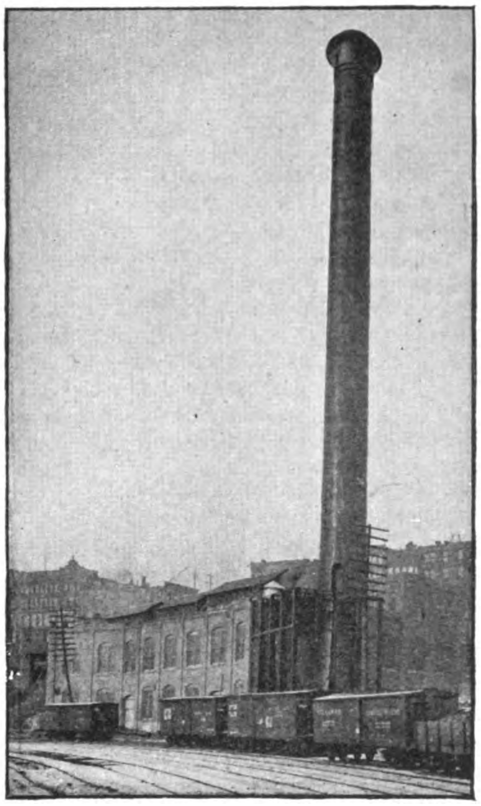
A student arrives at the Central,
His mind an absolute blank,
Yet he leaves simply teeming with knowledge
Imparted by turning a crank.

While as for my eminent guardian,
I suppose all his labor has been
To pick up the showers of money
And pensively oil the machine.

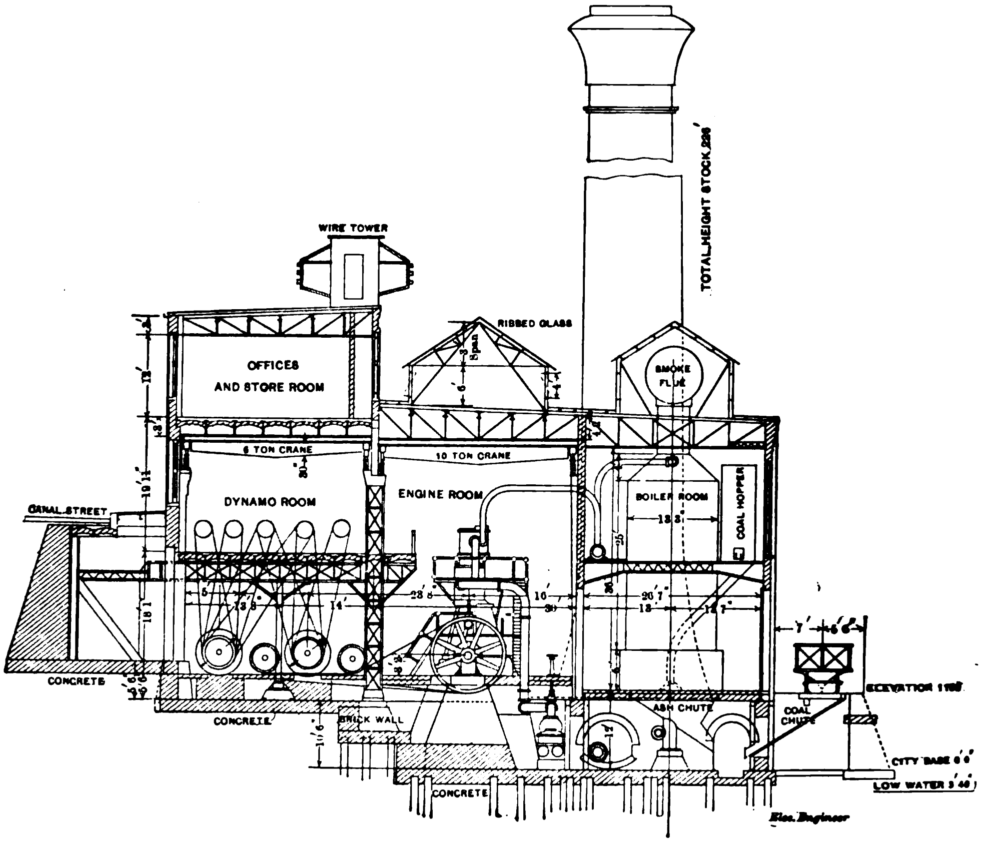
Then bring us the laurel and myrtle,
And bring us the garlands of bay,
Let us crown the brave Ayrton and Perry
For showing so royal a way.

Let everyone go to that college,
Let us all drop our coins in and see,
If her guardian would but turn the handle,
How wise even Tina would be.

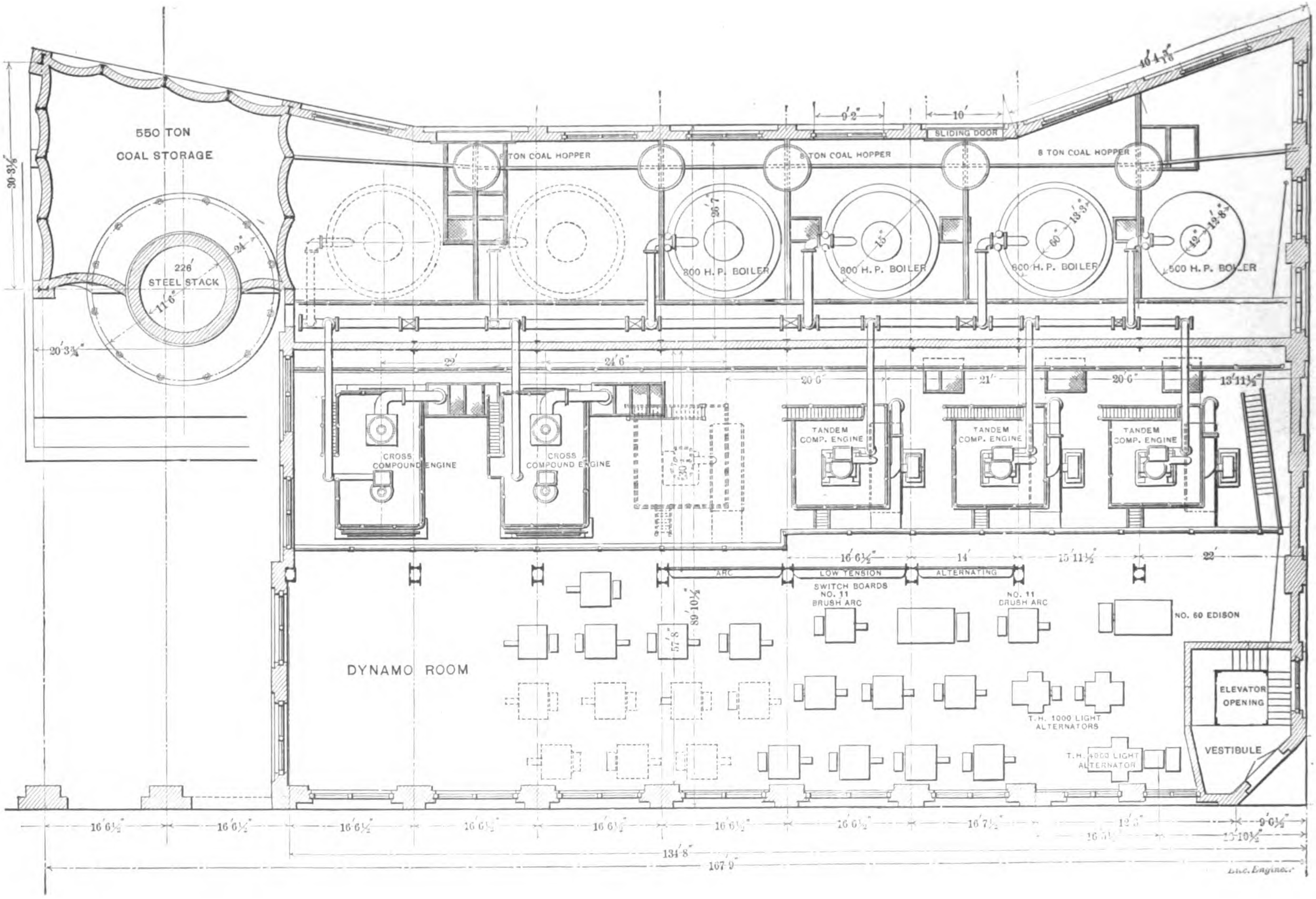
The Cleveland Electrical Illuminating Company's Station.



EXTERIOR VIEW.



STATION.



PLAN.

Church Illumination.

The Rich and Impressive Effects Produced by Electric Lighting in Some New York Churches.

Science and Art Join Hands in the Embellishment of Our Temples.

BY R. M. BERNARD.

The rapid advance made of late years in the application of electrical science to the lighting of public buildings, churches, etc., has directed the attention of architects to the subject, and the possibilities it offers insure thoughtful consideration for an article written for the purpose of calling attention to what has already been done in this direction, and hinting at what may yet be achieved by those who realize the great value of the omnipresent fluid for purposes of art, symbolism and decoration.

Our forefathers were satisfied with candle light for the simple reason that they could do no better; and just as when coal gas was superseding the dangerous and ill-smelling oil lamp it had many prejudices to overcome, so people have been timid about the adoption of electricity because of an imaginary danger which the uneducated supposed to underlie the use of this new, and to some minds uncanny force. In the last few years much has been accomplished to dissipate this feeling, and the popular mind is becoming gradually accustomed to the use of the electric light. Nothing, perhaps, has done more to educate the minds of the masses to the decorative possibilities of the electric light than its application within the last five years to the lighting of several of the largest churches in this city. The greatest advances in this new art of electrical church decoration must in justice be ascribed to Mr. D. Colombani, now secretary and treasurer of the Metropolitan Electric Equipment Company of this city. Five years ago Mr. Colombani was connected with the Edison Electric Illuminating Company, and had superintended the installation of electric lighting in many public and private buildings in the city. His early training and his favorite studies had inclined his mind to the subject of symbolical church decoration, and it was natural that the idea of applying electricity to this purpose should present itself to him. He succeeded, after considerable opposition, in obtaining the consent of the ecclesiastical authorities to light the Church of the Holy Innocents, West 37th street, with electricity, and this was accomplished just before Christmas, 1889.

GUARDIAN ANGEL, BAPTISTRY, IN ST. FRANCIS XAVIER'S CHURCH.

MR. D. COLOMBANI.

SYMBOLIC EFFECTS HEIGHTENED.

His efforts in this church were confined merely to providing an adequate and satisfactory substitute for the gas with which the church had theretofore been lighted, and in this he succeeded beyond the anticipations of all concerned. His artistic sense, however, was by no means satisfied with what he considered so meager a result as this, and it was only when he had obtained the consent of the Jesuit Fathers to decorate their magnificent church on West 16th street that he felt he was about to be afforded an opportunity of showing all that could be accomplished by the electric light in accentuating existing decorative features, and bringing forth in bold relief the symbols which are so important a feature of ecclesiastical architecture.

To Rev. Wm. O'B. Pardow, S. J., now Provincial of the American Jesuits, and at that time President of St. Francis Xavier's College, belongs the honor of appreciating the ideas presented to him by Mr. Colombani, and entering into them with such earnestness as to have rendered possible the accomplishment of what must be regarded as the parent of electric lighting as applied in its higher possibilities to ecclesiastical edifices. Father Pardow quickly recognized the advantages which would accrue to the church from the installation of the electric light, and, except for a few necessary limitations, gave Mr. Colombani carte blanche to go on with the work. He was rewarded when in May, 1892, he was able to realize that his progressive spirit had enabled the electrician to make his church the most complete electrically lighted place of worship in the world.

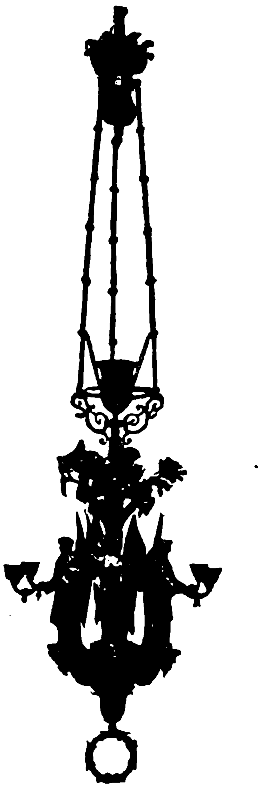
Following the installation in St. Francis Xavier's came in rapid succession the lighting by electricity of several other churches in New York and in Brooklyn, among which may be named St. Bernard's, on West 14th street; St. Agnes's, East 43d street; St. Francis d'Assisi, West 31st street; St. Joseph's, Washington Place; St. Gabriel's, East 37th street; Sacred Heart, West 51st street; St. Michael's, West 31st street, in this city, and the churches of the Nativity, St. John the Baptist and St. Thomas Aquinas in Brooklyn.

SPECIAL FEATURES BROUGHT OUT.

Each of these churches had its own peculiar features of architecture and of decoration to be considered in the installation of the electric light, and it is in his special treatment and attention to the particular requirements of each that Mr. Colombani has shown himself to be not only a skilful electrician but an artist. Born in Corsica, the island of genius, and reared amid the artistic and religious surroundings of Southern Europe, his intimate acquaintance with the symbols and ritual of the Catholic Church has enabled him to harmonize the mechanical part of his work with the ecclesiastical features which had to be emphasized, and has made it possible to overcome difficulties which must have proved insurmountable to an ordinary layman however skilful as an electrician.

In approaching the illumination of an altar or statue, or any special feature of a church, the artist always set himself the task of depicting by the aid of the electric lights the particular points upon which it was desired to lay emphasis.

For instance, in the lighting of the shine of the Sacred Heart, in St. Francis Xavier's, the idea sought to be presented was the love of Christ for man, and His victory over man's arch enemy, the Devil. That love was shown, as Catholic doctrine teaches, by His passion, death and resurrection, and His institution of the "sacrament of His love." This is typified in the scheme of illumination by a metal structure in the form of a grapevine, grapes and leaves being reproduced in the metal with faithful exactitude of color and form. In the center is a bunch of wheat ears. These are symbolical of the bread and the grapes of the wine of the sacrament. Intermingled with the leaves and branches of the vine are miniature lamps, wired eight in series, of the nearest form to that of a grape, and of various colors. The passion is symbolized by a passion flower vine running across the arch of the alcove, each flower and leaf being perfectly reproduced in hammered metal. Between the flowers and the leaves are small frosted candelabra lamps,



SANCTUARY LAMP, ST. JOSEPH'S CHURCH.

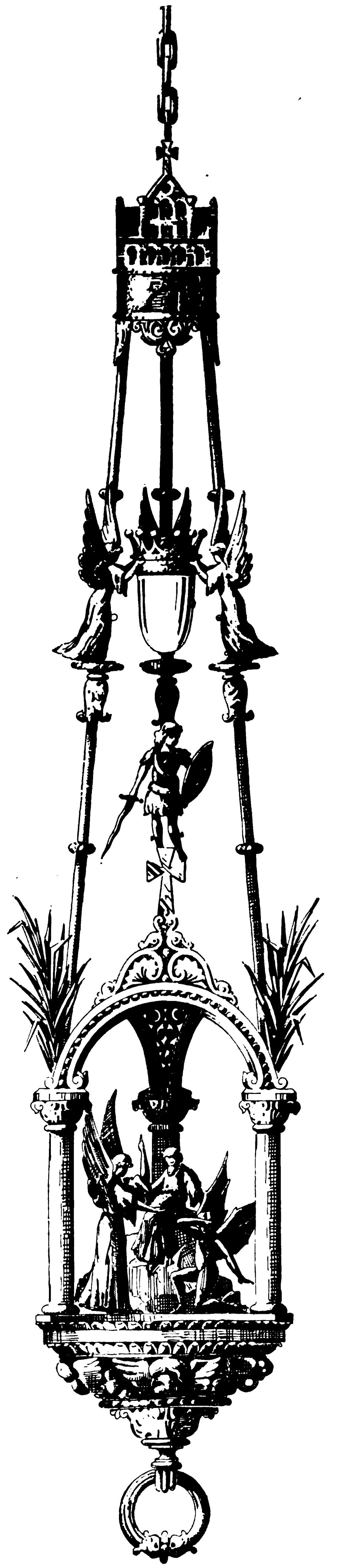
most appropriately made to correspond with the general artistic effect of the vine. These are wired two in series. Worshippers are reminded of the death of the Saviour by a cross composed of sixteen spherical 8 c. p. frosted candelabra lamps which surmount the outer edge of the alcove in which the altar stands. These lamps are wired two in series. The passion and resurrection are further symbolized by a large red rose on each side of the statue, in the center of which nestles a blood red 16 c. p. lamp. The victory of Christ over the Devil is shown by two fixtures fashioned of red hammered copper to represent palm leaves, the sign of victory. The lamps introduced among these leaves are 16 c. p. frosted bulbs. A beautiful effect is produced by an arch of thirty 16 c. p. lamps which are placed with a corrugated glass reflector behind them on the inner side of the coping of the arch. They are thus concealed from the view of the observer while they flood with their radiance the statue and the shrine below. This arch is wired in two circuits, which are connected with the switchboard in the sacristy, each switch controlling 15 alternate lamps. The idea intended to be conveyed by the arch is the omnipresence of God, who is watching over us at all times, though hidden from our view.

A BEAUTIFUL STATUE.

Another instance in which symbolism is admirably brought out in the same church by the electric light is in the bronze statue of the guardian angel designed by Mr. Colombani for the baptistry of the lower church. The beautiful tradition of the church is that a member of the angelic band is specially appointed to watch over the spiritual welfare of every soul that is born into this world, and that at the moment of baptism the regenerated mortal is handed over to the care of its guardian angel. In the treatment of the statue this conception is most artistically brought out. The figure of the angel is represented standing erect over the baptismal font with outstretched wings and looking with encouragement on the soul that has just received the rite of the church. In the right hand, which is just raised from the side, is held a small Pompeiian lamp whose weak flickering flame represents the still, small voice of conscience which the angel awakens in the soul of the Christian just aroused to a sense of its spiritual needs. The uplifted left arm pointed heavenward holds in the grasp of the hand a large 32 c. p. frosted lamp on a keyless socket, symbolical of the brightness of the glories of heaven to which the soul may attain if it hearken to the admonitions of its angel guardian. The contrast between the two lamps shows very effectively the progress in illumination since the days of the old oil lamp of the Romans.

In the altar of St. Aloysius, opposite the shrine of the Sacred Heart, the same miniature colored lamps which were used so effectively in the vines on the latter altar are again brought into play in producing the effect of jewels in the crown which two angels are represented placing on the head of the saint. Hitherto for work of this kind church decorators have had to depend on colored stone or glass which produces a dead and lifeless effect compared with the brilliancy of the tiny colored electric globes.

Before leaving the church of St. Francis Xavier there is one more thing which calls for remark, viz., the method used in lighting the pulpit. This is, perhaps, the most difficult problem which church illuminators have had to solve. In St. Patrick's Cathedral, for instance, the effect of the beautiful and artistic white marble pulpit is sadly marred by the inadequate means of lighting. The want of an electric plant in that magnificent pile has compelled the adoption of two gas fixtures—one at each side of the preacher. These produce a poor light compared with that of the electric current, besides causing a most inartistic effect by casting shadows in the most inappropriate places. The same trouble has been experienced in even a greater degree in the magnificent church of the Paulist Fathers in Fifty-ninth street. The gas jets not only fail to illumine the face of the preacher but also dazzle his eyes by their glare.



Sanctuary Lamp, St. Michael's Church.

In St. Francis Xavier's the presence of the electric plant suggested to Mr. Colombani an easy and artistic way out of the difficulty. From the front of the sounding board over the pulpit a silver dove is suspended as if flying toward the congregation with outstretched wings. In the back of the dove, hidden from view, is placed a 32 c. p. lamp with a reflector behind it which throws the light full on the face of the preacher, causing him no inconvenience and making visible to his hearers every slightest change of expression. Symbolism even in this small detail is not lost sight of, for the dove represents, of course, the Holy Ghost, the Spirit of Truth, casting his rays of inspiration into the heart of the preacher, as he sent tongues of fire upon the apostles on the first Pentecostal morning.

TRANSLUCENT ALABASTER PEDESTALS.

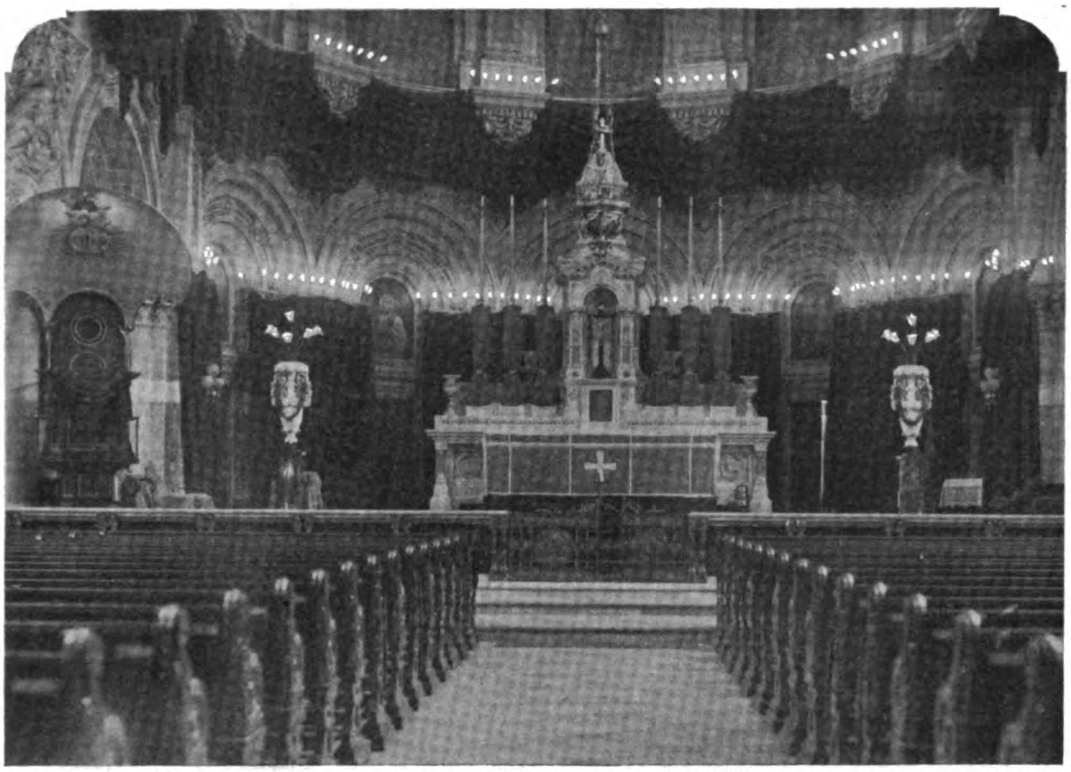
In St. Joseph's Church, on Washington Place, much difficulty had been experienced by the clergymen at the early services on dark winter mornings in consequence of their own shadows obscuring the faces of the communicants who had presented themselves at the sanctuary rails. This might have been overcome by affixing brackets with gas or electric lights to the columns at the ends of the railing, but this would have been inartistic and would have marred the general architectural beauty of the columns. The idea was conceived by the electrician of placing a hollow alabaster pedestal about four feet high at each side of the sanctuary, a few feet from the rail. These pedestals are each surmounted by a beautifully carved vase of about the same height. Six glass lilies of a delicate pink tint spring with carved metal foliage from the vases. A 16 c. p. lamp of a cylindrical pattern forms the stamen of each lily. A very beautiful effect is produced when the switch controlling the vases is suddenly turned on. The frosted stamina of the lilies show up in warm contrast to their pink petals and the electric lights in the hollow vases and pedestals penetrate through the transparent stone, causing the veins of the alabaster to show out in all their beautiful natural tints.

It is scarcely necessary to say that these pedestals and lilies have their symbolical significance as has all the church work of this artist. The pedestal is intended to represent the pillar of fire which led the Israelites through the wilderness, the vases are symbolic of the pot of manna, the heaven sent food of the chosen people, which was itself a type of the eucharistic bread of the new dispensation, and the lilies are types of the purity of heart expected from those who approach the table of the Lord.

The strictness of the rubrics in regard to placing anything upon the throne over the tabernacle in the center of the altars in Catholic churches has been a cause of great difficulty in throwing light upon the monstrance, the vessel in which the Host is exposed. In consequence, while each side of the altar blazed with lights the center, where the monstrance is placed, was always the darkest part of the altar, whereas to correspond with the spirit of the devotion it should be the brightest of all. To remedy this incongruity caused our artist considerable thought, but he finally hit upon a plan which would not conflict with the rubrics and yet produce the required effect. By placing six cylindrical 16 c. p. lamps behind the two front pillars of the four which support the throne, one at the base, one at the centre and one at the capital of each, he threw a perfect halo of light upon the monstrance.

THE GREAT CATHEDRAL MONSTRANCE.

This plan was carried out at St. Francis Xavier's, St. Joseph's, the Church of the Holy Innocents and several other churches, but could not be applied to the great ostensorium of St. Patrick's Cathedral, which on account of its great size has to be exposed on the table of the altar instead of being placed upon the throne. When this ostensorium was exhibited recently with the other works of art belonging to the cathedral, Mr. Colombani placed above and in front of the ostensorium a silver dove looking with outspread wings to the people and containing concealed in the back a 32 c. p. lamp with a reflector which threw its rays full on the magnificent and richly jewelled surface of the ostensorium. The dove was supported on a slender gilt rod conducting the electric wire which passed over and behind the sacred vessel.



SANCTUARY OF ST. FRANCIS XAVIER'S CHURCH.

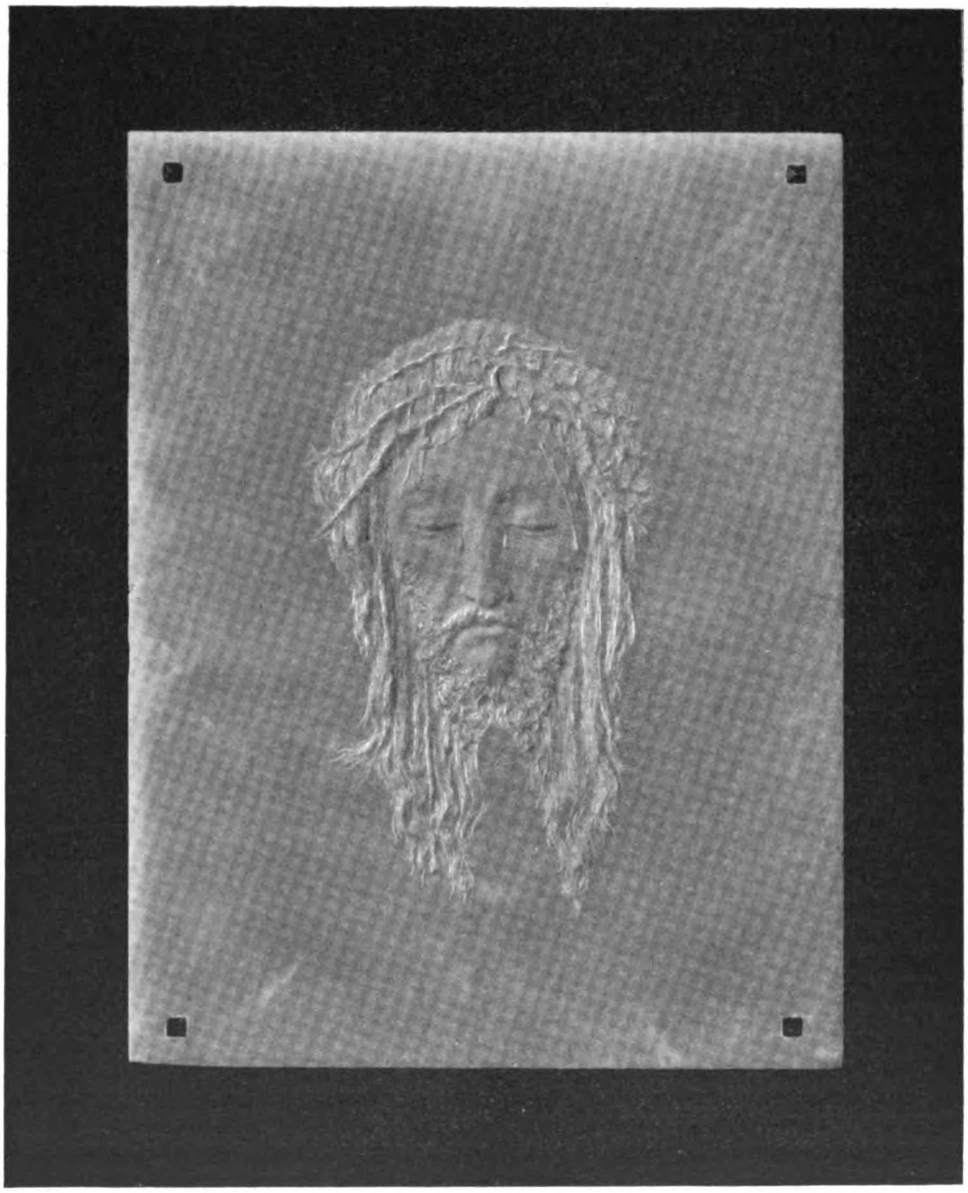
It being desired by the Confraternity of the Holy Face connected with the Church of St. Agnes, East Forty-third street, to erect a tablet emblematic of that devotion, it was found that on account of the chapel where the tablet had to be placed being situated beneath the gallery any ordinary means of lighting it would be totally ineffective. Electricity in the hands of our artist once again came to the rescue. He conceived the idea of having the image carved in bas-relief on a slab of white onyx the transparency of which would enable him to show the lineaments of the face by three 16 c. p. lamps with reflectors placed behind the slab. This was carried out and the effect is very beautiful. The tablet represents the apron of St. Veronica with which, as tradition relates, she wiped the bleeding face of the Saviour on the way to Mount Calvary, the apron afterwards retaining the impression of the countenance of the Man of Sorrows. The electric lights behind the tablet bring out in the clearest manner every line of the terrible, ghastly and pitiful face of the Saviour.

AN ARCH OF 160 LAMPS.

One of the most difficult achievements accomplished by our artist was the lighting of the immense painting of the crucifixion at the back of the high altar in the Church of the Holy Innocents. The only feasible way of effectively lighting the picture was by an arch of electric lights, backed by a corrugated glass reflector, hidden from the congregation, at the back of the coping of the great sanctuary arch. Difficulty followed difficulty in doing this work. The original plans giving the dimensions of the arch, which is 60 feet high, could not be found, and it seemed as if a scaffold would have to be erected to take new measurements. This was obviated by constructing the glass reflector on the principle of a fish's scales, so that it could either be expanded or contracted as might be found necessary. The row of lamps along the coping was erected in two sections on separate frames, which can be lowered for the purpose of replacing burnt-out lamps, by means of two rods which pass up through the ceiling of the church. In addition to these lights, there is a row of lights at the back of each of the columns supporting the sanctuary arch, and these are on flexible cords and may be raised and lowered by means of pulleys. Altogether, on the two columns and across the coping, there are 160 16 c.p. lamps controlled by three switches, one for the arc lights, and one for each of the columns.

A SPUR TO ARTISTIC DECORATION.

One noticeable effect of the application of electricity to church lighting has been the impulse given to improve the character of the other decorative features. For example, the rubrics of the Catholic Church ordain that before the tabernacle containing the blessed sacrament shall always be burned a lamp fed with pure olive oil, commemorative of the "perpetual fire" of Solomon's Temple and of that sacred mystic fire of divine charity with which the heart of the Saviour burns toward mankind. Before the advent of electric lighting, the general dimness of the churches made it a matter of



ONYX HOLY FACE, ST. AGNES'S CHURCH.

small importance what the character of the lamp (known as the sanctuary lamp) containing this oil might be. Now, however, that churches are brilliantly lighted, the general brightness puts to shame anything tawdry or inartistic, and several churches have sought to have designed for them sanctuary lamps which should be in harmony with their artistic surroundings and express symbolically some idea of the name given to the church in which they hang. Mr. Colombani has already designed and erected several sanctuary lamps which are something more than mere fixtures and have done much to elevate the artistic reputation of the churches in which they have been placed.

SYMBOLIC SANCTUARY LAMPS.

The sanctuary lamp in St. Joseph's Church, this city, represents the figures of the seven angels of the seven churches of the Apocalypse, each holding a candelabra lamp made to resemble when lighted a flame, typical of his guidance of the church under his care. These figures are grouped around the base of a tree representing the genealogical tree of St. Joseph as described in the first chapter of St. Matthew's gospel. At the summit of the tree is the red sanctuary light, typifying the fruit of the tree, which is "our Lord the light of the world." The height of the lamp is 12 feet. The figures of the angels are 2 feet high and are of solid bronze finished in gold plating. The use of the electric current gives to the whole lamp the appearance of massive gold. It weighs about 360 pounds, and is suspended by a steel cable plated with gold.

Soon after the erection of the sanctuary lamp of St. Joseph's, Mr. Colombani was commissioned by the two vicars-general of the archdiocese, Mgr. Farley, of St. Gabriel's, East 37th street, and Very Rev. Dr. Mooney, of the Church of the Sacred Heart, West 51st street, to design lamps for their respective churches, and both of these lamps are singularly beautiful examples of artistic church decoration.

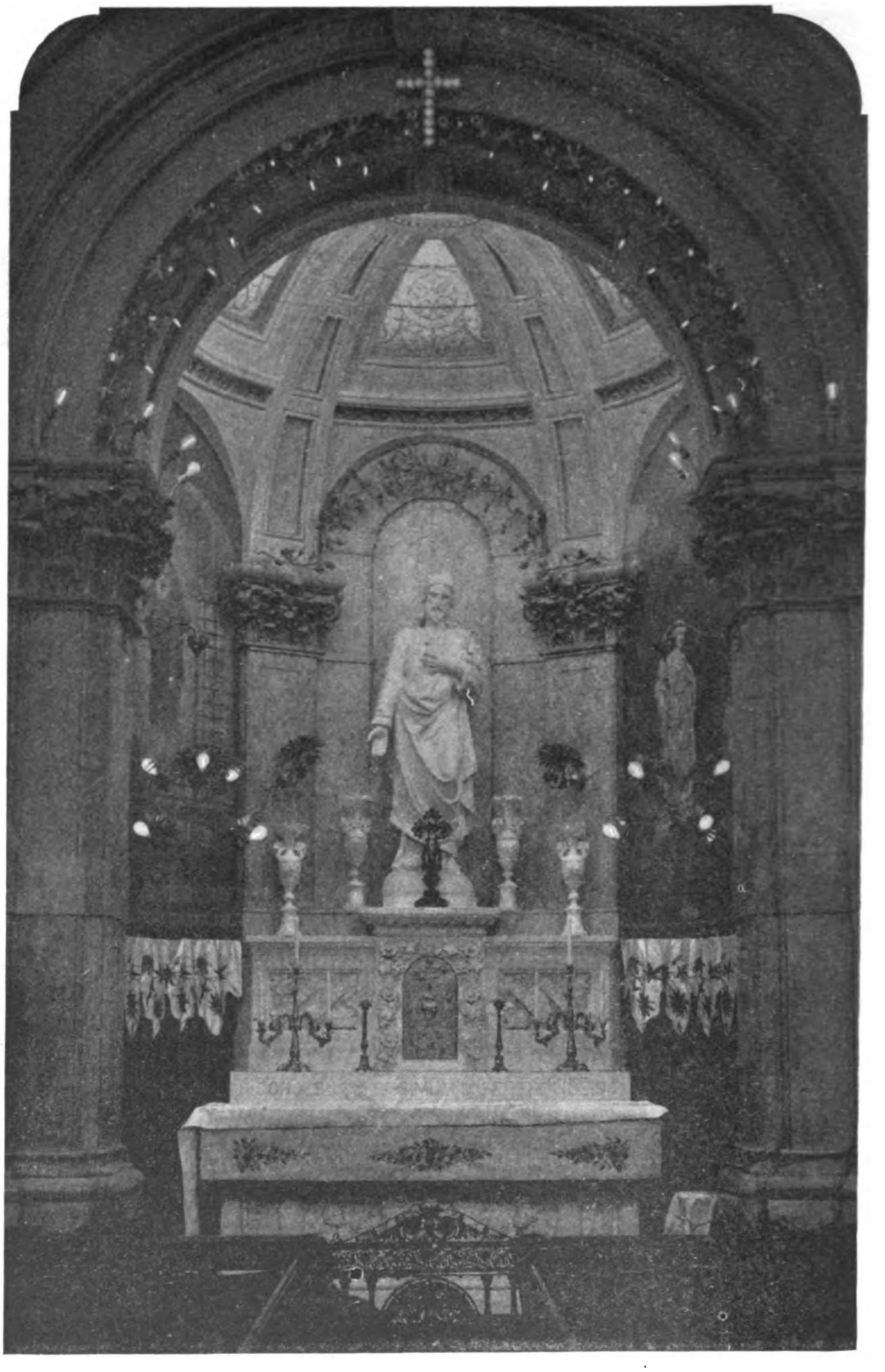
The lamp at St Gabriel's is one of the most striking features of the interior decoration of the church, which was renovated a few months ago so as to be almost a new building. Striking the eye immediately one enters the church, it reveals at once to the Catholic worshipper the fact that the angel Gabriel is the patron of the church. The lamp is cast of solid brass, and is 12 feet high and 22 inches wide at the base. The idea of the artist was that it should typify the patron saint of the church, and for this reason he has illustrated the various incidents in which St. Gabriel is related to have had intercourse with mankind. Thus, on the summit of the lamp is represented the castle of Susa, where the prophet Daniel had his vision of the ram and the he-goat interpreted by the angel Gabriel, who told the prophet that in answer to his prayers seventy weeks of years would be taken off the period remaining before the coming of Christ, or the Annunciation, which is represented by the angel Gabriel, the Virgin Mary and the Holy Ghost (in the form of a dove containing a 32 C.P. spherical lamp whose rays illumine the face of the Virgin).

Two lions are shown, to represent the meaning of the name Gabriel, "Strength of God." They also suggest the promise that God will deliver from harm those who watch and pray, as he delivered Daniel from the den of lions.

The artist has departed from the usual custom of having the lamp suspended from three or more chains, and has used but two, his idea being to remind the worshippers of the two captivities of the prophet Daniel, who was twice cast into a den of lions, and who received through the angel Gabriel the solemn promise of the accomplishment of the mystery, which the same divine messenger announced to the Virgin. This idea of the two chains led the artist unconsciously to a revival of one of the oldest forms of lamps used in the church, and which is not to be found in any church of modern times, though one or two examples may be seen in some of the oldest monasteries in Spain and Italy. It was the custom to suspend from a plain lamp, a disk or plate of silver or bronze, upon which was hammered out an image of the saint who was the patron of the chapel in which the lamp was hung. At the feet of the prophet Daniel, the Roman figures LXX, formed of 32 2 C.P. miniature lamps, eight in series, represent the seventy weeks of the prophecy.

Taking the motto of the Church of the Sacred Heart to mean, as it is usually interpreted, that the sacred heart of the Saviour is continually beseeching the uplifting of the hearts of men, the artist conceived the idea of this lamp from the verse of Jeremiah iii, 41: "Sursum corda," "Lift up your hearts," and the response, "Habemus ad Dominum." "We have lifted them up to the Lord." This lamp, like that of St. Gabriel's Church, is cast out of solid brass and is also 12 feet high. It is, however, spherical or bowl-shaped, and is 28 inches in diameter.

The main feature of the lamp is a statue of the Saviour pointing to his heart, illustrating the expression "Son, give me thy heart." There are seven attendant angels in a circle surrounding the feet of the Saviour, each holding in his raised hand a heart of hollow metal in which is hidden a receptacle on which is screwed a 2 C. P. candelabra lamp to represent the rays of faith which illumine the heart which the true Christian offers to the Lord. The number of angels represented is seven, the number mentioned in the Apocalypse as well as in many other sacred writings, notably in the Syriac liturgy of Philonexus, who mentions seven cohorts of angels.



SACRED HEART SHRINE. ST. FRANCIS XAVIER'S.

THE ARTIST'S MASTERPIECE.

The most recently designed lamp was that of St. Michael's Church, on West 31st street, and this may with justice be considered the artist's masterpiece. The subject, St. Michael, the defender of the Church of God, is so prolific as to have afforded an almost limitless field for the artistic employment of the electric light.

The scene pictured is St. Michael contending with the Devil for the body of Moses. This fact is represented by three figures, viz., the body of Moses, St. Michael and Satan. An electric candle is placed on each side of the body of Moses, which is on a rock in a recumbent position with the head inclined to the left. Satan is turning away from the spot, anger and despair being shown on his countenance. St. Michael stands erect delivering a message to Satan.

Pictorial Telegraphy—Fig. 1.

The two electric candles beside the body of Moses signify the cause of the dispute. The holiness and divinely brightened countenance of Moses were so pronounced that the Devil, knowing the idolatrous tendency of the Israelites, attempted to cloud all the brilliancy of worship with the darkness of idolatry and his own worship.

The hidden electric lights illuminating the group typify the providence of God, which watches us in doubt and shines upon us in the hour of our greatest darkness, the moment of death.

The vase of oil for the perpetual lamp is encased in the crown held by two angels, who were ordered to secretly bury the body of Moses. It brings to our minds Moses receiving his immortal crown through the anticipated merits of our Saviour, Jesus Christ, "The Light of the World," whose coming he foretold.

The bas-relief at the top of the lamp represents the apparition of St. Michael to the bishop of Seponto.

The miniature church is an exact copy of the Church of St. Michael in New York, which was remodelled in the year 1893 by the Rev. John R. Gleason, the present rector.

The cherubs' heads at the base of the lamp tell us of the holy office of the angels who assist us in our devotions, join their supplications to ours, carry up our prayers to God and bring back his blessings and gifts to us.

The palm branches at the base of the chains represent the triumph of Christ over the Devil.

The three rods holding the different parts of the lamp together bring to our minds the three holy archangels particularly distinguished in Holy Writ, who were God's ambassadors in the execution of his greatest designs—St. Michael, which name in Hebrew signifies, who is like God; St. Gabriel, the Strength of God, and St. Raphael, the Healing of God.

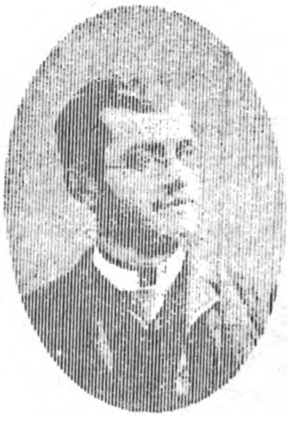
The ring is symbolical of God's eternity—without beginning and without end.

It also reminds us that man is the link between the spiritual and the material world, he being by his body allied to matter, and by his soul to the celestial intelligence.

In addition to its usefulness in illumination and decorative purposes, the efficacy of electricity as a motive power has been demonstrated in its application to the organs in several churches, notably in St. Patrick's Cathedral, St. Francis Xavier's, Grace Church, St. Thomas's Episcopal Church, St. James's Catholic Church, and in St. Peter's, the oldest Catholic church in the city.

There are many advantages connected with the use of an electric motor for pumping air into the bellows of an organ. When steam or hydraulic power is used the wear and tear are found to be very great in consequence of the incessant action of the machinery.

In recounting in this article what has already been accomplished in the application of electricity to the lighting and decoration of churches, our object has been to suggest to our readers its possibilities in the future, as much as to record its successes in the past. If so much has been done in the short space of a lustrum, what great triumphs may we not reasonably expect in the years to come?



Pictorial Telegraphy—Fig. 2.

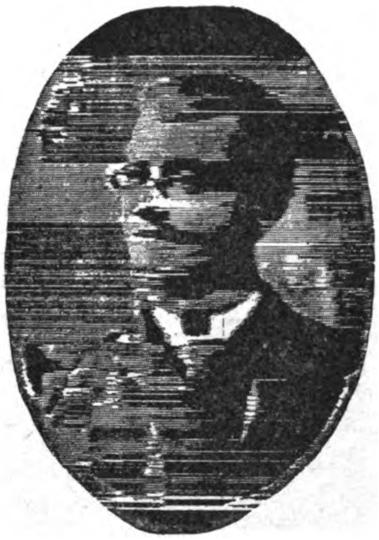
Popular Electrical Science.

XI.

PICTORIAL TELEGRAPHY.

BY NELSON W. PERRY, E.M.

In the issue of Electriciy for Nov. 18th, 1891, we published a memorable article entitled "Pictorial Telegraphy," in which was described the electro-artograph of Mr. N. S. Amstutz of Cleveland, O., by means of which half-tone reproductions of photographs could be automatically transmitted over an ordinary telegraph wire and automatically reproduced at the further end. It was our good fortune at the time to be able to present specimens of the work in that stage of

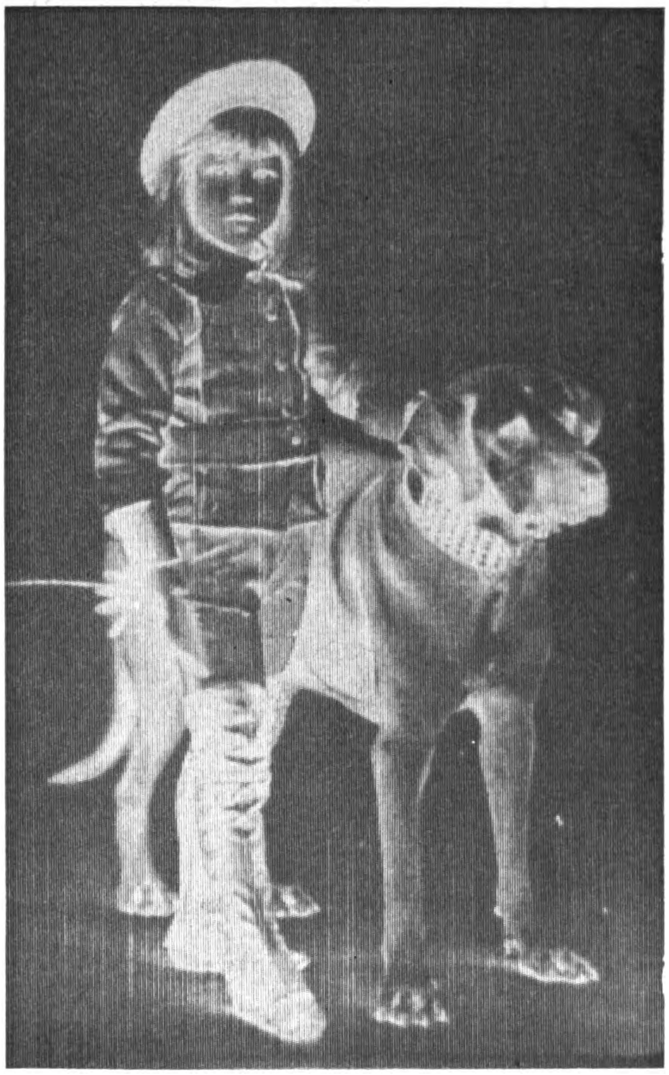


Pictorial Telegraphy—Fig. 3.

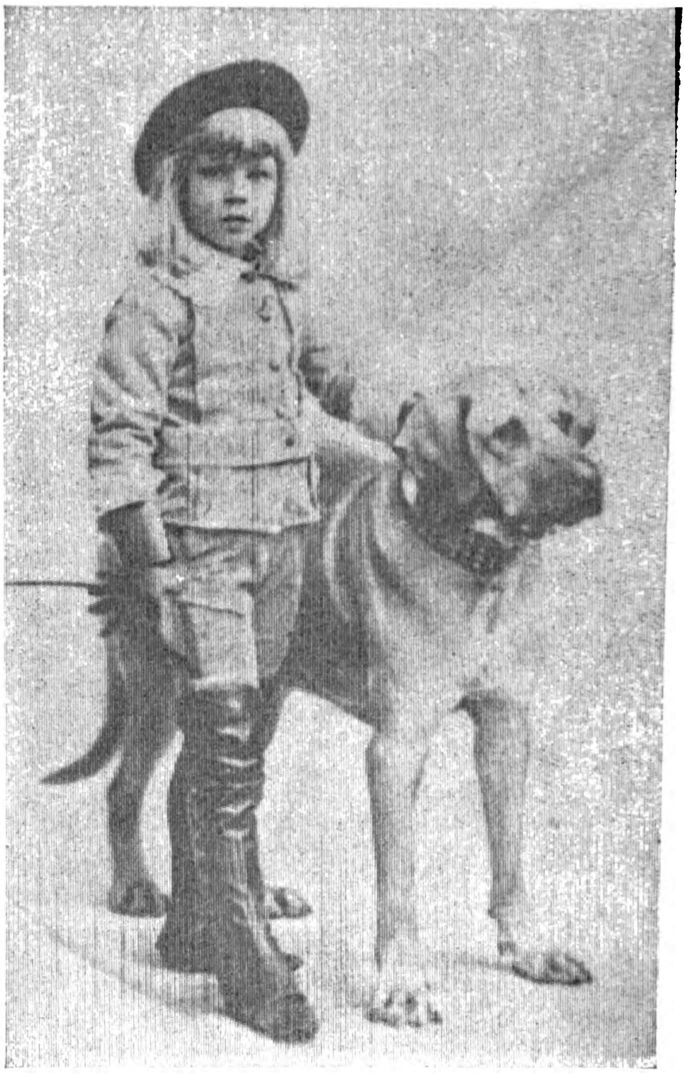
Pictorial Telegraphy—Fig. 4.

the development which had been sent over a single wire 20 miles long with a 110 volt current. These pictures were necessarily crude and it was with great difficulty that we persuaded the inventor to permit of their reproduction, but he finally yielded to our importunities and the result was that the article and pictures were copied by the press in every civilized country on the globe.

Commenting upon the process at the time, we said: "The illustrations which we present are not valuable from an artistic point of view, but we think they will be better appreciated by our readers than more finished productions would be, in that they show the operation of the process better. It is not often that an inventor is willing to have his first and crudest efforts published, and thus much of historical interest is often lost to the world. The avidity with which the first attempts of great inventors are sought for in after years attests to the interest they have for the public, and we think Mr. Amstutz is wise in permitting the publication at this time of the crude reproductions of his first experiments."



PICTORIAL TELEGRAPHY—FIG. 5.



PICTORIAL TELEGRAPHY—FIG. 6.

Three years and three months almost to a day have elapsed since the original publication, and we are now able to revert to this process again with feelings of pride and satisfaction in the results accomplished in that short period. No longer is it necessary to say that "the illustrations which we present are not valuable from an artistic point of view," but instead, we may now say, "they are artistic in a high degree," and the beauty of the work is only heightened by the contrasts of the accomplishments then and now.

The present occasion seems singularly opportune for this second article on this practically new art, since it is the occasion of the meeting of the National Electric Light Association at the home of the inventor, and no class of men will take more pride in the new achievements of electricity than that engaged in its commercial production.

A BRIEF DESCRIPTION OF THE PROCESS.

Alexander Graham Bell found that by varying the strength of an electric current in consonance with sound waves he could transmit articulate speech nearly to the ends of the earth.

Edison, Taintor and Bell found that by causing a stylus attached to the center of a diaphragm to which words were spoken to bear lightly upon a revolving wax cylinder they could engrave upon that wax and preserve for all time the characteristics of those words—the undulatory graved line in the soft matrix became the mechanical fac-simile of articulate speech, which required merely a reversal of the process to reproduce the original sound waves. If the diaphragm stylus were allowed to trip over the undulatory graved line it would give out spoken words. If it were caused to vary the strength of an electric current those undulations might be reproduced in sound at a distant point in a telephone receiver, or, by causing this current to actuate an electro-magnetic device, a duplicate engraved record could be made in wax at the distant point which could be made to utter again the original words.

The phonograph inscription is the mechanical record of sounds. Can we make a mechanical record of light in all its various gradations? Certainly, and quite as simply.

Many substances undergo changes of solubility which are proportional to the intensity of the light to which they are exposed. One such substance is ordinary gelatine in which is dissolved a little bichromate of potassium. This, when exposed to the action of light, becomes insoluble in warm water, whereas before such exposure it will be dissolved away. If, therefore, we expose such a plate beneath a photographic negative, those portions which are exposed to the strong light will become totally insoluble; those that are entirely shielded will remain soluble; and those affected by the subdued light—the half tones—will have their solubility affected in proportion to the amount of light received. It remains now only to sponge the plate with warm water to have a photograph in relief wherein the high lights will have the greatest elevations and the shadows will be depressed.

If now this relief photograph were rolled upon a phonograph cylinder and placed upon the machine, its stylus describing a fine spiral path would rise and fall as the picture passed beneath it just as it does when following the phonogram. It is not sound, however, that is wanted in this case, but another record at a distance, so Mr. Amstutz causes this rising and falling of the stylus as it passes over the relief photograph to vary in similar manner the strength of an electric current. This undulatory current passing over an ordinary telephone or telegraph wire actuates a similar stylus at the further end which, bearing upon a revolving wax cylinder, engraves in the wax an exact reproduction in elevation of the path over which the first stylus has passed. From this cylinder an electrotype may be taken, flattened out and placed upon the press, and it is from such that the illustrations herewith produced were made.

The graving tool is made V shaped so that as it cuts deeper it cuts wider, and in printing produces blacker lines.

If we follow the process we see that the relief photo in gelatine printed from a negative is a positive. This may be reproduced at the distant point either as a positive or as a negative. Both forms of reproduction are shown to better illustrate the process.

Fig. 1 is a reproduction from a photograph by the ordinary half-tone process of a portrait of the inventor of the artotype, Mr. N. S. Amstutz. Fig. 2 is a reproduction from the same negative made by Mr. Amstutz last summer by the artotype process. To better illustrate the progress of the art since our first description we give Fig. 3, which is a reproduction of a portrait of the same gentleman made in 1891 and printed in our issue for November of that year. The principles involved in both are the same, but the mechanical execution is far more perfect in the later than in the earlier work.

Through the kindness of Mr. Amstutz we are also able to give another series of cuts illustrating the art which are exceedingly interesting.

Fig. 4 is a half-tone reproduction prepared by ourselves of little Lord Fauntleroy and his dog. From the *same original* were produced Figs. 5 and 6—these by the electro-artograph. Fig. 5 is a negative reproduction such as before referred to. In this the marks of the graving tool give prominence and everything is reversed—viz., the portions of the lines which in the positive print black here print light, and vice versa. If this were printed in white ink on a black background the lights and shadows would come out in their proper relations. The ordinary ferrotype pictures are reproductions of a similar kind, and the writer possesses a picture from this same cut printed in silver on a black card. The effect is superb and resembles a photograph on white satin. Fig. 6 is a positive from the same original and shows the finished results obtainable after telegraphic transmission over a single wire.

These last two reproductions are made from engravings having 80 lines to the inch. The half-tone from the original (Fig. 4) is made with 120 lines, and shows finer gradations of light; but these effects are entirely within the compass of the electro-artograph, as it has recently been constructed to produce the same fineness of lining, and the writer received too late for reproduction in this article a sample of such work which is beautiful in the extreme.

For ordinary newspaper reproductions, however, this extremely fine work of 120 lines to the inch is not desirable, since the delicate effects are all lost in hasty presswork and poor paper.

But the great utility of this process lies in the fact that it is almost entirely automatic. The relief photo must, of course, be prepared and wound on the cylinder by hand, and the machines at both ends of the line started up, but the tracing of the transmitting stylus and the engraving on the receiving cylinder proceed without further attention.

As to the time occupied in this operation, Fig. 3 was transmitted and engraved in 10 minutes, while Figs. 5 and 6 occupied only 3 minutes' time.

In conclusion I will say that Figs. 5 and 6 were made from electrotypes from an original engraving marked "F," deposited with the Smithsonian Institution at Washington, D. C.

The plans for building a net of electric railways for the city of Vienna, Austria, are approaching completion. The new tramway company has quite lately made trials with motors worked by accumulators, and is now intending to give up working with horses altogether. An electric tramway is in course of construction at Nice, and is expected to be completed by March 1. This line will be used by Her Majesty Queen Victoria, who is expected to arrive there on the 15th of that month.

According to the London *Electrical Engineer* no less than 284 fires were caused last year in the city of London by what are termed gas explosions, but not a single conflagration has been traced to the electric light.

The Lighting of Cleveland.

BIRTHPLACE OF THE ARC LAMP.

New Plant of the Cleveland Electric Illuminating Company.

Attendants at the Cleveland meeting of the N. E. L. A. who are making their first visit to that city will be surprised when they observe that Cleveland is the poorest lighted city of its size in this country, if not in the world.

There are several reasons for this condition of affairs, chief of which is the intermingling of the gas interests with the political powers.

Whatever may have been the shortcomings of the previous electric lighting companies, the rulers of the city now have no further excuse for delay. The new station, now nearly completed, equipped with apparatus for every kind of service, is able to supply current anywhere within the city limits economically and with a guarantee of good service.

The local Brush company of that city was one of the earliest commercial ventures in the line of arc lighting, the company being organized in 1881. Here was tried for the first time on a large scale the experiment of lighting a large city by means of towers. The towers adopted were different from those now in use in Detroit and other cities, consisting of a single standard built of short sections of tubing of large dimensions. The first one erected was in the public square, 256 feet high, having 8 4,000 C. P. lamps, requiring 18 amperes. Afterwards three others were erected in the central part of the city. The idea was proved to be a failure. Three of the towers have been taken down, and the fourth lowered to 150 feet in height, carrying 8 lamps of 2,000 C. P.

Five years later, in 1886, a Thomson-Houston company was started equipped with series arc, alternating and low tension incandescent apparatus.

In 1893 these companies were consolidated, the new company taking the name of the Cleveland Electric Illuminating Co.

To show the poor headway made by the two earlier companies in lighting the city, nothing speaks more plainly than the bare figures. Out of 540 miles of streets in the city only 18 miles are supplied with electric lights. There are apparently no obstacles in the way of extending this service to the limits of the city except politics and the pull which the gas people enjoy. The longest line required would be not over six miles from the new station.

It is to be hoped that the public spirited citizens of Cleveland will imbibe some of the prevailing enthusiasm over electric lighting matters this week, and that the city will not be compelled to rest forever under the proven charge of being far behind other cities in adopting the modern lighting system of the civilized world.

The station has been planned with great care under the direction of Mr. Robert Lindsay, who had several years' experience in one of the best conducted lighting stations in the world—that of the Brooklyn Edison Company. The arrangements are the result of careful study of the best American and European practice, and when completed it will rank with the best in this country or abroad. It is designed for high tension series arc, alternating current lights, low tension lights and power.

The building, 135 ft. long and 97 ft. wide, is located on Canal street, and extends back to the Valley Railroad. The Cuyahoga River is about 200 ft. from the rear of the building, the railroad being between the river and the building. A curved siding from the tracks of the Valley Railroad parallels the entire length of the boiler room side of the building.

The boiler room and engine room are 36 ft. clear between floor and roof trusses, while the front part of the building is 3 stories high.

The second floor is the dynamo room and is 18 ft. above engine room floor. This room is about on the level with sidewalk line at the front of the building.

The third floor, or workshop storeroom, is 20 ft. above dynamo floor and has a clear headroom under roof trusses of 12 ft. The engine room and boiler room are separated from each other by a fireproof wall extending up to the roof line. There are two Yale & Towne cranes in the plant, one in the engine room of about 28 ft. span and having a capacity of 10 tons, supplied with two geared trolleys and hoists. The dynamo crane has a span of 26 ft. and a capacity of 6 tons with single trolley and hoist. These cranes travel the entire length of engine and dynamo rooms, and are capable of handling any part of the engines or dynamos.

The general idea of the location of the machinery was to place the engines, boilers, and dynamos in such position that the loss of transmission of the different forms of energy from the coal to the line was to be the least possible.

BOILERS.

The boilers are four in number and of the Climax vertical type, three of them being rated at 800 H. P. each, and one 500 H. P. on 30 lbs. evaporation of water per hour. They are built for 200 lbs. working pressure, and are provided with individual dampers. Space has been left in boiler room of present building for two additional 800 H. P. boilers.

COAL AND ASH HANDLING APPARATUS.

The coal is dropped from the bottom of the hopper cars on the siding into a pocket under same, and delivered inside the wall of the boiler room basement. By means of valves on inside of building, the coal is delivered to the coal handling apparatus, and transferred to coal storage at the extreme end of the building, or directly to individual coal hoppers between the boilers in boiler room. This coal storage is placed about the base of steel stack, and is of the same height as the building proper, i.e., about 43 ft. The ashes are removed by means of the same apparatus as used for handling the coal. While hoppers are provided under each boiler, with valves, etc., necessary for holding a day's run of ashes, an ash storage is formed at the extreme southern end of building for receiving ashes until such times as they can be removed by carts drawn under the storage, and the same emptied by means of valves opening into either carts or railroad cars.

The steel stack, built by Riter & Conley, of Pittsburgh, is 226 ft. in height above stack base, and is 25 ft. 6 in. in diameter at cast-iron base, and 11 ft. 6 in. clear inside of brick lining at top. This stack is of sufficient capacity to take care of any increase of plant which can be located on the property. It is built of steel plate $\frac{7}{16}$ in. thick at the bell base and diminishes in thickness until the top plates are reached, which are ¼ in. thick. The steel shell is lined its entire height with a tapering brick lining, started 21 in. thick at the bottom and tapering to 4½ in. thick at the top.

There are three McIntosh & Seymour tandem compound vertical belted engines for driving shafting of arc and alternete-current generators. The engines have 19 x 36 x 24 cylinders, and develop 750 H.P. each at 125 lbs.. 150 revs. condensing. There are also two cross compound vertical condensing engines of the same make having 2 200 K. W. General Electric multipolar generators connected direct to each engine. These cross compound engines have cylinders 20x36x34, developing 800 H. P. on 125 lbs. steam, 150 revs. condensing. These engines are of the makers' latest type, having piston valves with

(*Continued on page 75.*)

THE HOME OF "ELECTRICITY."

Editorial Room.

Publisher's Office.

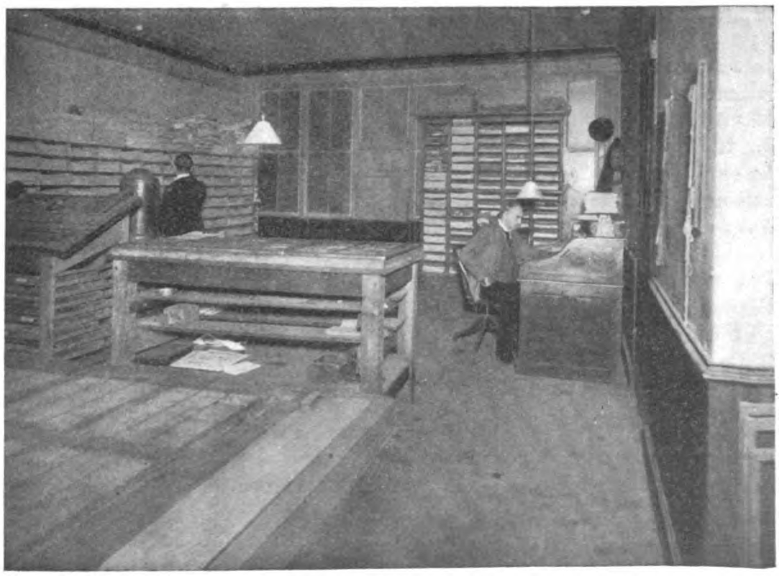
"Electricity's Home."

We do not think we are assuming too much in taking it for granted that the thousands of friends which Electricity has made in its brief and successful career are interested somewhat in the people who make the paper, and in having laid before them a view of the offices which have been its home.

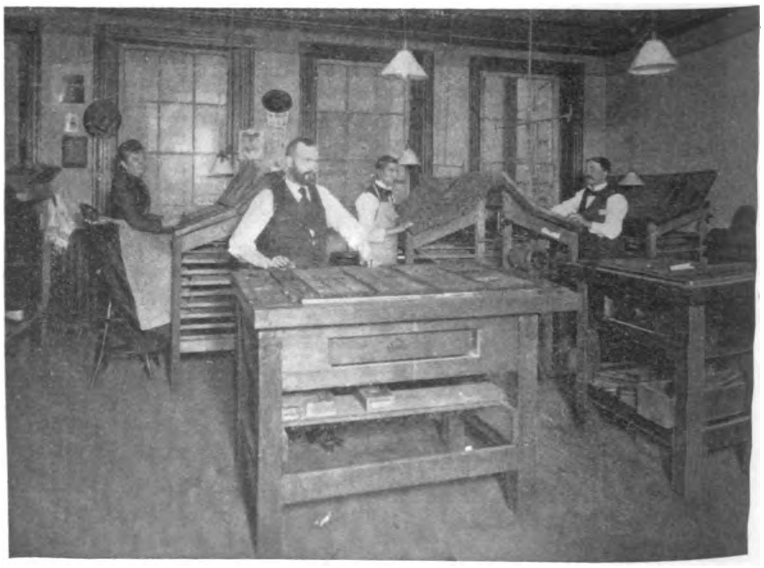
As is well known, Electricity's views of the entire newspaper question are different from most other people's in the same line of business. We have different views of the kind of offices which are fitted for good newspaper work. Hence, instead of choosing a show place, where comfort and convenience must give way to mere display, the present management chose a location where *work* could be done to the best advantage. Our home is, at the same time, convenient to reach for those who want to see us, and there is always an easy chair and a good cigar at the disposal of the man who has a good news story to tell. If the story be an extra good one, the visitor may be invited to lunch in the hostelry of John Rogers, on the next floor below. Just far enough from Broadway to avoid the procession of idlers, and just near enough to be still in the swim, at No. 6 Park Place, our friends can always find us.

As will be noted from the accompanying illustrations, Electricity possesses a composing room of its own, where all the type is set and forms made up, thus enabling us to take the news twelve hours later than any of our contemporaries; and if there is one feature of Electricity which, more than any other, has contributed to its pronounced success, it has been the feature of giving ALL THE NEWS up to the hour of going to press.

Counting Room.



File Room.



Composing Room.

(*Continued from Page 73.*)

riding cut-off on high pressure cylinders, and gridiron valves on the low pressure cylinder, and governed by means of shaft governor. All bearings and slides are water-jacketed, and the engines of heavy and well-balanced design.

PIONEER HUSTLERS—H. WARD LEONARD.

CONDENSERS.

Each engine has its individual condensers, there being five Worthington duplex 12x15x15, but so arranged that either engine can be thrown on either condenser.

The steam pipe between the engine and boilers is arranged to be as direct and simple as possible, with as little drop in pressure, and at the same time to take care of all expansive strains. The valves on the entire plant are Chapman gate valves. On the steam lines they are extra heavy ribbed shells, outside screw and yoke, bronze seats, and tongued and grooved flanges.

The exhaust pipe is entirely of flanged cast iron, as is also the discharge pipe and a portion of the injection pipe. The exhaust and discharge mains are 24 inches in diameter. The injection main is 18 inches in diameter, and is arranged so that an additional main can be put up for future plant. In the branches from engine exhaust to exhaust main 14 in. relief valves are used and the plant arranged so that it can be operated condensing or non-condensing at any time in case of necessity or emergency.

The injection water is taken from the cold well located on inside of building with a lift of about 10 ft. This well is connected with the Cuyahoga River by means of a 24 in. cast iron inlet pipe. The outboard end of this pipe is connected with a 10x10 x10 ft. crib sunk in river and secured by means of piles driven in river bed. The 30 in. cast iron discharge pipe extends from building to river, as well as the 8 in. cast iron blow-off pipe. These pipes were laid under the entire tracks of the Valley railroad.

PIONEER HUSTLERS—J. H. REID.

A 3,000 H. P. Hoppes heater is used for heating the feed water for the boilers. The feed pumps are placed in the basement but operated from boiler floor by the fireman. The pumps take the water from the heater and deliver it to boilers through feed lines or blow-off lines if necessary.

There are fourteen 125-light Brush generators of latest type with automatic regulators for arc lighting, two No. 60 Edison bi-polar generators for low tension direct current light and power, two T.-H. alternators of 1,000 lights capacity each and one of 4,000 lights capacity for incandescent lighting.

PIONEER HUSTLERS.

BRIEF SKETCHES OF EARLY ELECTRICAL SALESMEN.

The Men who Compelled the Business to Grow.—1879-1886.

R. J. Randolph.

Mr. Robert J. Randolph was born in Buffalo, N. Y., January 3, 1847. He went to Chicago in '65, and moved from there to Rockford, Ill., in '75, remaining in the latter city about eight years. While in Rockford he was a member of the Board of Aldermen, and during a portion of that time was vice-president of the Winnebago County Republican Central Committee. His first experience in the electrical business was with the Vandepoele Electric Company, being one of its first salesmen, having entered its employ shortly after Vandépoele moved from Detroit to Chicago, in '78. He sold some of the first machines that the Vandepoele Company ever built, some of which are running today; in fact, the first machine the Vandepoele Company ever built, five lights capacity, sold to the Rockford Bolt Works, Rockford, Ill., is still there. Shortly afterward, when Vandepoele succeeded in building a machine of fifteen lights capacity, Mr. Randolph sold one to the Nelson Knitting Company, Rockford, Ill, which is still in service. Early in the '80s he became connected with the Excelsior Electric Company, with which company he has been ever since, excepting about two years, when he went to Cincinnati and took charge of the Municipal Lighting, Power and Mining Department of the General Electric Company's Cincinnati district. Last year he returned to the Excelsior Company and opened headquarters at No. 5191 Monadnock Block, Chicago, Ill. Mr. Randolph is also president of the Akron and Cuyahoga Falls Rapid Transit Company.

F. S. Terry.

Mr. Franklin S. Terry was born at Ansonia in 1862. After passing through the High School there he entered the employ of Wallace Bros., and began his active business career in charge of the books of the Electric Supply Company in 1880. In 1884 he was sent to Chicago to open the branch in that city, which rapidly grew to be the largest supply house in the West or in this country. He was one of those most ardently interested in the organization of the N. E. L. A. Owing to lack of working capital, and through no fault of Mr. Terry's, the Electrical Supply Company (then called the Ansonia Electric Company) was forced to suspend, following closely upon the failure of the firm of Wallace & Sons at Ansonia. Mr. Terry is now identified with the Sunbeam Lamp Company of Chicago, which he and his brother, A. S. Terry, founded some years ago.

Charles D. Shain.

Mr. Charles D. Shain was born in Philadelphia, November 8, 1855, son of Charles J. Shain of the firm of Knox & Shain of Philadelphia, who were the first manufacturers of telegraphic instruments in the United States. He was graduated from the Central High School in 1872, and commenced business experiences with H. P. M. Birkenbine, hydraulic engineer. Afterwards he was engineer for the Johnson and Somerset Railroad Company, and later assistant engineer in charge of construction on the Jefferson division of the Texas and Pacific Railroad Company. In 1874 he was engineer for R. J. Dobbins, contractor for the Centennial buildings in Philadelphia; in 1880 superintendent of a silver mine in Arizona for the New York Mining Company. In 1881 became assistant engineer of the Toledo, Cincinnati and St. Louis Railroad Company, and in 1882 chief engineer of the Burlington and Ohio Railroad Company. Early in the year 1883 Mr. Shain entered the electrical field, being connected with C. C. Warren of the United States Electric Lighting Company at the time that company opened its Chicago office. In the latter part of 1884 was Western agent in the sale of incandescent lamps and supplies for the electric light department of the Union Switch and Signal Company. In 1885 was again connected with the United States Electric Lighting Company, and became assistant manager of the Western office. In 1889, after the purchase of the United States Electric Lighting Company by the Westinghouse Electric and Manufacturing Company, he became general district agent for the latter company at Cincinnati. In the fall of 1889 became connected with the United Edison Manufacturing Company in New York, and later became assistant general manager to H. Ward Leonard, general manager. In the summer of 1890, at the time of the formation of the Edison General Electric Company, was made Eastern district manager, filling this position until the fall of 1892, when the consolidation of the Edison General Electric Company and the Thomson-Houston Electric Company having taken place he resigned his position and opened an office at 136 Liberty street, New York, as a manufacturers' agent, representing the Weston Electrical Instrument Company, the Siemens & Halske Electric Company of America the Carpenter Enamel Rheostat Company, the Cutter Electrical and Manufacturing Company, and the Sunbeam Incandescent Lamp Company.

R. T. McDonald.

Mr. Ronald T. McDonald, who is now the president of the Fort Wayne Electric Corporation, could not be left out of the list of the early and successful salesmen, for it is only a few years since he was hustling in the sale of apparatus and the organization of new companies.

Mr. McDonald is believed to hold the record as the most successful individual salesman in the field, though in volume of business done Mr. Chas. D. Shain would be a very close second. Mr. McDonald is 46 years old, has a creditable record as a soldier, having entered the service as a drummer boy when a lad of only 13 years. After a successful commercial experience, he entered the electrical field in 1882, being one of the incorporators of the Fort Wayne Jenney Electric Light Co., and at the same time he assumed the management of the business. Since that time he has been very much in evidence, and always sticking closely to the Fort Wayne interests. The coup which resulted in his withdrawal from the General Electric Combination and the establishment of a new company upon an independent basis is matter of recent history and has not been forgotten. Mr. McDonald is probably the hardest worker in the trade to-day, and there seems no limit to his energy.

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H. Ward Leonard.

Mr. Leonard was born in Cincinnati, O., February 8, 1861. After leaving the High School, he worked for two years as machinist in the railway shops of Cincinnati, and then went to the Massachusetts Institute of Technology, where he took a course in mining engineering. Graduating in 1883, he secured a position with Mr. Edison, became one of four selected by him as a staff of engineers to erect stations in this country. Two years later Mr. Leonard accepted a position as electrical engineer to install Edison's stations in Ohio. In 1887 he went to Chicago as general superintendent of the Western Edison Light Company. Two years later, as senior partner, he started the firm of Leonard & Izard. In 1889 Mr. Leonard accepted the position of general manager of the United Edison Manufacturing Company. Later he became manager of the light and power department of the General Electric Company, which position he occupied until September 1, 1891, when he resigned. He is now engaged in some important engineering work.

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J. H. Reid.

Mr. J. H. Reid was born in Auburn, N. Y., in 1856, and started in the electrical business in that city in the fall of 1878 as a general construction man on the Edison Telephone Exchange. He installed the exchange at Lockport, N. Y., in 1878. In 1880 he became connected with the Empire State Telephone Company as foreman of construction. In 1885 he entered the United States Electric Lighting Company's Chicago office, remaining there until the summer of 1886. In 1886 he took the Western management of the Mather Electric Company's business, with office in Chicago. Afterwards Mr. Reid entered the employ of the Electrical Supply Company of Chicago, and was one of the active men in forming the N. E. L. A.

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George H. Bliss.

Mr. Geo. H. Bliss was born at Worcester, Mass., May 12, 1840. He became a paper telegraph operator in 1858, at Dixon, Ill., on the Chicago and Galena Union Railroad. In 1864 he was made superintendent of telegraph of all the lines on the Chicago and Northern Railway. In 1877 he entered into a partnership with L. G. Tillotson & Co. of New York, forming the firm of Bliss, Tillotson & Co. which operated at Chicago. This was the first electrical industry of importance at Chicago. The concern was burned out in the great Chicago fire of 1871, losing $50,000 and recovering only $15,000 of insurance. In 1872 he bought out his New York partners and reorganized the business under the name of Geo. H. Bliss & Co. This concern was burned in the second large Chicago fire of 1874. The business was then merged with the Western Electric Company, of which Mr. Bliss was director and general agent for three years. In 1877 he became associated with Mr. Edison and handled his specialties in this country and Europe for two years. In 1879 he started the Electric Merchandising Company, at Chicago, which concern had a license to manufacture some of the Bell telephone apparatus. Afterwards he became general Western agent of the Edison Electric Light Company. His efforts resulted in the formation of the Western Edison Light Company, of which he was superintendent for three years. At present he is president of the Ozone Company, treasurer of the Rowell Potter Safety Stop Company and identified with other electrical enterprises.

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B. F. Stewart.

Mr. B. F. Stewart was born in Virginia in 1854, and began his first experience of any consequence with electrical work in 1880. He went to Chicago with Mr. Van Depoele in 1880 and was with the Van Depoele Electric Co. from that time to September, 1884, during all Mr. Van Depoele's early electric railway experiments. Mr. Stewart then went with the Western Electric Co. for four years, and was afterwards with the Sprague Co. in the Chicago office until April of 1890, when he became connected with the Westinghouse Electric Co. and at present has charge of their Chicago office.

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George H. Wadsworth.

The first electric light carbon salesman in this country was Mr. Geo. H. Wadsworth. Born February 28, 1851, near Columbus, O., at the age of 21, while acting as assistant chief in the Western Union telegraph office at Cleveland, O., he became greatly interested in the subject of electricity. The wires for the first duplex and quadruplex instrument ever used in that office were run by him at that time, and the first telephone in the city of Cleveland was put up by him in the winter of '78-79. He was afterwards made chief of the Western Union office, acting in that capacity until he resigned to enter the Arnoux Electric Light Co. Later on he was connected with the Boulton Carbon Co. of Cleveland, and lastly with the Thomson-Houston Co. at Chicago. An attack of pneumonia while at the Windsor Hotel in New York, in 1887, left him greatly broken in health. He died in Kansas City, July 29, 1889.

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James F. Kelly.

Mr. James F. Kelly was graduated from Stevens Institute of Technology in 1879, taking his degree of M. E. His first business connection was with the Gold and Stock Telegraph Company as telephone inspector. Later he was with the Western Electric Company for three years and with the Electrical Supply Company for about the same time. In 1886 he became general sales agent of the Edison Machine Works. When the U. S. Wire and Cable Company was formed Mr. Kelly took the position of manager of the sales department. He is now with the New York Insulated Wire Company in Cortlandt street.

Frank Ridlon.

Mr. Frank Ridlon, one of the earlier pioneers, first became connected with the electrical business in the year 1879 with the New York office of the Brush-Swan Electric Light Company. He sold the first plant to the Havemeyer Sugar Refinery in Williamsburg, N. Y., and in 1880 went to Boston as the New England agent for the above-named company. He retained this position until the fall of 1888, when he took the agency of the Baxter motor for New England, and was appointed treasurer of the Sun Electric Company. On April 1st, 1889, he established the firm of Frank Ridlon & Co., Boston, which was changed to the firm of Frank Ridlon Co. on June 1st, 1894, with offices at No. 180 Summer street, Boston.

—

G. W. Hart.

Mr. Gerald W. Hart, after leaving the Sheffield Scientific School of Yale College, entered the employ of the Thomson-Houston Electric Company upon its organization as the American Electric Company at New Britain, Conn., in July, 1880. He remained at the factory at New Britain until the spring of 1882, going out occasionally to install isolated plants. In April, 1882, he was sent to Kansas City, Mo., to install for the Kansas City Electric Light Company the first central station using the Thomson-Houston system. From that time until December, 1886, he remained in the employ of the Thomson-Houston Company, and was located at various points in the West, selling and installing arc lighting apparatus for that company. Early in 1887 he returned to Kansas City permanently, and was made assistant general manager of the Kansas City Electric Light Company and superintendent of the Edison Electric Light and Power Company of that city. In 1891 he formed a partnership, under the name of the Hart & Hegeman Manufacturing Company, with George S. Hegeman for the manufacture of electric light supplies. In May, 1891, the business was removed to Hartford, Conn., where they are now located.

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F. W. Harrington.

Mr. Frank W. Harrington was born about forty-two years ago of New England ancestry. In 1870 he became connected with Mr. C. Williams, Jr., in Boston, and was closely identified with some of the earlier experiments in both telephone and electric lighting work. Later he was sent abroad and did important telephone work both in England and the West Indies. In 1885 he went with the Western Electric Company of New York and Chicago and remained until 1890, when he took charge of the New York branch of the Tropical American Telephone Company. In 1892 he joined the forces of the New York Insulated Wire Company, remaining there until last December, when he resigned to take a similar position with Mr. J. W. Godfrey in the interests of Habirshaw wire.

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John A. Seeley.

Mr. John A. Seeley says he was born in Virginia in 1855, and we think he must have made a mistake as he looks ten years younger. He entered into the electrical business in 1878 with the American Union Telegraph Company. In 1879 he became connected with the City and Suburban Telephone Company of Cincinnati, O. In 1882 he accepted a position with the Metropolitan Telephone and Telegraph Company, New York City, as their electrical engineer, and resigned from this position in 1888 and embarked in the construction business. He has been one of the most active members of the National Electric Light Association, and is now president of the Complete Electric Construction Company of New York.

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C. O. Baker, Jr.

Mr. Cyrus O. Baker, Jr., was born in Newark, N. J., in 1857, on October 12th. This latter date will be noted as the same upon which Columbus discovered America. He came actively into the electrical business in 1879, and at present his chief connections are with C. O. Baker & Co., platinum refiners, and with the Complete Electric Construction Company, of which latter he is vice-president. He is well known as the gentleman who looks after the comforts of the excursionists at the time of the annual meetings of the National Electric Light Association. In addition to his other duties he has for some time served as valet to Mr. John A. Seeley.

A. H. Reece.

Mr. Achilles H. Reece was born in Allegheny City in 1851 of Quaker parentage. His first employment was in the shops of John M. Cooper & Co., Pittsburg, as machinist's apprentice. In 1872 he went to California, where, as he says, "I entered into competition with a score of Shoshone Indians, and as the main question seemed to be cheapness of cord wood, I concluded to let the Indians have the contract all to themselves." Mr. Reece then went to sea for three years, turning up in Cleveland in 1875 as gas engineer in the Euclid Avenue Opera House, where he first met Mr. Charles F. Brush. In 1877 he was again in California, and associated with Mr. Stephen D. Field in the exploitation of the Jablochkoff system. He again spent a few years at sea. In 1881 Mr. Reece entered the employment of the Brush Electric Company, and was sent to the City of Mexico in their interests, starting the first Brush plant in that country.

B. F. STEWART.

J. F. KELLY.

FRANK RIDLON.

GEORGE H. BLISS.

C. O. BAKER, JR.

F. W. HARRINGTON.

G. W. HART.

JOHN A. SEELEY.

Subsequently he travelled extensively through South America for the Brush people, and later joined the United States Company. Afterwards he was with the Edison Company, and represented them as district manager in San Francisco and Denver. Early this year Mr. Reece took charge of the St. Louis business of the Fort Wayne Electric Corporation.

Charles S. Knight.

Mr. C. S. Knight was born in Ohio about 48 years ago, near the city of Columbus, and gained his earlier business experience during twenty years spent in the service of the Pennsylvania Railroad Company west of Pittsburg. He left the railroad business to become superintendent of the Fort Wayne Gas Company. After remaining with that company for several years he cast his lot in with the Fort Wayne Jenney Electric Light Company, beginning in April, 1886. He has for several years had charge of the sales department, and later has had general supervision of the sales and manufacturing departments. Mr. Knight is vice-president of the reorganized Fort Wayne Company.

Spencer Borden.

Mr. Spencer Borden was born at Fall River June 10, 1849, and was educated in the public schools of Fall River, the Brooklyn Polytechnic Institute (from which he was graduated in 1868) and the Conservatoire des Arts et Metiers, Paris. From 1870 to 1872 he held the position of chemist at the American Print Works, Fall River. In 1872 he built the Fall River Bleachery. In 1880 he organized the New England department of the Edison Electric Light Company, establishing many licensee stations which have become good properties. In 1882 he returned to the management of the Fall River Bleachery, with which he is at present identified.

GEORGE W. WADSWORTH.

Henry Hine.

Mr. Henry Hine was born at Bridgeport, Conn., in 1859. He entered the employ of the United States Electric Light Company, New York, October, 1880, as assistant secretary. For nearly two years he was engaged almost exclusively on patent work, and then entered the commercial end of the business as salesman. In the spring of 1883 he went to Chicago and assisted in establishing the United States business there, travelling widely through the West as salesman. He returned to New York in the spring of 1885, took general charge of the sales department of the United States Company, remained in this position until the consolidation of the United States and Westinghouse companies in 1889, at which time he became the general district agent of the Westinghouse Company in New York, having the territory of New York, Pennsylvania, New Jersey, Maryland, Delaware and Virginia. He remained with the Westinghouse Company until February, 1891, and then left to take charge of the business of the Stanley Electric Manufacturing Company, of Pittsfield, of which he is at present general manager.

A. H. REECE.

J. W. Godfrey.

The birthplace of a man like James W. Godfrey counts for little. We all know him, and that he is about 48 years old. After a successful commercial experience he took the management of the sales department of the New York Insulated Wire Company about nine years ago, and the results of his work are in evidence. He was a prominent member of the New York Electric Club until its untimely death, and was a member of the board of managers. In December of last year Mr. Godfrey retired from the New York Insulated Wire Company and is now in charge of the sales department of the India Rubber and Gutta Percha Insulating Company, with offices at 15 Cortlandt street, New York.

H. C. Adams.

Capt. H. C. Adams was born in Schuyler County, New York, in 1845, and enlisted in the United States Army in August, 1861, being at that time less than sixteen years old. Mr. Adams served in the army until the close of the war, and was mustered out in August, 1865, after a service of four years. He then entered Lowell's Commercial College at Binghamton, N. Y., from which he was graduated, and on March 9, 1867, accepted a position with Holmes, Booth & Haydens as collector, and remained in their employ until 1887. He left their service to accept a position with the American Electric Manufacturing Company, which was at that time becoming a factor in electric lighting circles. With this company Mr. Adams became successively factory manager and purchasing agent, secretary, treasurer, and finally president. In 1888 he took charge of the New York office of the Fort Wayne Electric Company, and remained with that company until January 1, 1893, when he accepted the position of president of the Phillips Insulated Wire Company of Pawtucket, R. I., which position he now holds and is in charge of their New York office.

James W. Godfrey.

Walter F. Smith.

Mr. Walter F. Smith, general manager of the United Electric Improvement Company of Philadelphia, has enjoyed whatever advantages attach to very early schooling in the electrical line, having been a protegé of Moses G. Farmer and a member of his family. His connection with the business dates back to 1869, in the old Wallace establishment at Ansonia. He was actively interested in the electroplating business, and has a fund of reminiscences of the early days which should not be lost to history.

F. A. Scheffler.

C. A. Bragg.

J. E. Ridall.

Geo. L. Wiley.

John E. Ridall.

Mr. John E. Ridall's first connection with the electrical business dates back to the spring of 1880, when he made a contract with the Brush Electric Company, taking the exclusive license and agency for the territory comprising the western part of Pennsylvania and counties bordering the Ohio River in the States of Ohio and West Virginia. At that time the company's name was the Electrical Supply Company, which afterwards merged into the Brush Electric Company, the capitalization then being $100,000. Mr. Ridall built the first electric railway in that section, started the first electric light company, which is the Allegheny County Light Company, and for the first few years was its vice-president and business manager. It started with $150,000 capital, and now has an authorized capital of $1,000,000 with $560,000 issued and $500,000 bonded debt, and is in a flourishing condition. He has been a successful salesman, and still retains the license for Brush apparatus in his original territory.

Spencer Borden.

George L. Wiley.

Mr. Wiley's electrical experience began in June, 1869, when he entered the service of the Gold and Stock Telegraph Company of New York as clerk, at their office in the New York Bank Clearing House. He served in all the intermediate grades until his appointment in 1878 to be superintendent, and the telephone business of the company for New York, Brooklyn and Jersey City was put under his management. In 1880 the present Metropolitan Telephone Company was formed. In that company Mr. Wiley was assistant general manager until June, 1882, when he sailed for the Republic of Mexico as vice-president and general manager of the Mexican Telephone Company. After three years of successful work there, he returned to New York nine years ago and assumed his present position with the Standard Underground Cable Company. Mr. Wiley is not only a good salesman, but has gained some credit as an inventor.

Walter F. Smith.

Charles A. Bragg.

Mr. C. A. Bragg was born in St. Louis, Mo., in 1850, and was educated in the Union High School and Stamford University, preparing for Yale at the latter place. In 1883 he took up the study of electricity, and in 1886 entered the employ of the United States Electric Lighting Company, locating in Philadelphia. At that time Philadelphia had one United States plant of 400 lights; in three years this was increased to a number of plants aggregating 85,000 lights. When the Westinghouse Company absorbed the United States Company he continued with them as manager of the Philadelphia Agency, which office he still retains.

H. C. Adams.

Henry Hine.

F. A. Scheffler.

Mr. Frederick A. Scheffler was born in Galion, O., was graduated in 1875 from the Paterson Seminary. He became a draughtsman on the Long Island road in 1875, and went with the Long Island Locomotive Works in 1877 to 1879. During 1880 he was with the Harris Corliss Engine Company at Providence. From 1881 to 1884 Mr. Scheffler had charge of the engineering department of the Edison Company for isolated lighting. In 1881 and 1882 he designed the first electric locomotive, which Mr. Edison built for experimental work at Menlo Park—the narrow gauge road, using the rails for conductors. After 1884 and until 1889 he held the position of superintendent Erie City Iron Works, Erie, Pa; then engaged, until 1891, with the Westinghouse Electric and Manufacturing Company as acting general superintendent. From 1891 to 1893 was superintendent of the Brush Electric Company at Cleveland, Ohio. At present he is general sales agent for the Stirling Company, manufacturers of water-tube safety boilers.

Charles S. Knight.

Col. Geo. L. Beetle.

Col. George L. Beetle was born at Edgartown, Mass., July 7, 1832. In 1847 he entered the service of the Erie and Michigan Telegraph Company (now Western Union) as messenger boy in the Milwaukee office. Soon after he was employed by the Wisconsin Telegraph Company as operator, and opened the offices at Waukesha, Palmyra, Whitewater, Fort Atkinson, Jefferson and Beloit, Wisconsin. After several years' service with the Wisconsin Telegraph Company, Col. Beetle in 1855 was appointed manager of the Milwaukee office. In 1874 he accepted a position with the Western Electric Company, and excepting absence of three and one-half years in Europe and a brief business experience in New York, he has been in the employ of the Western Electric Company up to the present time. Col. Beetle is easily the patriarch of the present list of old-timers.

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Col. S. G. Booker.

Col. Samuel G. Booker was born in Amelia County, Virginia, so long ago that he never tells just when. He served under "Jeb" Stewart as a cavalryman in the Confederacy, and has an honorable record as a soldier. He is as ready now to fight for the stars-and-stripes as he was 35 years ago for the State of his birth. He went to St. Louis in 1870. He was an operator on the Virginia and Tennessee Railroad, occupying the position at the same time when stationed at Christiansburg of postmaster, freight agent, etc., and was at times even a justice of the peace. He was for many years connected with the Fidelity Carbon Company in St. Louis, having inaugurated the carbon business in that city. He is now general manager of the Phœnix Carbon Company of that city, who have succeeded to the plant of the Fidelity Company.

A. F. Stanley.

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A. F. Stanley.

Mr. A. F. Stanley is one of the early birds, having started in the electrical business with the Western Electric Company in Chicago in 1873. Shortly after that time he commenced travelling for that company through the Western States. In 1884 he came to New York, and traveled through the East until 1887, when he started in the electrical supply and manufacturing business. He is at present senior member of the firm of Stanley & Patterson, general supply dealers in Frankfort street, New York.

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W. L. Candee.

Mr. Willard L. Candee was born in 1852, and he began his electrical career in 1876 as assistant superintendent of the New York Telephone Company. He was subsequently manager of the Western Electric Light Company in Centre street, New York, and still later was connected with the Jablochkoff Electric Light Company. In 1883 he joined hands with the Okonite Company, Limited, in the growth of whose business he has been an important factor. Mr. Candee was one of the leading members of the New York Electric Club and for five years its treasurer. He has also been a popular member of the Thirteenth Regiment N. G., S. N. Y., and some years ago was chosen captain of one of the companies composing that regiment. He is at present the guiding spirit in the sales department of the Okonite Company, Limited.

George F. Porter.

Mr. George F. Porter was born on March 12, 1855, in Pittsburgh, Pa., and was graduated from the public schools of that city in 1871. He began life as a civil and mechanical engineer and continued that profession until 1873. During 1875 he first turned his attention to electrical work, commencing in this business as a telegraph operator. Until 1877 he was connected with the Pullman Palace Car Company. In 1883 he went into the carbon business, and later held a position with the Westinghouse Electric Company in their Philadelphia office. During Mr. Huntley's term as president of the National Association he was appointed to the position of secretary, and has been reappointed successively by Messrs. Ayer, Armstrong and Francisco.

Willard L. Candee.

George L. Beetle.

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C. C. Warren.

The blue pencil of the editor has refused to move across the manuscript of which the following is a verbatim copy. Every old-timer in the list will, we are confident, enjoy it all :

A REMINISCENCE.

Who among the old stagers that fell under the spell of electrical fascination does not remember the special edition of the New York *Herald*, issued in the winter of 1878-9, portraying the Aladdin possibilities of Edison's discoveries in the subdivision of the electric current that was to knock into a cocked hat all the gas monopolies in Christendom and become itself the colossal monopoly that was to enrich every fellow fortunate enough to secure one of the shares.

George F. Porter.

"Go to Menlo Park and witness the marvelous exhibition." I went. I couldn't buy one of those $100 shares for less than $4,500. I didn't buy. Some did, I was told, who afterward looked upon it as a South Sea bubble.

I wanted to be a millionaire, and with unseemly haste applied for a license to establish an Edison plant in the goodly city of Toledo, O., where I then resided. A reply came forthwith on a lovely blank form, that my "application would be placed on file." About a hundred others from the same city made application for the privilege, showing that I was not lonely in my desire to get rich. All those applications are still "on file." In 1879-80 I became tired of waiting, and being determined to signalize myself as a pioneer in the introduction of electricity in the city of my home, I made the discovery of the United States Electric Lighting Co. of New York, who with their Maxim incandescent system (they talked "system" even then) and the Weston arc light system. left all the other systems as pale and attenuated stars in the grand planitary systems of the universe.

I struck a deal, and acquired fame when those four, ten light Weston arc machines came up to speed and generated a current that set those forty arc lamps aglow with a radiance so dazzling as to cause all the shareholders of the modestly incorporated company (under the Ohio double liability law) to button their shares of stock securely in their pockets for future balloon prices. 'Twas a great event, brief but glittering, for soon these shareholders went down into the aforesaid pockets, sadly and reluctantly fishing out a $100 note with each $100 share of stock, for the purpose of rounding up that extraordinary financial investment and relieving themselves from the insidiousness of the Ohio statutes.

Meanwhile the astute officials of the United States Electric Lighting Co. in the exercise of their usual sagacity came to the startling conclusion that I was designed by nature to fill a great aching void in the commercial vacuum of electrical development. History records that for a paltry consideration I became their servant, and in the year 1882 opened a modest office in basement No. 185 La Salle street, Chicago, surrounding myself with a complete corps of assistants, consisting of one lonesome stenographer (just out of school) and a young gentleman named Chas. D. Shain, stranded, but inspired with the idea that he, too, was eminently endowed by nature to swash around in the electrical vacuum. In his case, nature apparently did a good job.

S. G. Booker.

The growth of this modest undertaking from 1882 up to 1890, was by no means insignificant, covering a business measured by the installation of 411 separate plants, big and little, scattered over a dozen of the Western States, among these being some of the most prominent office and Government buildings in Chicago, St. Louis, Cincinnati and all other Western cities, nearly all of which are being operated successfully and satisfactorily at the present time.

In the sale of chattels by the United States Electric Lighting Co. to the Westinghouse Co., the writer was excepted, and a few months later inaugurated the business of the Edison Co. in Chicago, known as the "Central States District."

To those familiar with ancient (electrical) history, it need not be mentioned that previously there had been no great and enduring love, no ecstatic condition existing between the aggressive representative of the U. S. Co. and the Edison Co., so that in the writer's new environ his sensations were probably much like those of the Angel Gabriel's cornet player, taking a job when business was dull of Mephisto, with whom he had not been on the best of terms, but as the c. p. said, "Business is business, and I'll blow just as hard for Meph as I did for Gabe," and he did. Strict accuracy compels me to say, however, that again, like the c. p. alluded to, neither the climate nor morals of the new environment was wholly satisfactory.

The wild scheme then took possession of me that Mr. Westinghouse ought to build street car motors and engage actively in the electric railway business, and I thought I was ordained to convert him and lead him into the true path. He listened, acknowledged the error of his way, but spurned the truth. He listened again, he hesitated. The old story—"he who hesitates is lost." He went into it, he took me in. That was in 1891—you know what happened then, and since.

I haven't represented any company actively in the electrical business since that event. My dome of thought has been bulging, however, and I hope to be ere long in the swim, with the "Warren Alternator," the advanced idea, the slow speed—variable phase—multi-potential—brushless—commutatorless Alternator. (A limited number of shares only for sale.)

In my eagerness to give you my history that you have asked for, I came near forgetting to tell you about that first meeting of the National Electric Light Association. It was held in one of the dark rooms of the Grand Pacific Hotel one evening sometime in the winter of 1883-4, at which were present a lot of us visionary chaps—about all there was at that time except touch-me-not Edison Co. There was present: Brown, of the Western Electric Co., who thought his company's interests would be enhanced; Sperry, who was sure the Sperry Electric Co. would be boomed; Bowen, who talked towers, and talked them high. Terry and Reed wanted to talk to a convention upon the safety of Underwriters' wire, Hammett upon the steam engine, Bullock upon the existence of the Brush Electric Company, and your humble servant wanted a convention to talk to on the advantages of the Weston shunt wound arc dynamo for series arc lighting.

The Convention took root from that small planting, and all the world knows what it has done, how the various hotels in the Convention's perambulations have profited; how the railway companies have been struck for special rates, with Pullman buffet car attachments; and how those gilded, mirrored, mahogany and cut glass equipped parlors could betray secrets would they but speak; and how, incidentally, electrical information and science have been disseminated. I have attended some of the Conventions—why need one attend all? Human capacity has its limitation. I was full. Others are capable of absorbing more intellectuality, general information and other things than I. To all such I would say most emphatically, attend the National Electric Light Conventions, all of them.

When I was born in Wyoming County, State of New York, along in the thirties, within hearing of the roar and thunder of Niagara (when the wind blew right), no one dreamed that within the period of a single generation the festive mule of the tow path near our back door would wink his starboard eye and make his politest bow to the shining trolley that was doing his work by the forces of the mighty cataract, forty miles away, through the medium of subtle electricity. Grand thought—the Convention should grapple with it. Yours truly, C. C. WARREN.

Chicago, Jan. 22, 1895.

C. C. WARREN.

Personal.

H. T. Edgar, secretary and general manager, and Oscar Turner, purchasing agent, of the Georgia Electric Light Company, at Atlanta, Ga., will be at the Cleveland Convention of the National Electric Light Association as representatives of the Cotton States and International Exposition, to be held at Atlanta, Ga., September 18th to December 31st. Mr. Edgar and Mr. Turner propose to make a trip through the North, taking in the principal cities, where they will confer with the supply houses and electric companies relative to exhibits at the Exposition.

1885—N. E. L. A.—1895.

How the Association Was Organized.

The First Meeting.

The formation of the National Electric Light Association was due to the efforts of Mr. George S. Bowen, then president of the Elgin Electric Light Company, who, in November, 1884, wrote a letter to the *Electrical Review*, outlining the proposed plan which first attracted general attention to the subject.

MR. GEO. S. BOWEN.

The parent companies at first, especially the Brush and Edison, opposed the idea, but their opposition was not sufficient to dampen the ardor of those with broader minds.

The first meeting to discuss the formation of the Association was called by Mr. Bowen, and held at the Grand Pacific Hotel in December, 1884. The following were among those present: Geo. S. Bowen, president Elgin Electric Light Company; C. C. Warren, Western manager United States Electric Lighting Co.; Elmer Sperry, electrician Sperry Electric Motor and Car Brake Co.; W. A. Hammett, Western manager New York Safety Engine Co.; J. H. Reed, with Electrical Supply Co., Chicago; F. S. Terry, manager Electrical Supply Co., Chicago; C. A. Brown, Western Electric Co.

At this meeting Mr. Geo. S. Bowen was appointed chairman and John H. Reid secretary. There was but one other meeting of those in charge of the preliminary work, and this was held in January, 1885, when it was definitely decided to hold a meeting in Chicago at the Grand Pacific Hotel, and a date was named and a committee was appointed to prepare and issue an invitation, this committee being composed of Elmer A. Sperry, Geo. S. Bowen and F. S. Terry.

The first meeting was held at the Grand Pacific in February, 1885, and Mr. Geo. S. Bowen was chosen temporary chairman, and afterwards Mr. Frank Morrison, of Baltimore, was elected first president.

Following is a copy of the minutes of the first meeting:

CHICAGO, Ill., Feb. 6.

At a meeting of electric light representatives, held at the Grand Pacific Hotel, Chicago, on the evening of February 3d, presided over by C. A. Brown, of Western Electric Co., resolutions were passed that the chairman appoint the following committees:

Committee of Arrangements.

Geo. S. Bowen	Van Depoele Elect Mfg. Co.
C. C. Warren	United States Elect. Lighting Co.
E. B. Palmer	Sperry E. L. Car Brake and Motor Co.
Geo. L. Crossman	Thomson-Houston Co.
C. A. Brown	Western Electric Co.
Wm. A. Hammett	The New York Safety Steam Power Co.

Committee of Invitation.

E. A. Sperry	Sperry E. L., C. B. and Motor Co.
F. S. Terry	The Electrical Supply Co.
Geo. S. Bowen	Van Depoele E. Mfg. Co.

Finance Committee.

M. A. Knapp	Railway Telegraph Supply Co.
S. S. Badger	Badger Electric Co.
M. A. Buckley	Excelsior Electric Lt. Co.

Treasurer.

W. A. Kreidler	Western Agt. "Electrical World."

Secretary.

J. H. Reid	The Electrical Supply Co.

London Notes.

(From our London Correspondent.)

EUROPEAN ELECTRICAL EXHIBITIONS.

There are to be at least two good exhibitions in Europe during this year. One of these will be at Vienna in May, and will be devoted to all classes of machinery and apparatus employed in connection with agriculture and its branch industries.

Electrical apparatus is to have a special prominence, and it is to be hoped that as a result of this exhibition there will be developments in this department of the electrical business. The exhibition will only remain open for about a week, so it can hardly be expected that exhibits will be sent from a great distance, and without articles from England and America it will be a poor show.

ELECTRIC TRACTION.

The tardiness with which we do things over here becomes every day more wearying, and these remarks specially apply to our backwardness in adopting electric traction. There are already obstacles enough placed in the path of the electrical engineer if he dares to think of even suggesting electric tramways or railways, but the London County Council have now made it all the harder. The London United Tramway Co. wanted to abolish horse traffic and were intending to install the overhead electric system over a portion of their line. Of course they had to apply to the County Council for powers, and on the 29th inst. they refused their permission. Some of the labor members thought the blue sky would be hidden, the streets disfigured, people use the lines as clotheslines, and the kites of playful lads would attach themselves thereto. A host of foolish statements were made and the minds of the councillors convinced that an overhead electric tramway must be a most outrageous thing. Thus, what would have been a most interesting, important and progressive work of British electrical engineering is for the present shelved. The London County Council is a body professing to care for the laboring classes, and by this unwise decision they have prevented an extensive piece of work being carried out.

The Dublin United Tramways Co. are of opinion that horses are out of date, and have accordingly resolved to abolish them over a portion of their system and adopt electricity as the motive power.

The Man Who Started First.

MR. MARCUS NATHAN.

[On Friday, Jan. 18, Mr. Marcus Nathan, whose portrait is printed above, rushed into the office of ELECTRICITY in breathless haste, travelling bag in hand, and wanted to know if he had time to get a shave before the departure of the Cleveland Convention Special. Mr. Nathan, always up to date, is here.]

The Transactions in Local Stocks and Bonds.

Companies in Which the G. E. Co. and Its Financing Companies Have Holdings.

Following is a complete list of the holdings of the G. E. Company and the three financing companies in various local properties. The statement was made up a few months ago from the company's books, and is exact excepting the few sales of stocks and bonds since the date of compilation :

GENERAL ELECTRIC COMPANY.

NAME.	ISSUED.		HOLDINGS.	
	Bonds.	Stocks.	Bonds.	Stocks.
Andover Electric Light Company	$28,000	$30,000	.....	$2,000
Athol G. and E. Company	25,000	25,000	.....	600
Attleboro, No. Attleboro and Wrentham Street Railway Company	......	......	.....	41,000
Atlanta Cons. St. Railway Company	2.058,000	2,000,000	$18,000	.....
Asheville Street Railway Company	50,000	......	14,000	.....
Amsterdam Street Railway Company	170,000	250,000	.....	9,900
Appleton Edison Light Company	70,000	100,000	.....	15,000
Austin Electric Company	......	50,000	.....	50,000
Bay Shore Electric Light Company	10,000	18,400	.....	1,000
Bangor E. L. and P. Company	885,000	......	b 64,500	.....
* Binghamton G. E. Company	267,000	400,000	.....	90,500
Buffalo G. E. Company	1,900,000	1,900,000	.....	260,000
Cambridge Electric Light Company	200,000	200,000	.....	2,700
Canton (Ohio) E. L. and P. Company	75,000	75,000	.....	12.200
Calgary Electric Light Company	......	25,000	.....	1.000
Chatham Electric Light Company	......	15,000	.....	1,100
Charlotte (N. C.) Electric Light Co	25,000	50,000	.....	1,500
* Chattanooga St. Ry. Company	......	20,000	.....	.....
* Chattanooga Electric Light Co.	150,000	100,000	b 57,000	.....
Charleston (S. C.) L. and P. Company.	175,000	100,000	25,000	94,175
Chester E. L. and P. Company	35,000	87,325	.....	1,750
Chicago Edison Company	130,000	2,934,000	17,000	2,666
" "	D 2,195,000	......	.....	.....
Chicago N. S. Street Railway	1,500,000	650,000	24,000	.....
Citizens' Lt. and P. Co., Dayton, O	......	......	.....	1,790
Citizens' G. E. Co., Louisville	......	462,300	115,000	c 320,000
" " "	230,000	p 67,500	.....	p 12.300
Citizens' E. L. and P. Company	....	23,000	.....	19,000
Cicero and Proviso St.Ry. Co.,Chicago.	740,000	1,000,000	.....	15,000
Cincinnati Edison Electric Co	......	......	.....	150,000
do. Sub. to stock O. C. E. E. Co	......	......	.....	66,666
City Electric St. Ry., Little Rock	600.000	500,000	.....	20,000
Cleveland General Electric Company	404,000	c 500,000	.....	c 200,000
" " "	......	p 260,000	.....	p 16,900
Columbian Intramural Railway	500,000	500,000	250,000	250,000
Columbus (Ohio) Edison E. L. Co	......	258,000	.....	23,100
Concord Land and W. P. Company	400,000	c 500,000	74,500	.....
" " " "	......	p 100,000	.....	.....
Consumers' L. and P. Co., Little Rock.	27,000	75,000	27,000	25,000
Consolidated E. L. Co., Birmingham	354,000	500.000	b 79,000	414,511
Consolidated E.Co.,Ltd.,St. John, N. B.	......	......	.....	150
Cooperstown G. and E. Company	12,000	25,000	.....	c 1,125
" " "	......	......	.....	p 1,125
Covington Electric Light Company	......	......	7,000	.....
Cumberland L. and P. Co., Nashville	400,000	500.000	100,000	.....
Dallas (Tex.) Electric Co., 1st mort	300,000	......	.....	.....
" " " 2d mort	100,000	400,000	b 1,000	.....
Dayton Electric Light Company	420,000	600,000	282,000	.....
Davenport P. and Lt. Company	......	50,000	.....	50,000
Decatur Land Imp. and Furnace Co	......	......	3,750	.....
Des Moines Edison Light Company	80,000	136,840	.....	92,420
Dillon General Electric Company	......	40,000	.....	40.000
Dubuque Light and Traction Co	350,000	600,000	10,000	459,500
Eastchester Electric Co., Mt. Vernon	122,900	250,000	.....	36,425
Edison E. Illum. Co., Altoona, Pa.	......	164,250	.....	10,000
Edison E. Illum. Co., Brooklyn, N. Y	500,000	1,500,000	.....	8.300
Edison E. Illum. Co., Cumberland, Md.	10,800	50,000	.....	8.500
Edison E. Illum. Co., New York	3,562,000	7,938,000	.....	700.200
Edison E. Illum. Co., New Brunswick.	45,500	42,700	.....	9.500
Edison E. Illum. Co. Newburg, N. Y	30.000	60.000	.....	29,650
Edison E. Illum. Co., Paterson, N. J	196,500	711 600	.....	31,500
Edison L. and P. Co., Erie, Pa	113,000	200.000	.....	14 400
Edison L. and P. Co.. Kansas City	......	280,000	.....	14,200
Edison L. and P. Co., York, Pa.	21,500	146,876	.....	13.200
Elgin City (Ill.) Railway Company	186.000	250,000	.....	40,000
Essex County Elec. Co., Orange, N. J	......	125,000	.....	5.000
Fairhaven and N. W. Ry. Co., Fairhaven, Wash	......	......	.....	50,000
Fargo Gas and Elec. Co., Fargo, Dak	......	......	.....	20,000
* First Cincinnati Edison E. Illum. Co.	......	50,000	.....	8,700
Fort Dodge G. L. and P. Co	17,500	50,000	.....	42.500
* Fort Clark Street Railway Co	250,000	252,500	.....	177,750
Framingham Gas, Fuel and P. Co	75,000	75,000	.....	500
Geneva Brush E. L. and P. Co., Geneva, N. Y	......	100,000	.....	10,000
Georgetown Water Company	......	......	b 5,000	.....
Glens Falls E. L. and P. Company	10,000	35,000	.....	550
Goshen L. and P. Company	......	14,900	.....	100
Grand Rapids Edison Light Company.	......	143,425	.....	29,000
Greensboro E. L. and P. Company	......	......	b 2,500	.....
Grinnell Electric Company	......	25,000	.....	1,000
* Hackensack (N. J.) E. Lighting Co	......	60,000	.....	59,600
Housac Valley Street Ry. Company	50,000	50,000	800	.....
Huntsville Electric Light Company	......	......	.....	2.300
Hyde Park and Dedham Street Ry	......	......	.....	7,960
Hollister L. and P. Company	......	......	.....	250
Jackson L. and P. Co	150,000	100,000	83,000	25,000
Jacksonville E. L. Company	79,000	30.000	.....	100
Johnstown (Pa.) E. L. Company	21.000	78,000	.....	18,600
Kansas City Sub. Belt Railway	1,750.000	2,554,210	.....	4,060
Kansas City, Pitts. and Gulf Ry	......	......	b 3,500	1 750
Keokuk E. Street Ry. and P. Co	......	......	.....	40,800
Kingston (N. Y.) Electric Company	239,500	236,850	7,000	.....
Knoxville (Tenn.) Street Railway Co	......	......	b 6,000	.....
Larrabee E. G. and P. Company	......	......	.....	16,500
Lee Electric Company	15,000	20,000	b 11,000	.....
Little Falls E. L. and P Company	......	......	.....	2,500
Los Angeles Electric Railway	3,000.000	......	41,440	.....
* Macon (Ga.) Cons. St. Ry. Co	300,000	490,000	.....	490,000
Manhattan E. L. Company	900,000	1,500,000	52,000	.....
Madison City (Wis.) Railway Co	......	......	22,000	.....
Martha's Vineyard Street Railway	......	......	.....	2,890
Marion Water Supply E. L. and P. Co.	......	......	b 5,000	.....
McKeesport L. Company	......	......	.....	8.900
Metropolitan St. Ry. Co., Macon, Ga	60,000	100,000	b 45,000	100,000
Milwaukee Street Railway Company	8,536,000	5,000,000	325,000	.....
* Middleboro (Mass.) G. and E. Co	80,000	80,000	b 45,000	.....
Monongahela E. L. and P. Co	15,000	......	b 15,000	.....
Napa T.-H. Company	......	83,500	.....	33,500
* Narragansett Pier E. L. and P. Co	60,000	60,000	1,000	.....
Natick Electric Company	35,000	40,000	17,500	.....
* Natick G. L. Company	......	20,000	.....	10,100
New Omaha T.-H. E. Company	400,000	c 600.000	.....	30,600
" " "	......	p 303,000	.....	.....
* North River E. L. and P. Company	307,000	400,000	2,000	.....
Northwest E. Company, Winnipeg	50,000	82,314	.....	20,000
No. Attleboro S. and E. Company	......	......	.....	40,100
Newport (R. I.) Illuminating Co	182,500	200,000	.....	36,700
Ocala L. and P. Company	25.000	25,000	10,000	21,900
Oshkosh (Wis.) E. L. and P. Company.	100,000	21,400	.....	2,300
* Oskaloosa Electric Company	......	......	b 7,500	.....
* Ottawa (Ill.) Street Railway	75,000	100,000	b 51.000	68,000
Overland Ry. Co., Nashville, Tenn	......	......	11.500	5,000
* Oxford Lake Line Railway	175,000	175.000	175,000	p 29,650
* Portland (Ore.) G. E. Company	1,550,000	c 2,000.000	.....	c 527,800
" " "	......	p 1,250,000	.....	.....
* Public Works Co., Bangor, Me	......	......	b 35,000	.....
* Pueblo City Railway Company	500,000	500,000	50,000	50,000
* Piedmont Exposition Company.	......	......	2.000	.....
* Queen City Railway, Dallas, Tex	350,000	400,000	85,000	199,700
Queen City Railway, Marion, Ind	75,000	c 150,000	b 5,000	50,000
" " " "	......	p 30,000	.....	.....
Raleigh Street Railway	175,000	......	b 25,000	.....
Rensselaer W. L. and P. Company	20 000	30,000	b 20,000	30,000
Rome (Ga.) Gas Lt. Co., 1st Mort	17,500	......	.....	.....
" " " 2d Mort	15,000	100,000	.....	.....
" " " 3d Mort	42,500	......	.....	20,000
Roseberg (Wash.) E. L. and P. Co	......	20,000	.....	20.000
* Rutland E. L. Company	......	50,300	.....	15,000
San Louis-Obispo T.-H. Company	......	6,400	.....	800
* San Francisco and San Mateo Ry. Co.	......	......	b 15,000	.....
Scranton Illum. H. and P. Co	86,000	99,900	.....	42,000
Seneca Electric Company	......	54.500	.....	300
Skowhegan E. L. Company	......	48,000	.....	4,300
St. Cloud City Street Car Company	......	......	5,000	....
Standard L. and P. Co., Montpelier, Vt.	43,500	c 45,500	.....	c 1,000
" " "	......	p 28,050	.....	.....
Steubenville Street Railway	......	......	b 2,500	.....
Stoughton (Wis.) E. L. Co	......	......	.....	1,200
Suburban E. H. & P. Co., Newport, Ky.	......	......	.....	16,415
* Syracuse Cons. Street Railway	3,3[illegible]0,000	4,000,000	.....	20,500
* Tacoma Railway and Motor Co	1,250,000	750,000	b 200,000	45,000
Trenton L. and P. Co	......	......	.....	55,000
Tuscumbia L. and P. Co	......	25,000	.....	200
T.-H. E. L. and P. Co., Quincy, Ill	......	100,000	.....	2,200
T.-H. E. Co., Augusta, Ga	80.000	100,000	.....	3,000
Union Street Railway, Dover, N. H	100,000	150.000	.....	8.800
Valley Field E. Co., P. Q	14,150	20,500	.....	1,000
Vancouver Ry. and L. Company	......	......	.....	3,100
Visalia G. L. and H. Co	......	36,000	.....	14,700
Watertown (N. Y.) H. L. and P. Co	......	......	2,000	.....
Westboro E. L. and P. Co	......	25.000	.....	1.620
* Weymouth (Mass.) L. and P. Co	75,000	75,000	b 39,000	5,000
West Asheville Imp. Co	......	......	.....	15,000
Winona (Wis.) G. E. Co	......	500,000	20,000	.....
Wilkesbarre Electric Company	25,000	100.000	.....	10,100

* In hands of Receiver.
b Defaulted.
c Common stock.
p Preferred stock.

SECURITIES COMPANY.

NAME.	ISSUED.		HOLDINGS.	
	Bonds.	Stocks.	Bonds.	Stocks.
Andover Electric Company	$28,000	$30,000	.....	$5,000
Atlanta Cons. Street Railway	2,058,000	000,000	$161,000	.....
Badger Electric Company, Ltd	90,000	75,000	75 000	65,700
Binghamton Gen. Electric Company	267,000	400.000	78 000	.....
Bloomington Electric L. Company	......	122,700	.....	115.600
Brockport Electric Company	......	......	.....	5,300
Butte Gen. Electric Company	421,000	600 000	400,000	.....
Canton (N. Y.) E. L. and P. Co	......	18,000	.....	5,000
Charleston (Ill.) T.-H. E. Company	30.000	40,000	30,000	.....
Citizens' E. L. and P. Co., Houston	200,000	200,000	84,000	.....
City E. St. Ry. Co., Little Rock	600,000	500,000	b 300,000	.....
Cleveland Gen. Electric Company	404,000	c 500,000	100,000	.....
" " "	......	p 260,000	.....	.....
Cumberland E. L. and P. Company	400.000	500 000	283,000	.....
Dallas Electric Company, 1st	300.000	......	b 100,000	.....
" " " 2d	100,000	400,000	.....	.....
Detroit E. L. and P. Company	350,000	c 305,000	100,000	.....
" " "	......	p 200.000	.....	.....
Eastchester Electric Company	122,000	250,000	68,500	201,800
Eastport Gas and Electric Chmpany	30,000	......	30.000	.....
Edison E. Illum. Co., New Orleans	500,000	200.000	200,000	.....
Edison E. Illum. Co., Paterson, N. J	194,500	711,600	.....	40,300
E. L. and P. Company, Syracuse	750,000	800,000	388,000	.....
Elgin City (Ill.) Railway Company	186,000	250,000	150,000	.....
Framingham Electric Company	50,000	80 000	.....	45,100
Fulton E. L. and P. Company	80,000	80,000	.....	67,500
Goldsboro E. L. and P. Company	15.000	25.000	b 15,000	24,800
Hartman Gen. Electric Co., Duluth	285,000	360 300	275,000	.....
Hudson E. L. Company, Hoboken	500.000	500.000	500,000	.....
Jacksonville E. L. Company	79,000	30,000	8,000	9,900
Jackson (Mich.) E. L. Works	60,000	50,000	34.000	....
Jamestown E. L. and P. Company	50,000	75 000	50,000	....
Jenney E. L. and P. Company	148.500	50,000	10,000	....
Kingston (N. Y.) Electric Company	239,500	236,850	b 173.000	105,000
Knoxville Schuyler E. L. and P. Co	20,000	......	20,000	.....
Knoxville E. L. and P. Co	22,000	......	10,000	.....
Lancaster (N. H.) E. C.	......	18,000	.....	11,000
Lee (Mass.) Electric Company	15.000	20,000	.....	19,400
Leicester (Mass.) Electric Company	20,000	25.000	.....	22,100
Leominster (Mass.) E. L. and P. Co	......	50.000	.....	11,000
Louisiana E. L. Company	728,000	126.000	485,000	212,500
Macon Cons. Street Railroad Co	300,000	490,000	300,000	.....
Manhattan E. L. Company, Ltd	900.000	1,500.000	132,000	.....
Memphis Lt. and P. Company	400,000	150,000	292,000	.....
Middleboro Gas and Electric Co	80.000	80.000	.....	75.900
Millbury Electric Co., mtg. note	16,000	15.000	.....	3,500
McGavock and Mt. Vernon H. R. R. Co., Nashville	700,000	......	b 30,000	.....
Narragansett Pier E. L. and P. Co	60,000	60,000	30,000	1,900
Natick Electric Company	35.000	40,000	.....	37,500
New Omaha T.-H. Electric Company	400,000	c 600.000	.....	c 300,000
" " "	......	p 303.000	.....	.....
North River E. L. and P. Company	307,000	400,000	b 250,000	.....
North Shore Electric Company	75.000	125,000	b 72,000	120,800
Orange (Mass.) E. L. Company	45,000	45,000	4,000	.....
Oshkosh E. L. and P. Company	100,000	21,400	b 62,500	6,600
People's E. L. and P. Co., Oswego	110,000	110.000	84,000	.....
Peninsula E. L. Co., Detroit	600.000	600,000	5,750	.....
Portland (Ore.) Gen Electric Co	1,850,000	c 2 000,000	28,000	.....
" "	......	p 1,250,000	.....	.....
Rappahannock E. L. and P. Co	......	......	.....	5 000
Rome Gas L. Company, 1st Mort	17,500	100,000	.....	30,000
" " " 2d Mort	15,000	......	.....	....
" " " 3d Mort	42,500	......	.....	...

Saginaw E. L. and P. Company........	50,000	50.000	b 50,000	....
Seashore E. Ry. Co., Asbury Park.....	200.000	200 000	b 31,000	....
Springfield (Ohio) L. and P. Company.	125,000	200,000	122,000	200,000
Standard L. & P. Co., Montpelier, Vt..	43,500	c 45.500	.....	c 2,500
" " " ..	......	p 28.050	.....	....
St. Paul and White Bear Railroad.....	200,000	200,000	125,000	....
St. Johnsbury Electric Company......	30.000	50,000	.....	6,000
Tacoma Railway and Motor Co........	1,250.000	750.000	b 600.000	....
Toledo Electric Company.............	194,000	......	83.000	14.200
Topeka Railway Company.............	1,100.000	1,250.000	108,000	....
T.-H. Electric Co., Augusta. Ga........	80 000	100.000	.....	17,100
T.-H. E. Company, New York..........	600,000	1,000,000	.....	8.700
Utica Belt Line Street Railway Co....	......	......	b 25,000	....
Woodstock Electric Ry. Co., Waverly..	......	......	90,000	....
Weymouth L. and P. Company........	75.000	75,000	75.000	81,800
Winona (Wis.) Street Railway Co.	170,000	200.000	100,000	....
Yonkers (N. Y.) E. L. and P. Co........	187,000	200,000	.....	24.000

ᵃ In hands of Receiver.
b Defaulted.
c Common stock.
p Preferred stock.

STREET RAILWAY AND ILLUMINATING PROPERTIES.

NAME.	ISSUED.		HOLDINGS.	
	Bonds.	Stocks.	Bonds.	Stocks.
Atlanta Cons. Street Railway Co......	$2,058,000	$2.000.000	$244,000	......
Amsterdam Street Railway Co........	170.000	250,000	9,000	......
Austin Rapid Transit Company.......	......	......	5.000	......
Auburn E. L. Company...............	150.000	150.000	4,000	......
Auburn City Railway Company.......	200,000	50,000	5,000	......
Bennington W. P. and E. Company....	......	......	13.500	$5,000
Birmingham Ry. and Electric Co......	1,112,000	2,141,000	175.000	175,000
Binghamton Gen. Electric Co.........	267,000	400,000	30,000	100 000
Boston and Revere E. St. Ry. Co......	50.000	50.000	50,000	......
Buffalo Gen. Electric Co..............	1,900,000	1,900,000	......	250,000
Catskill I. and P. Company...........	......	......	6,000	......
Charlotte (N. C.) E. L. Company.......	25.000	50,000	25,000	......
Chattanooga E. L. Company...........	150,000	100.000	......	29,350
Charleston (S. C.) L. and Power Co....	175,000	100.000	150,000	......
Chester E. L. and P. Company.........	35,000	87,825	......	13,200
Citizens' Gen. Electric Co., Louisville.	235,000	c 462,300	......	.... .
" " " ..	......	p 67.850	100,000	......
Cleveland Gen. Electric Company.....	404,000	c 500 000	......	c 150,000
" " "	......	p 260,000	110,000	......
Cons. E. L. Company, New York......	......	......	10.000	......
Cons. E. L. Co., Burlington, Vt........	100,000	150,000	17,000	......
Consumers' L. and P. Co., Little Rock.	27,000	75.000	......	49,900
Columbus (Ohio) Edison E. L. Co......	......	258,000	......	25,900
Concord Land and Water Power Co...	400,000	c 500 000	30,000	......
" " " " ...	......	p 100,000	......	......
Cumberland E. L. & P. Co., Nashville..	400.000	500,000	15,000	250,000
Dayton E. L. Company	420,000	600,000	100,000	310,000
Detroit E. L. and P. Company...	350,000	c 305,000	......	......
" " "	......	p 200,000	15.000	......
Dubuque L. and H. Company..........	350,000	600.000	70,000	......
East Oakland (Cal.) St. Ry. Co........	73,500	161,000	18,000	......
Edison E. Illum. Co., Altoona, Pa.. ...	......	164,250	......	15,000
Edison Electric Illum. Co., Brockton..	100,000	100.000	......	17.950
Edison Electric Illum. Co., Detroit....	......	850,000	......	54,375
Edison Elec. Illum. Co., Lancaster, Pa.	......	......	......	2,500
Edison Elec. Illum. Co., New York....	3,562,000	7,938,000	......	2,000
Edison Elec. Illum. Co., New Orleans.	500.000	200,600	50,000	......
Edison Elec. Illum. Co., Paterson, N.J.	196,500	711,600	......	75,000
Edison Elec. Illum. Co., Shamokin....	......	......	......	6.070
Edison Illum. Co., St. Louis............	700,000	......	300,000	350,000
Edison Elec. Illum. Co., Topeka........	......	163,400	......	29.550
Edison L. and P. Co., Kansas City....	......	280,000	......	26,500
Edison L. and P. Co., La Crosse........	......	75.000	......	16,200
Edison L. and P. Co., San Francisco...	800,000	1,500,000	......	42,000
Edison, E. L. Co., Europe, N. Y........	......	......	2.280	......
E. L. and P. Co., Syracuse............	750.000	890.000	314,000	95,000
Excelsior E. Co., Tarrytown, N. Y....	30,000	50,000	30.000	......
Forest City E. L. & P. Co., Rockville, Ill.	......	......	......	c 20,000
" " ..	12,000	80,000	......	p 3,000
Ft. Clark Street Railway Company....	250,000	252 500	......	50,000
Fulton E. L. and P. Company..........	80,000	80,000	61,000	......
Georgia E. L. Company, Atlanta......	432.000	501,000	31,000	31,400
Globe Street Railway, Fall River......	750,000	300,000	10,000	......
Hoosick Falls W. P. and L. Co.........	......	......	28,000	5,000
Hudson E. L. Company, Hoboken......	500,000	500,000	......	225,000
Hyde Park (Mass.) E. L. Company....	60.000	100,000	10,000	......
Indianapolis L. and P. Company......	400,000	600.000	......	50.000
Jenney E. L. and P. Co., Ft. Wayne...	148,500	50 000	28,000	......
Kingston (N. Y.) Electric Company....	239,500	236,350	.... .	99,350
Leroy Gas L. Company................	20,000	25.000	6,000	......
Leicester Electric Company...........	20.000	25.000	3.000	......
Little Rock E. L. and P. Company.....	10,000	29,650	10,000	......
Manhattan E. L. Company.	900,000	1,500.000	......	230,000
Marquette City and Presque Isle Ry..	......	......	16,500	......
Milwaukee Street Railway Co.........	8,536,000	5,000,000	600,000	......
Minneapolis Gen. Electric Company..	......	......	......	500.000
North River (N. Y.) E. L. and P. Co....	307,000	400,000	......	177,667
North Shore Traction Company.......	......	c 2,000 000	......	c 100,000
" "	......	p 4,000.000	......	......
New Omaha T.-H. E. Company........	400,000	c 600,000	......	p 50,000
" " "	......	p 293,200	......	......
Newport (R. I.) Illum. Company.......	182,400	200.000	5,000	......
Orange Electric Light Company.......	45,000	45,000	21.000	......
Owatonna (Minn.) Electric Company..	25,000	25,000	25.000	......
Paris (Ill.) G. L. and C. Company......	15,000	......	15,000	......
Paducah (Ky.) Street Railway Co......	102,260	115.000	11,000	......
Pasadena E. L. and P. Company.......	25,000	36.400	25,000	......
People's E. L. and P. Co., Oswego, N.Y.	110,000	110.000	4,000	......
Portland (Ore.) Gen. E. Company....	1,850,000	c 2,000,000	90,000	c 200,000
" " "	......	p 1,250.000	.....	......
Queen City Railway Co., Dallas......	350.000	400,000	192 000	......
Queen City E. Ry. Co., Marion, Ind....	75,000	c 150,000	60,000	......
" " "	......	p 30,000	......	......
Rome G. L. Company, 1st Mort........	17,500	......	......	......
" " " 2d Mort........	15.000	......	......	......
" " " 3d Mort........	42,500	100,000	36,500	......
Ross Park Street Railway, Spokane..	40,000	125.000	40.000	......
Scranton Illum. H. and P. Company...	86,000	99,900	40,000	......
So. Suburban Ry. Co., Kansas City....	100,000	100,000	100,000	100,000
Tacoma Railway and Motor Company.	1,250,000	750.000	200,000	......
Tarrytown and Irvington Union Gas Light Company......................	50.000	100 000	50.000	......
Thomson-Houston E. Co., New York..	600,000	1,000,000	325,000	......
Tiffin (Ohio) Edison Illum. Company..	9,600	27,700	......	5,500
Toledo (Ohio) Electric Company.......	194,000	......	60,000	105,000
Tucker Electric Const. Company......	25,000	43,000	14,500	......
U. S. E. L. Co., Washington, D. C.....	......	......	......	11,000
Utica Belt Line Railroad Company....	......	......	......	76,000
Watauga L. and P. Company..........	43,000	56,000	17,000	......
Washington W. P. Co., Spokane.......	......	......	......	29,000
Woodstock (Ontario) E. L. and Ry. Co.	......	......	18,000	......
Yonkers E. L. and P. Company........	187,000	200,000	9,000	......

b Defaulted.
c Common stock.
p Preferred stock.

THE ELECTRIC CORPORATION.

NAME.	ISSUED.		HOLDINGS.	
	Bonds.	Stocks.	Bonds.	Stocks.
Chattanooga E. L. Company..........	$150,000	$100,000	$16.000	......
Chicago and N. S. Street Railway.....	1,500,000	650.000	200,000	......
Citizens' Gen. E. Co., Louisville, Ky..	......	c 462,300	......	c $47,000
" " " ..	235,000	p 67.500	......	......
Cons. E. L. Company, Birmingham....	354,000	500,000	b 119 000	......
Concord L. W. and P. Company........	400,000	c 500.000	......	......
" " "	......	p 100,000	169 000	......
Edison Illum. Company, St. Louis.....	700,000	......	220,000	10,000
Great Western Mfg. Co., Chicago.....	......	......	......	20,000
Louisiana E. L. Co., New Orleans.....	728.000	426.000	143,000	......
Portland (Ore.) Gen. Elec. Company...	1,850,000	c 2,000.000	....	......
" " " ...	......	p 1,250.000	182,000	......

b Defaulted.
c Common stock.
p Preferred stock.

THE PHOSPHORESCENT LIGHT.

In response to an invitation from Mr. E. J. Wessels, vice-president and secretary of the Moore Electrical Company, a party of about a dozen notable electrical experts assembled last Tuesday evening at the laboratory of the company at Harrison, N. J., to witness a confidential exhibition of some results obtained by Mr. D. McFarlan Moore in the line of phosphorescent lighting. This opportunity was one which few who were so fortunate as to receive an invitation could resist, and all were well repaid for the trouble by the most interesting and brilliant display of the "new light" which they witnessed. As to the technical details of the apparatus employed the lips of the visitors are sealed for the present, but we believe we are violating no confidences in the following outline:

The invited guests, after having assembled at the laboratory, were first shown through the extensive establishment and then ushered into a small room where chairs had been provided and where Mr. Moore explained the general principles of his method and then illustrated its practical working.

He said in substance that heretofore the results which he was about to show had only been accomplished by means of extremely high potentials and frequencies. These involved either very expensive, specially constructed alternators, or large induction coils, condensers, etc., which would cost hundreds or thousands of dollars to construct. He proposed to show that these same or similar results could be accomplished by apparatus that would cost but a few cents, and which was ideal in its simplicity.

The energy used in most of the experiments which followed was the ordinary 110 volt direct current, modified for his purpose by the introduction in series with the lamps of the little "vibrator" which constitutes the gist of his invention. In the earlier stages of his work he had supposed that one of these vibrators would have to be attached to each lamp, but he had found by experience that this was not necessary, and that the insertion of a single instrument, the whole of which could be carried in the vest pocket, in the supply mains, was sufficient for all the lamps supplied therefrom.

The lamps shown, of which there were a variety of forms, were really condensers. They were ordinary incandescent lamp bulbs into which two plates separated from each other had been inserted—one connected with the positive and the other with the negative side of the circuit. The bulb was then exhausted, and when the terminals were connected into the circuit, acting inductively upon each other, produced the most beautiful phosphorescent effects. The plate connected with the positive side of the circuit was always far less luminous than the other, but in several cases there appeared a beautiful flame-like excrescence—in one instance fully half an inch long and covering an area of a quarter of a square inch. This flame seemed to be nearly white, but the chief light of the lamp came from the other plate and resembled closely the familiar Geissler tube effects only more brilliant.

When one of these lamps was burning everyone in the room could be distinctly recognized, the shadows on the walls were visible, and nonpareil type easily legible a few feet away from the lamp.

The inductive surfaces were not always true planes, but more often were spirals of iron wire, sometimes with their axes concentric, sometimes eccentric. In other lamps a plane surface faced such a spiral, but in all the effect was essentially the same.

As to the energy consumed Mr. Moore was unable to give any very definite information, but in proof that it was small he produced the same results, though with less brilliancy, when his source of energy was, 1st, a Grenet (bi-chromate of potash) cell; 2d, a small cell of dry battery, and finally a little chloride of silver cell not more than an inch in diameter and four inches long.

Mr. Moore closed the evening's entertainment by showing the adaptation of his method of electrical control described in his paper before the Institute on September 20, 1893, to the turning down of incandescent lamps. By this exceedingly simple and inexpensive means he showed that lamps could be reduced to low candle power quite as efficiently on direct currents as on alternating currents.

After this most enjoyable demonstration, and congratulations to Mr. Moore and Mr. Wessels, the party, much pleased and instructed, returned at a late hour to New York.

LEGAL NOTES.

The Interior Telephone Company, on February 12th, commenced suit in the United States Circuit Court for the Southern District of New York against the Tucker Electrical Manufacturing Company, of 14 Whitehall street, and against James R. Strong and Thomas McConbray, as individual co-defendants, for the infringement of Colvin patents Nos. 513,305 and 524,524.

The Campbell Electric Supply Company, 104 High street, Boston, has made an assignment, to close up the business, to R. A. Stewart, treasurer of the company.

General News.

What is Going on in the Electrical World.

Bridgeton, N. J.—The electric light plant at Woodbine was destroyed by fire on the 9th.

Biloxi, Miss.—Application has been made to the council for a franchise for electric street cars by E. G. Burklin of Vandalia, Mo.

Topeka, Kan.—An act is before the Senate making appropriations for the erection of a boiler house, electric light plant, etc., at the Girls' Industrial School, at Beloit.

Fall River, Mass.—At the last meeting of the poor commissioners the advisability of maintaining an electric light plant for the hospital was discussed, but no action was taken.

Hastings, Neb.—A franchise has been granted to the Hastings Electric Light and Power Company giving them an exclusive right to furnish the city with electric light for ten years.

Cohoes, N. Y.—President Weldon of the Cohoes City Railway Company states that bids for the construction of the road will be advertised for shortly, and that work will begin early in the spring.

Boonsboro, Md.—The Boonsboro and South Mountain Electric Railroad Company has been granted a charter and its capital stock has been placed at $30,000. The road will be completed as soon as practicable.

Fairmont, W. Va.—A movement is on foot here to build an electric road from Fairmont to Riversville by way of West Fairmont, Monongah and Barnsville. The road is to cost about $100,000 and will be 15 miles in length.

Cleveland, O.—Mayor Blee is considering the advisability of the city establishing an electric lighting plant of its own to furnish light for the city hall, the public library, the central police station and the central market.

Boston, Mass.—The annual report of the Edison Electric Illuminating Company of Boston for the year ending December 31, 1894, gives: Gross earnings, $628,206, increase, $34,318; net income, $317,164, increase, $54,913.

Kenosha, Wis.—A communication has been received here from Manitowoc asking this city to co-operate in the matter of securing a law from the present Legislature giving small cities the right to own and run their own electric light plants.

Mississippi City, Miss.—Messrs. Bennett & Cahel, concessionaires, are making efforts to get up a stock company among citizens of the Gulf coast for their proposed electric road between Pass Christian and Biloxi, a distance of twenty-two miles.

St. Louis, Mo.—The *Republic* has published a table showing the market standing of the street railways of this city, which it is understood are to be consolidated under one corporation. The total capital stock is $13,962,000; bonded debt, $16,050,000; miles of track, about 290.

Columbus, Ohio.—Managers Whiting, Hay and Apthorp of the penitentiary board, in connection with Adjutant General Howe, have been appointed a special committee to make preparations for the construction of the electric light plant at the penitentiary for which an appropriation of $22,000 has been made.

Bridgeport, Conn.—Col. N. H. Heft, president of the Bridgeport Traction Company, is to have complete supervision of the installation of electricity on the Nantasket Beach division of the New York, New Haven and Hartford Road, if the experiment proves successful. He is at the head of the company's electrical department.

Albany, N. Y.—Among the bills introduced in the Senate last week was one making the wages of gripmen, motormen, drivers and conductors $2 a day; in the House, fixing day telegraph rates at fifteen cents for ten words and one-half cent for each word extra; and the night rate at fifteen cents for twenty words and one-half cent for each word extra.

Carrollton, Ill.—Hiram M. Howard, representing the National Electric Company, has been here talking electric lights. Mr. Howard is not looking for a twenty-year franchise, but wants to put in an electric lighting plant to be owned and operated by the city. Such a plant, he says, would cost $10,000, and could be run economically in connection with the waterworks plant.

Hartford, Conn.—The Hartford Street Railway Company has created two new offices, those of vice-president and general manager. The directors have elected Samuel G. Dunham to fill the office of vice-president and Electrician Norman McDonald Crawford has been elected general manager. President E. C. Goodrich will continue to have general charge of the management of the road.

Brooklyn, N. Y.—The Edison Electric Illuminating Company's annual report for the year ending December 31, 1894, shows gross earnings, $421,073.83; operating expenses, $189,316.88; net earnings, $231,746 95. The income from all other sources was $36 529.78, which, added to the net earnings, is $268,276, from which must be deducted $44,870.71 for general expenses, taxes, etc., leaving the net income for 1894, $223,406.02.

Lynchburg, Va.—L. P. Rodes, city engineer, advertises for proposals for the complete erection and equipment of an electric lighting station for this city. The proposals must be submitted not later than Feb. 26th and must be accompanied by a certified check for $500 made payable to the treasurer of Lynchburg, Va. Any information desired can be had on application to David E. Evans & Co., No. 7 Harrison street, Baltimore, Md.

Philadelphia.—The *Times* says: "The electric surface railways could scarcely have been subjected to a severer test than was furnished by the recent storm, which was hardly excelled in severity by the famous blizzard of March, 1888. In all fairness it must be admitted that they stood this severe test extremely well. completely demonstrating the superiority of electricity as a motive power in a driving winter storm to either horses or cables."

Gouverneur, N. Y.—Electric lights for this town are to be supplied from a new plant erected by the Oswegatchie Light and Power Company at a point in the Oswegatchie River about one mile above Hailesboro. Mr. A. L. McCrea is the general manager of the company, and under his direction and that of A. J. McDonald the water power attainable has been utilized to the fullest extent and is expected to drive three dynamos, one of which is already in place.

Syracuse, N. Y.—The minutes of the stenographer taken in the reference before William Nottingham in the case of Paul T. Brady against the city and the Electric Light and Power Company have just been completed and delivered to the attorneys in the case. As soon as the attorneys can look the evidence over they will submit points to the referee, who will then make up his report, which will be handed to Justice Vann. The decision will then be made as to whether the temporary injunction secured by Mr. Brady will be vacated or made permanent.

Paterson, N. J.—The absorption of the six electric railway companies of the Morrisse system formed under the traction law of 1893 was completed on the 11th inst., and the united companies will hereafter be known as the New Jersey Electric Railway Company. Its lines will extend from Singac to the Hudson River, passing through Passaic, Bergen and Hudson counties. The company has executed a mortgage to the Mercantile Company of New York as trustee for the bondholders for $3,500,000, and the mortgage has been recorded.

The Handling of Coal and Ashes at the 3d District Station of the Edison Electric Illuminating Co., Brooklyn, N. Y.

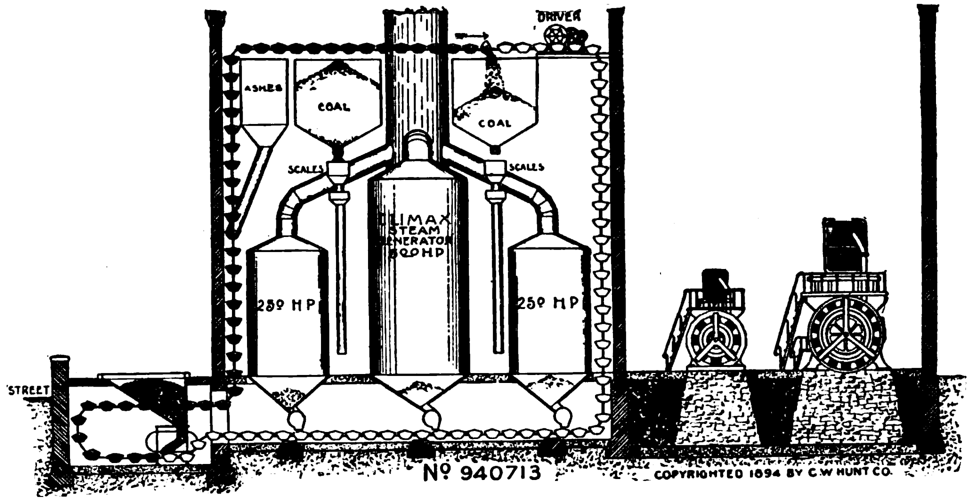
The C. W. Hunt Company, 45 Broadway, New York City, has been prominently identified with the development of coal handling machinery and installed the apparatus for that purpose in use at the Third District Station of the Brooklyn Electric Illuminating Company, at Pearl and Gwinnett streets, that city.

This station (Third District) is situated at some distance from the coal wharves, and the coal is delivered by wagons. It was necessary to take the coal from the wagons, carry it to the furnaces, and also to remove and dispose of the ashes.

The coal is now carried from the hopper underneath the sidewalk to the coal tanks above the boilers by a conveyor, which, upon its return, passes underneath the ash-pit of the furnaces and carries the ashes to a bin, from which they can be drawn at will for removal.

The conveyor consists of a series of gravity buckets pivoted in a double chain, and the whole system is carried on self-lubricating wheels. The buckets are so pivoted in the double chain that the force of gravity keeps them always in an upright position whether full or empty and no matter how tortuous the track over which they are drawn.

The material is carried to its destination by a single conveyor in a horizontal, vertical or angular direction, all of which were utilized in this station. The change in the direction of the conveyor is made by running around curves instead of over sprocket wheels, and the whole machine is noiseless in its operation.



C. W. Hunt Coal Carrying Apparatus.

The power for driving the conveyor is located at the top line, and is furnished by a ten horse-power electric motor. The operating switches are placed below on the boiler room floor for convenience in starting and stopping the machinery. At this station, when receiving coal at its full capacity, the power required to operate the conveyor is 4½ horse-power measured at the switch.

The coal is drawn from the storage bins above the boilers into weighing hoppers, from which it is spouted to the floor of the boiler room at such a distance as to be easily shovelled directly into the furnaces.

The Power Plant of the Baltimore and Ohio Belt Line Tunnel.

The Belt Line road is about seven miles long. It begins near Bayview, to the east of the city, and runs several miles through deep cuts along the northern edge of the city until it swerves around to the Jones Falls embankment, west of Oak street: it crosses the valley of this stream, the tracks of the Pennsylvania Railroad and the Baltimore and Lehigh Railroad on a large bridge, and a short distance beyond this enters the tunnel which follows Howard street through the city to the present Camden Station.

The tunnel is 7,430 feet, a little less than a mile and a half long, and it cost the Baltimore and Ohio Railroad Company between $7,000,000 and $8,000,000.

The motive power for the new electric plant is furnished from one station located near the end of the tunnel. In addition to the traction plant an electric lighting plant is found here which will supply about 2,000 incandescent lamps which are placed throughout the tunnel. As there will be no smoke in the tunnel, it is intended to paint its interior white, and when illuminated by the electric lights it will not be necessary to light the lamps in the cars of passing trains, as the passengers will find it almost as brilliant inside the tunnel as outside in the daylight. The generators will be driven by Armington & Sims engines, and the steam will be furnished from Improved "Root" Water Tube boilers. The boiler room of this plant is most interesting and includes the most modern appliances.

Twelve "Root" boilers are found arranged in six batteries, three batteries on each side of the room. Each of the two flues, which run along the opposite walls back of the boilers, carries the heated gases to economizers which rob the gases of their heat, and by this means raise the temperature of the feed water.

The gases then pass into a fan of the Sturtevant pressure pattern, which expels them through a short stack into the air. This fan establishes an induced draft, causing the air to pass rapidly through the grate bars and coal, thus promoting combustion more or less rapid, according to the speed of the fan, which is regulated by the demand for steam on the plant.

As the General Electric Company are relying entirely upon the success of this plant for their sale of it to the Baltimore and Ohio Railroad Company, they did not place their order with the boiler manufacturers until after they had thoroughly tested them in two of their plants in Lynn, Mass., which are equipped with this make of boilers.

A Good Testimonial.

THE SMITH PREMIER TYPEWRITER CO.,
Syracuse, N. Y., Mar. 3, 1894.

Onondaga Dynamo Co., Syracuse, New York.

Gentlemen: The 600 incandescent light dynamo of your manufacture that you installed about eight months ago for service in both of our factories has given the best of satisfaction.

We find the dynamo economical in point of attention, as it adjusts from a light to a heavy load automatically, which reduces the liability of breakage of incandescent lamps to the lowest possible minimum. Our engineer states that words cannot express the full satisfaction it gives. It gathers its load on starting with great promptness, and we find the commutator in as perfect condition as when the machine first started, with no appreciable wear. Yours truly,

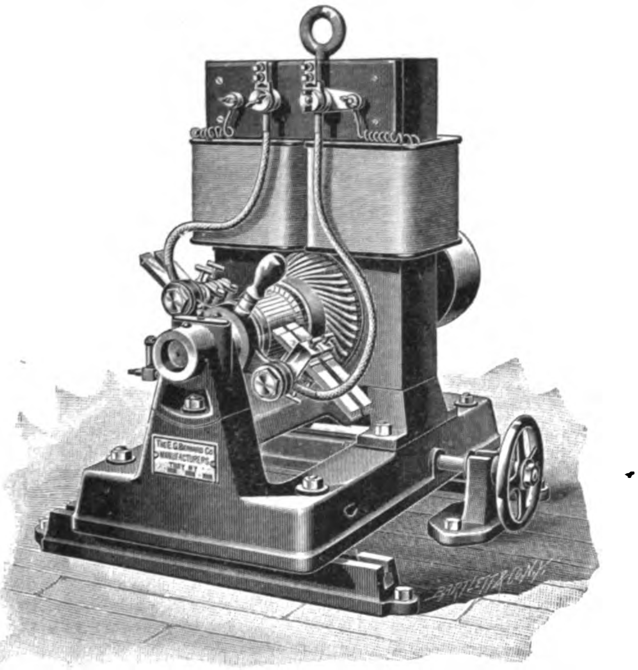
L. C. SMITH, President.

The Adams Dynamo and Motor.

The accompanying cut represents the improved Adams ynamo and Motor which the E. G. Bernard Company of Troy, N. Y., have been making for some time past. While they have not aimed at bringing out any new style or type of machine, they have greatly improved on this standard type in a number of details. One of their principal features, however, is making the magnetic field out of wrought iron forged in one piece, thus doing away with any joints in the magnetic field and decreasing the number of parts, which, from an engineering point of view, is of considerable importance, besides making an extremely simple, compact machine of high efficiency. They are the only makers in America of this type, although a number of prominent manufacturers in Europe adopted it some years ago. It has the least number of parts of any machine at present on the market.

The insulation is of mica throughout. The mechanical details are of the latest, such as self-oiling bearings, self-centering phosphor bronze journal boxes, automatic brush-holders and positive belt adjusting rails. The commutator is made of tempered copper, insulated with best quality of India mica. The dynamos are compound wound and absolutely automatic under all conditions of load.

All parts of the machines are interchangeable, and any parts proving defective in one year will be replaced free of charge.



THE ADAMS MOTOR AND DYNAMO.

The Bernard Company are just issuing an attractive price list and testimonial sheet. The latter, by the way, is a novelty in testimonials and reads as follows:

We, the undersigned, hereby certify that we have the system of Electric Lighting and Power as installed by E. G. Bernard in our factories and buildings for the period of time set opposite our names, and time thus far has proved all of his assertions and guarantees to be true, the Dynamos, etc., having given us perfect satisfaction; and we recommend this system to those desiring similar apparatus. Dated Feb. 15th. Then follows the signatures of over 100 of their customers.

The Metropolitan Electric Company.

The above company have received a letter from one of their customers that reads as follows:

"Metropolitan Electric Company, Chicago.

"Gentlemen: The bill of goods you shipped me January 9th just received, and to my great astonishment I find same to be the very first bill of electrical goods received in eight years just as ordered. You did not make a single mistake, and the goods came up in good shape, only one 32-power candle lamp broken in the entire lot. This is an extraordinary circumstance, and contrary to my previous experience with any electrical concern."

The above shipment contained parts of nearly everything contained in their catalogue. When it is considered that it travelled over 2,000 miles to reach the customer, the company may well be proud of the undertaking, and we think the general trade ought to know of it, as the feat is said to be unparalleled in the history of electrical supply business.

COMMERCIAL PARAGRPHS.

The Colburn Electric Manufacturing Company, Fitchburg, Mass., is building a brick machine-shop, and will add a boiler and engine house 42 x 40 ft.

The National Conduit Manufacturing Company have appointed Mr. H. F. Tate general Western manager, with headquarters at room 542 Rookery Building, Chicago.

Capt. Willard L. Candee and George T. Manson will be on hand at the Convention representing the Okonite Company, Ltd.

The Improved "Fishkill-Corliss" engine, built by the Fishkill Landing Machine Company, of Fishkill-on-the-Hudson, N. Y., is especially well adapted to situations where close regulation and noiseless operation is desirable, and on this account finds a ready adoption for electric light and power plants.

Those interested in the economical handling of coal and ashes in electric lighting and power stations should make application to the C. W. Hunt Company, 45 Broadway, New York City, for a copy of their finely illustrated catalogue, "Coal Handling in Power Stations."

The Abendroth & Root Manufacturing Company, 28 Cliff street, New York City, are the sole makers of the Root Improved Water-Tube Boiler, so generally employed nowadays in electric lighting and street railway power stations. It has branch offices in the Perin Building, Cincinnati, O.; Monadnock Building, Chicago, Ill.; Security Building, St. Louis, Mo., and at 8 Oliver street, Boston, Mass. The company will be represented at the Convention by Mr. P. M. McLaren.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED FEBRUARY 12, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

533,861. Electric Locomotive. Eben M. Boynton, West Newbury, Mass. Filed April 9, 1894.

533,869. Conduit System for Electric Railways. Frederick S. Davenport, Jerseyville, Ill. Filed Oct. 26, 1894.

533,905. Distribution System for Electric Railways. Walter H. Knight, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Nov. 30, 1894.

534,078. Regulating Device for Car-Motors or Other Electrical Apparatus. Horace F. Parshall, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed Dec. 11, 1891.

534,238. Supply System for Electric Railways. Malone Wheless, Washington, D. C., assignor to the Electro-Magnetic Traction Company, same place. Filed Dec. 3, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

533,918. Fuse-block and Socket. Frederick W. Mount, St. John, Canada. Filed July 16, 1894.

533,932. Carbon for Arc Lamps. Elihu Thomson, Swampscott, assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Nov. 26, 1894.

534,086. Electric-Arc Lamp. Thomas Spencer, Philadelphia, Pa. Filed June 6, 1894.

534,206. Filament for Incandescent Lamps. Thomas A. Edison, Menlo Park, N. J. Filed Jan. 4, 1884.

534,207. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J. Filed Dec. 27, 1886.

534,209. Incandescent Arc Lamp. Thomas A. Edison, Llewellyn Park, N. J. Filed Sept. 17, 1890.

DYNAMOS, MOTORS, ETC.

533,873. Alternating-Current Dynamo-Electric Machine. Axel Ekstrom, Lynn, assignor to the General Electric Company, Boston, Mass. Filed July 26, 1891.

533,885. Apparatus for Winding Armature-Coils. Henry Geisenhoner, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, same place. Filed Aug. 22, 1894.

533,920. Series Parallel Controller. Edward D. Priest, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Nov. 24, 1894.

533,930. Armature-Winding. David P. Thomson, Schenectady, N. Y., assignor to the General Electric Company, Boston, Mass. Filed Aug. 4, 1894.

533,931. Dynamo-Electric Machine. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 29, 1890.

534,038. Dynamo-Electric Machine. Rodolphus Fuller, Detroit, Mich. Filed Oct. 20, 1894.

534,060. Electric Controller. George F. Card, Covington, Ky., assignor to the Card Electric Company, Mansfield, Ohio. Filed May 17, 1894.

534,079. Armature for Dynamo-Electric Machines. Horace F. Parshall, Schenectady, assignor to the Edison General Electric Company, New York, N. Y. Filed Feb. 20, 1892.

534,092. Means for Mounting Dynamos on Railway Cars. William Biddle, Brooklyn, assignor to the American Railway Electric Light Company, New York, N. Y. Filed May 23, 1894.

534,151. Alternating-Current Motor. Robert H. Hassler, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Nov. 30, 1894.

534,208. Induction-Converter. Thomas A. Edison, Llewellen Park, N. J. Filed May 21, 1888.

TELEPHONE AND TELEGRAPH APPARATUS.

533,893. Electrical Exchange System. George W. Hey and Arthur E. Parsons, Syracuse, N. Y. Filed March 30, 1893.

533,967. Combined Telephonic and Telegraphic System. Christopher A. Shea, Boston, assignor of one-third to Freeborn F. Raymond, 2d, Newton, Mass. Filed July 30, 1892.

534,025. Automatic Telegraphing Machine. Charles E. Yetman, Oak Park, Ill., assignor to the World Flash Company, of Chicago. Filed Dec. 2, 1893.

534,083. Telephone Metallic Circuit. Christopher A. Shea, Boston, assignor of one-third to Freeborn F. Raymond, 2d, Newton, Mass. Filed July 30, 1892.

534,084. Combined Telephone and Telegraph System. Christopher A. Shea, Boston, assignor of one-third to Freeborn F. Raymond, 2d, Newton, Mass. Filed July 30, 1892.

534,085. Telephone Metallic Circuit. Christopher A. Shea, Boston, assignor of one-third to Freeborn F. Raymond, 2d, Newton, Mass. Filed July 30, 1892.

BATTERIES.

533,936. Electric Battery. James M. Wells, Peoria, Ill. Filed July 31, 1893.

534,036. Galvanic Battery. Warren P. Freeman, Brooklyn, N. Y., assignor to the Newton Rubber Works, Newton, Mass. Filed June 11, 1894.

MISCELLANEOUS.

533,902. Electrically-Operated Recording Instrument for Compasses. Charles L. Jaeger, Maywood, N. J. Filed Jan. 25, 1894.

533,910. Tip for Electric Conductors. Amandus Metzger, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Nov. 26, 1894.

533,919. Synchronizer for Clocks. Henry S. Prentiss, Elizabeth, N. J., assignor to the Prentiss Clock Improvement Company, New York, N. Y., and Jersey City, N. J. Filed June 30, 1892. Renewed June 22, 1894.

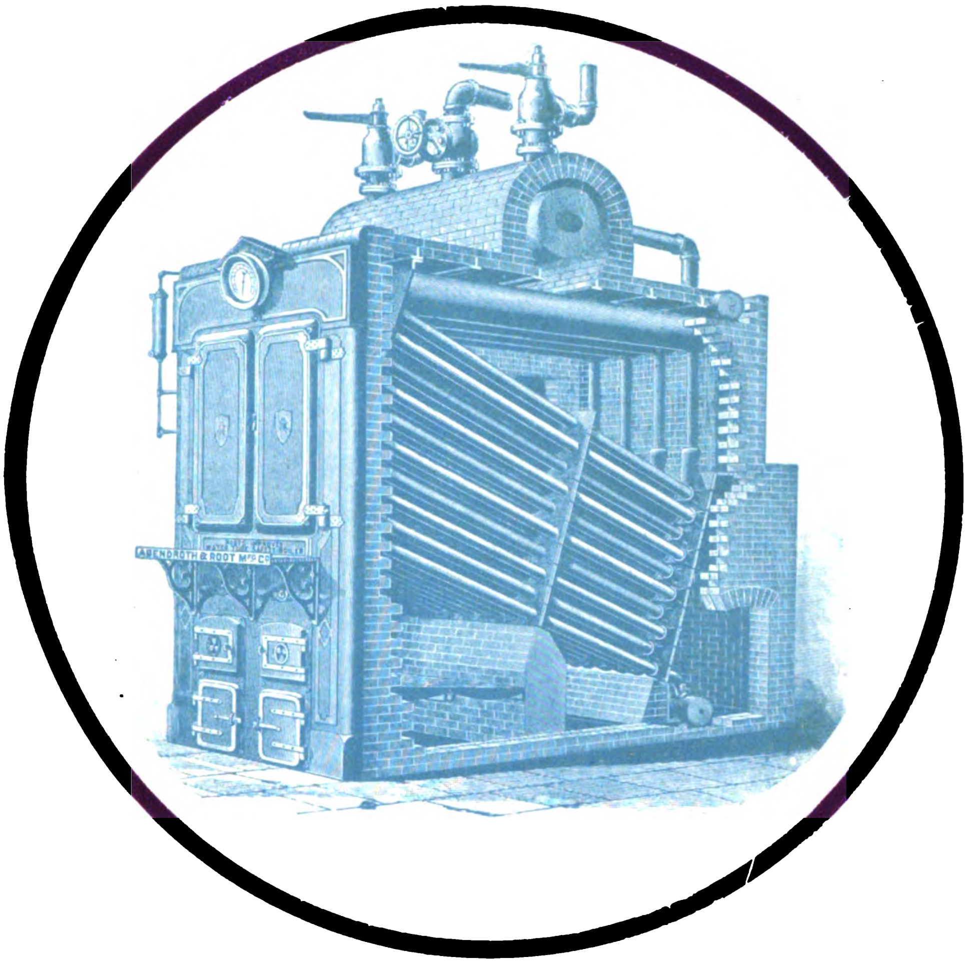
533,926. Electric Automatic Block-System Signal. Joseph P. Stewart, Haverstraw, N. Y. Filed Mar. 8, 1894.

533,979. Electrical Time-Alarm. Walther Wilke, Wermelskirchen, Germany. Filed Aug. 7, 1894.

534,028. Electric Railroad-Switch. Rollin A. Baldwin, South Norwalk, Conn., assignor to the Fitch Excelsior Switch Company, of New Jersey. Filed June 27, 1893.

534,082. Measuring Apparatus. Amos Y. Reeder, Philadelphia, Pa. Filed Mar. 14, 1894.

THE IMPROVED "ROOT" WATER TUBE BOILER

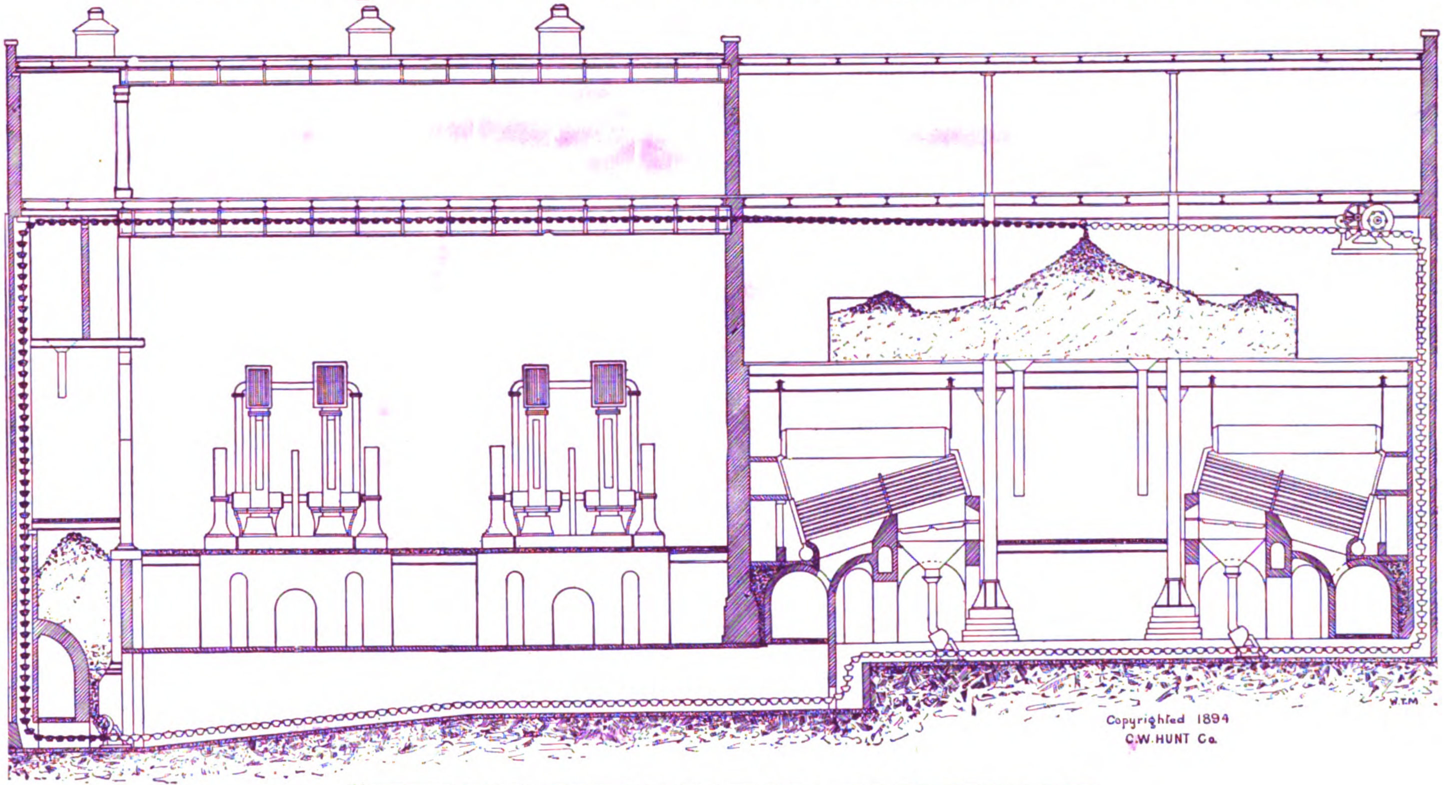

ABENDROTH & ROOT M'F'G CO.

FOR
ELECTRIC LIGHT
AND
POWER STATIONS.

BEST ADAPTED TO HIGH PRESSURES.
A Rapid and Economical Steam Generator.
FURNISHES DRY STEAM.

ABENDROTH & ROOT
M'F'G CO.,
28 CLIFF STREET,
NEW YORK.

"HUNT" System of Coal Handling in Power Houses.



"HUNT" NOISELESS CONVEYOR.

A complete system of storing and conveying coal. Coal is carried to the boilers, and the ashes are carried away by the same machine, at less cost per ton than by any other machinery.

This illustration shows the "HUNT" conveyer as constructed for handling coal and ash at the Pearl Street Station of the Edison Illuminating Company, Brooklyn.

We invite correspondence, and will be pleased to furnish complete plans and estimates for handling of coal and ash. You cannot afford to install any method of coal handling until you have investigated the "HUNT" system.

Send for a Catalogue.

C. W. HUNT COMPANY, 45 BROADWAY, N. Y.

THE OKONITE CO., Limited,

13 PARK ROW, NEW YORK.

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Buffalo, N. Y.

PETTINGELL-ANDREWS CO.
72-74 Federal St.,
Boston, Mass.

ELECTRICITY.

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EDITORIAL NOTES.

The Monocyclic System. This paper, which together with its discussion will be given in full in the columns of ELECTRICITY, meant far more to those who assembled at the Cleveland Convention than appeared on the surface. To the Central Station man and the average electrician it meant a disclosure of a new system of distribution by means of periodic currents whereby greater elasticity was expected than had even been claimed for systems already in use or described. The claims which had already been promulgated for this system had been of such a nature as to arouse curiosity to the highest point as to how the results could be accomplished and as to the actual economies resulting, and the classes above referred to attended with the expectation of having these points cleared away and of learning from the discussion how the system as a whole was regarded by those more competent than themselves to judge from *a priori* reasoning. It is unfortunate for any invention that it be heralded with too high a blaring of trumpets, for by this cause expectation is sure to be aroused to such a degree as to render it impossible of fulfilment even if the intrinsic merits of the discovery be such as to entitle it to a high place in the estimation of the public. In so far as its merits fall short of these unreasonable expectations, the invention suffers. A feeling of disappointment far out of proportion to that which is justified is sure to be experienced by the public, and Dr. Bell's excellent paper suffered badly from this cause. However much we may have been disposed to criticise the business methods of the G. E. Company, we believe we are entirely unbiassed as regards the scientific accomplishments of its staff of able engineers, and would as willingly award our meed of praise to Mr. Steinmetz, or Dr. Bell, or Prof. Thomson, or Mr. Rice, as to Mr. Kelly, Mr. Scott, or any other worker in electrical science. In the science of electricity we know no General Electric Company, no Westinghouse, no Stanley, no other electric company—they are all workers in the same great cause and have al worked great good, and this we hope to recognize whatever its source. In the fierce business competition which has existed among the various large electrical concerns in this country there has naturally arisen an intense professional rivalry which in so far as it has been professional has been healthy and salutary and conducive to the progress of the science as a whole. It was doubtless this competition and rivalry that added the great intensity of interest manifested in the paper, and which caused those present to hang intent on the words of the able representatives of the various great interests who took part in the discussion.

For ourselves we must confess to a feeling of disappointment in the system as a whole as described in Dr. Bell's paper. This disappointment does not extend to the paper itself, for that was one of the most finished efforts of a finished scholar, ripe in experience of the subject which he handled. It was, too, a paper far more moderate in tone than previous papers and the occasion had led us to expect from Dr. Bell, and it was this very moderation that constituted its greatest strength and charm. But to our mind it fell short of a convincing argument that there had been accomplished the great improvements that had been claimed. One of the main efforts of the friends of the system was to convince the public that the monocyclic system differed radically from any polyphase system—that its phenomena were not polyphase phenomena—that it was in fact a development *ab initio* of an entirely new system.

To this end Mr. Steinmetz very adroitly defined polyphase phenomena in a way that excluded entirely those of his own system. If his definition was legitimate, the case was of course proved, but we think his definition will hardly be accepted by the electrical world. At any rate, if there is to be a division on this question the question will still remain one dependent upon how we shall define the word "polyphase." It will not be settled by the merits of the system, as its friends would like to have it, but simply upon the preponderance of feeling as to the definition of a word already long in use and generally pretty intelligently used. It appears to us that Mr. Scott's definition is by far the better of the two, and very accurately defines the meaning as the word is used to-day by intelligent electricians the world over. With this meaning attached to the word—and it is the one which we approve—the monocyclic system is *not* an entirely new one as claimed, but simply a modification of existing polyphase systems. While this question may have great legal and scientific import, it has no bearing upon the economic value of the system, and this after all is what concerns the public at large.

As we now understand the monocyclic system, it is one involving a generator developing currents differing in phase—a conducting system of at least three wires and the usual reducing transformers. It seems to differ from the ordinary three-phase system in that but two currents, differing in phase, instead of three are transmitted —the third current being obtained by the combination of the other two. The transformers for lighting are connected across but one pair of mains. The third wire of the system is said to convey no energy, but the motor transformers are connected with this in order to give to the three-phased motors which are connected thereto a starting torque. The third wire performs service in starting up, but when full speed is attained it might be discontinued without injury to the system so long as favorable conditions are maintained. If, however, conditions arise whereby the motor would perform badly under the two-phase condition, the third wire still in circuit would come to the assistance of the machine.

It would seem that the monocyclic system requires quite as complex a generator as the two-phase—an entirely similar line system and a three-phase motor. There seems, therefore. to be no simplification in this over present systems. Rather the reverse, for the wires cannot be used indifferently for light and power—the third wire is sacred to power. Although it is claimed that this wire consumes no energy, it does not reduce the amount of copper elsewhere, and the energy wires must be amply sufficient to transmit the whole energy single phase. The extra expense for copper thus brought about appears, therefore, to amount to 25 or more per cent. of the whole amount required for single-phase transmission Comparing it with two-phase transmission, Dr. Bell described a method of the latter which no engineer using two phase would think of adopting as though the latter was standard. By making this comparison a considerable economy was indicated where in fact it does not exist. When his attention was called to this he had to admit that there was another method of two-phase transmission which required less than 73 per cent. as much copper as single phase, instead of 45 per cent. more as he had shown. Now this method is in fact the system in common use, as shown by Mr. Scott, who further stated that if the voltage were pushed as high on the two-phase as on the three wire single-phase plan, of which Dr. Bell spoke approvingly, the copper required would be only 36.4 per cent. of that of ordinary single phase.

Electricity to the Fore. The occasion of an Electric Light Convention is always one of rivalry among the electrical journals, when each attempts to present in the most attractive form its claims for superiority. Never before in the annals of electrical journalism has the result of such a contest been left so little in doubt as in the present case. Never before has the existing order of things been so completely reversed as was the case at the Cleveland Convention. Since the Washington meeting the arrogant *Electrical World* has seen every prop by which it has sought to bolster itself up knocked from beneath it, and its fall has been ignominious and deserved. Its claim to age has been so successfully disputed by at least two of its contemporaries that it has now been abandoned. Its claim to advertising patronage in excess of all rivals is now as baseless as its claim to general utility or gentility has long been. It attracted the least attention of all the journals at the Convention, as evinced by the numbers of its issue discarded at the hotels. In contrast with this, not a copy of ELECTRICITY was made improper use of. It created no litter, and the ash barrels and toilet rooms of Cleveland are free from its familiar colors. The avidity with which ELECTRICITY was sought for, and when secured preserved for future perusal and reference, was something unparalleled in the annals of electrical journalism, and even our most bitter competitors were forced to award us the palm. This is the merited reward of genuine worth. We have ever striven to give the public something that it wanted—we have tried to meet the demand. The *Electrical World* has tried to force the masses to accept its own standard. Public opinion is slow to crystallize, but give it time and its judgment is infallible. Its judgment at the Convention was so overwhelmingly in our favor as to be unmistakable, and virtue has at last received its due reward.

* * *

The Cleveland Convention. The Eighteenth Convention of the National Electric Light Association, at which was celebrated the tenth anniversary of its birth, went out in a blaze of glory which bespeaks a future of increased usefulness for the organization. What has been accomplished during its decade of existence was fittingly referred to in President Francisco's address. Just how far the Association has been contributory to this progress—unparalleled in the history of industrial life—it is impossible to state, but it goes without saying that it has been a most important factor. What its influence is to be during the next decade it is also impossible to foretell, but it will be largely of its own making. The conventions of an association such as this are necessarily largely creatures of circumstances. As the business aspects change, so must the character of the meetings, and it has been a matter of congratulation to all that the organization has been sufficiently flexible to rise to each occasion as it presented itself. Thus the policy of holding several meetings a year, which was doubtless wise in the earlier history of the Association, gave way to the single meeting. The character of the papers presented at once advanced to a higher standard, and each succeeding meeting since that held at Buffalo has marked a distinct progress in this direction, and the programme presented at Cleveland was as far in advance of that at Washington as that was ahead of the programme at St. Louis ,or that an improvement upon Buffalo. There have been exceptional papers at other Conventions, notably that of Mr. Scott at Washington, that have surpassed in importance any of those read at Cleveland, but never before has the programme *as a whole* reached the same standard of excellence as that of the one just presented. The Cleveland Convention, too, will go down to history as the *business* Convention unless it shall be eclipsed in this regard by those which are to follow. The Washington Convention marked the high-water record of attendance from abroad, but in attendance on the meetings its record was not one to be proud of. At the Cleveland Convention both the numbers from abroad and of those attending the sessions surpassed any previous record. Never before has the interest in the papers been so well maintained as at this last meeting, and this is a matter of sincere congratulation as showing what a good programme will do.

The proportionate decrease in attendance of Central Station men, however, was the occasion for remark and solicitude. It seems strange that those for whose especial benefit the Association was organized should by their absence indicate an apathy for that which should and does advance their interests to such an extent. It becomes imperative now to do something to increase the attendance of electric light men. A step in the right direction was the change of date of meeting to a time when local interests can better spare the services of those who have them in their keeping. The suggestions of Mr. Beggs—ill-timed and in bad taste—that a better attendance could be obtained by lowering the annual dues—met the reception that it deserved. If the value of these meetings to the Central Station man is not appreciated to the extent of the present dues, it will not be appreciated at any lower figure. This class of men will not attend because membership is cheap. They are not cheap men in any sense of the word, and Mr. Beggs's insinuations were not relished. To gain a better attendance of those engaged in the electric light industry the endeavor should be to make the meetings more interesting and valuable to them. Presenting a good programme of papers is not the only way to do this. More time must be given to discussion in which experiences can be exchanged. The weak point of the Cleveland programme was that there was too much of it. The papers could not be adequately discussed, and that is a fatal weakness. One good subject such as that of how to light large cities, which was practically not discussed at all, might well have occupied two whole sessions. From our own standpoint, more success will attend a curtailment of the papers and an extension of the discussions than in any other way.

Discussion is the very life of all bodies like the N. E. L. A.

In harmony there is stagnation, but in controversy there is music

Under the Searchlight.

Views and Opinions on Timely Topics.

The Robust Baby.

(From the Toledo Bee.)

Electricity is still in its infancy, and new uses for it are constantly developing.

* * *

Advertising Axioms.

(From Printers' Ink.)

It is true that advertising, as a general thing, does not sell goods, but it brings the buyer to the seller.

The general public is not a mind reader. If it does not know what you have for sale, how can you expect it to go ask for your goods?

* * *

They Imitate Their Superiors.

(From the Albany Argus.)

The General Electric Company lately came into possession of information which implicated several foremen in the various departments of its works at Schenectady in a systematic scheme of extortion exercised upon men employed under them. It is said that in many instances the foremen sold positions which their authority enabled them to bestow, and other cases are cited in which it is related that employees were forced to pay tribute to the accused men in order to retain their positions.

* * *

Who is Kicking?

(Advt. in Boston Dailies.)

Holders of General Electric Co., preferred and common, are invited to communicate with the undersigned, stating number of shares held.

Venner & Company,
Tremont Bank Building, 8 Congress Street.

* * *

THE KIND OF MAN HE IS.

When we were pursuing our investigation of the Electropoise we interviewed, in regular newspaper manner, a number of physicians and others upon the subject. Among those so interviewed was Dr. Henry H. Morton, of Brooklyn. He along with Dr. W. J. Morton, of New York, Dr. A. D. Rockwell, Dr. Cyrus Edson and others, wrote us letters on the subject which we accepted as being inspired by the desire on the part of those gentlemen to aid the cause of truth.

Dr. Henry H. Morton has now sent us his bill for $35 for advice and for the letter he wrote.

* * *

The Chicago office of the G. E. Company is said to have advanced to one Lester Hills, special agent, $2,500 on his note (which is still unpaid), money to be used by Hills in the attempt to elect himself alderman in the First Ward of the city of Chicago in 1893. He got sadly left, and the General Electric Company has the note as a remembrance. It ought to be itemized in their securities.

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THE CONVENTION.

The appearance of Mr. H. L. Shippey in the lobby recalled those other days when the Old Guard were not yet scattered.

* * *

Among the Cleveland men who were in regular attendance none made more friends than Scott Hayes. He will have to come into the Association and be one of us.

* * *

If Mr. Beggs will keep his tongue unheard for a year, and his face unseen, New York will have the next meeting. No cause, however, can endure his advocacy.

* * *

Mr. B. E. Sunny was in attendance for two days in his usual urbane and courteous frame of mind.

* * *

From the eloquence displayed by Capt. Harry Adams when discussing Ft. Wayne apparatus, it might be guessed that the Phillips Wire had not entirely effaced the memory of his old connections.

* * *

The punch served by E. W. Little and his associates was as strong as the insulation on Interior Conduit.

* * *

The first thing Frank Brobst did the morning after Pudd'nhead Johnston's arrival was to order ten tons of coal.

* * *

An old New Yorker, now domiciled in Cleveland, whom all the boys were glad to see, was Mr. M. M. Hayden.

* * *

Mr. John I. Beggs has not lost his desire for notoriety. That there was anything sincere in his bellowing at Cleveland will not be believed by anyone who knows him. If his attack had not been so unjust it would have been funny. After being dropped as a deadhead, and with scarcely a right to the floor, his attempt to revolutionize the Association was at least out of place. But Mr. Beggs does not know when he is funny. If he had wanted to be truly interesting and create a sensation he would have told what he knows about the fire in the Edison Building in 1892, when so many rare documents were burned up. If Beggs will do this next year, Electricity will guarantee a large audience.

* * *

The facts are that the N. E. L. A. is conducted very well indeed; and had it not been for those who are now prominent in the management, especially Mr. George F. Porter, the Association would be dead now. There is room for improvement, and the management are at all times eager in their search for suggestions. As for running the Association cheaply, why should it be thought of? We are not cheap people; we do not want a cheap Association; we do not want a cheap Secretary.

* * *

WE MAINTAIN OUR RECORD.

(From "Electricity," Feb. 20.)

If there is one feature of Electricity which, more than any other, has contributed to its pronounced success, it has been the feature of giving ALL THE NEWS up to the hour of going to press.

Last March we were able through superior enterprise to present the epoch making paper of Mr. Scott, read at the Washington meeting, one week in advance of our contemporaries.

Elsewhere in this issue will be found Dr. Bell's paper on the Monocyclic System, read at Cleveland, printed in full, and with the accompanying diagrams.

Electricity is up to date.

Personal.

Mr. R. S. Stearns, formerly of the G. E. office in Cincinnati, has gone to New Orleans to take charge of the sales department of the Southern Electric Company.

The Columbia (S. C.) Cotton Company's new cotton mill at Columbia is equipped with an electric plant for operation. The electric current is derived from the water power of the Congaree River, and is conducted in underground conduits and across the river under the iron bridge from the place of generation to the mill, where a number of electric motors in the different rooms operate the machinery used in the manufacture of cotton cloth.

The Schafer-Heinemann Accumulator.[*]

BY A. M. GIBSON.

During recent years but little progress has, for a variety of causes, been made in the improvement of storage batteries. The difficulties to be overcome in themselves were not great, but until recently the incentive to inventors of high scientific attainments was lacking. Early adventurers in the field obtained so-called master patents, and these falling into strong hands gave a practical monopoly of the accumulator system.

These early patents were for the containing grids, or plates for holding what is called the active mass. A storage battery is an arrangement of positive and negative electrodes with capacity for storing oxygen and hydrogen in certain chemical combinations, with capacity under given conditions of converting the elements so stored into electric energy. Metallic lead in the shape of powder, or compounds of lead, were found, in combination with sulphuric acid, to afford the most efficiency.

The lead compound was made into a paste and was fixed to conductors, a leaden frame or grid, and thus an electrode was formed. These were fixed in a box and sulphuric acid was added in sufficient quantity to cover the electrodes. But to hold the paste to the frames or grids a binding agent had to be employed which was insoluble in sulphuric acid and incapable of being electrolyzed. Therefore, a great deal of useless, because non-conductive, material had to be employed. There was both bulk and weight and low efficiency. Moreover, the molecular action which took place by the chemical conversions occurring during charging and discharging caused expansion and contraction of the lead compounds—the active mass—and two things happened: warping or buckling of the plates or grids and disintegration of the lead compounds. In a relatively short time the electrodes were destroyed.

As the time for the expiration of the so-called master patents drew near more attention began to be paid to perfecting accumulators. At the same time the employment of electric energy for various purposes began to extend greatly, and a demand for serviceable and highly efficient accumulators was created. A new class of electricians had also been created—men who had received thorough scientific training and were well grounded in chemistry and the physics of electricity. Electro-chemistry, it must be borne in mind, is a science of recent development and is daily widening its field as trained experimentalists are enabled to prosecute systematic work. Pioneers like Davy and Faraday indicated many important discoveries, and their laboratory demonstrations elucidated general laws governing phenomena theretofore incomprehensible. But there is a wide region between the laboratory demonstrations and the practical working upon a commercial scale. For instance, the phenomena connected with electrolysis in all their variety were noted and explained by Faraday, but the realization of electrolytic decomposition of the halogen compounds upon a commercial scale—a vast and important field—is just beginning.

Foremost in the field of electro-chemical discoveries and useful application thereof since Faraday's time we must recognize the German school of chemists. Hertz, Helmholtz and Ostwald have been the great teachers, and their pupils form an active, numerous band of trained men, who are patiently attacking difficult problems by scientific methods. Empirical experimenting may accomplish great results, but in electro-chemistry the worker who can grasp the possibilities in the largest degree of the many reactions in organic and inorganic chemistry is the one most likely to achieve the greatest success.

As before stated, the earliest experimenters with storage batteries confined themselves to the paste compounds of lead oxides and fixing them in grids with a mechanical binding agent. They employed for the latter tar products dissolved in alcohol, gum arabic and other adhesive substances. Two German electricians—Schafer and Heinemann—struck out a new line about the same time that Clement Payen, a French chemist, began experimenting with storage batteries. These three inventors, in common with many others, endeavored to eliminate as far as possible what may be termed electrically inert materials in the construction of storage batteries. Two requisites in accumulators are necessary—an active mass of the highest efficiency in the least compass and great stability of this active matter. The French inventor sought to get these results by the use of chloride of lead, and the German inventors employed glycerates of lead. Practical results, in my opinion, prove that the Germans have achieved greater success than their French rival.

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[*] From the *Engineering and Mining Journal.*

Stability is required to successfully resist all interior molecular as well as exterior mechanical influences, but at the same time this stability of the active mass must not be secured by making it so dense that the sulphuric acid cannot act upon each molecule. It is necessary that there should be a certain porosity, or rather a crystalline structure, of the active mass which will, with the action of the electric current, permit an endosmostic action on the molecules by the sulphuric acid. This is also necessary in order to increase the superficial area and thus give greater capacity both in reception and in discharge. Another important point is to avoid cramping the lead molecules. They must have room for due expansion and thus prevent bending, bulging or warping of the containing grids or plates.

Glycerine has the property of forming with lead oxide a compound which, according to the proportions of the components, will in a few moments set and become a stone-like material, this being due to the formation and intergrowth of the crystals of lead glycerate having the following composition: $PbC_3H_6O_3$.

The lead glycerate is by the action of an electric current, in the presence of a solution of permanganate of potassium acidulated with sulphuric acid, converted into a chemical compound of peroxide of lead and peroxide of manganese, i. e., a lead salt of manganous acid under simultaneous oxidation or decomposition of the glycerine. The following equation partly illustrates the reactions:

$$C_3H_8O_3+4KMn.O_4+2H_2SO_4=2K_2SO_4+$$
$$H_2C_2O_4+4Mn.O_2+5H_2O.$$

The electrodes can be made either wholly of lead glycerate or of the latter, and a carrier constructed of a conductive metal capable of resisting the action of sulphuric acid, as, for instance, a lead frame, grid or plate, the required form being given to either, after which the glycerate of lead is converted into a lead salt of manganous acid as above described, whereby the glycerine is oxydized, the peroxide of manganese separated, and a coherent plate consisting essentially of dioxide of lead and dioxide of manganese is obtained.

The glycerate of lead by itself is non-conducting, of great density and firmness, and offers great resistance to all chemical agencies. It is only by the combined effects of the electric current and the sulphuric acid and alkali-permanganate that the chemical is affected—the glycerine being dissolved out and the remaining body rendered conductive. The manganese molecule combines with that of the lead and forms the salt thus: $Pb.\ O_2\ Mn.\ O_2\ (Pb.\ Mn.\ O_4)$.

If the electrodes are formed with carriers, the glycerate of lead is introduced into the lattice work, or grids, in its soft state, and crystallization takes place, and to obtain a transformation and get a conducting carrier, or material purely active, the plates are immersed in sulphuric acid to which has been added permanganate of potassium (the latter proportioned to the size of the plates), and then the electric current, in combination with the acid and permanganate of potassium, effects the desired transformation. The glycerine is oxydized away from the positive plates and the manganese enters and combines with the lead molecules.

With the negative plates the process is reversed. In the place of oxydation a reduction of the glycerate of lead is obtained and a pure, spongy lead results. The electrical formation of the electrodes requires from 12 to 24 hours.

The plates thus produced are now put together in the usual manner and charged. In this process peculiar phenomena make themselves manifest. In charging the accumulators the plates show red coloring, and in discharging they become colorless. The cause is found in the fact that in charging the manganese is freed from the lead by the superfluous oxygen and the hyper-manganic acid is dissolved, while it is bound up in the discharge thus:

$$Pb.\ O_2\ Mn.\ O + H + O_2=Pb.\ O_2 + H\ Mn.\ O_4.$$

Thus there exists in the electrode a conditionally bound separable salt which does not, however dissolve as salt of the acid of the electrolyte, but as an independent acid.

The manganese has a double function: 1st, it is intended to heighten the electromotive power given off by the change of the hyper-oxide of lead to sponge lead; and, 2d, it is intended to make room for the swelling of the molecules of lead through the absorption of oxygen, which in turn takes place in charging and the dissolving into hyper-manganic acid. In the discharge it returns to its old place; thus, in a sense, filling the free space as a sort of mechanical prop.

In this manner Schafer and Heinemann solve, by the most simple means, the task of finding room for the extension of the hyper-oxide of lead, same time the diffusion of the sulphuric acid is largely extended and the superficial area much enlarged. The discharge can be carried to the limits of all that is possible, i. e., even to short circuit, without injury to the battery.

One fact appears specially worthy of mention, viz., the growing together as it were into one body of the active matter with the lead lattice or grids, which consists of a legation of antimony of lead. This embodying is so dense that it shows on close observation a purely crystallic fusion, and a separation of matter and plate can only be achieved by a violent mechanical process. The absence of any mechanical binding material heightens, to a large degree, the electrical performance of the lead molecules. Thus an almost theoretical using up is obtained.

Meantime the interior resistance has become a matter of no importance through the purity of the substance used.

That under such circumstances the power of this accumulator is unequalled must appear self-evident even to the eye of the layman.

But these are the facts: Per 2 lbs. weight of plates it gives 17·6 ampere hours with a discharge of 2 amperes for same weight.

The only other accumulators which approach in efficiency the Schafer Heinemann are the chloride accumulators of the Electric Storage Battery Company of Philadelphia; the chloride giving per 2 lbs. of plates 11 to 13 ampere hours by a discharge of 1·1 ampere. The superiority of the Schafer-Heinemann accumulator over the chloride is thus apparent. The Schafer-Heinemann compares still more favorably with the Tudor system, giving a six-times better result than the former.

Still more remarkable is the mechanical effect between charge and discharge, as the following shows:

Loss of watts in the Tudor,	25 %	to	40 %
Loss of watts in the Chloride,	15 %	to	25 %
Loss of watts in the S.-H.,	1.4 %	to	5 %

The Imperial German Institute of Charlottenburg, under the presidency of Helmholtz, says in its report:

"The change of tension was the normal one as in lead accumulators, and showed the greatest regularity and absolute agreement in all trials with even currents.

"Crumbling or falling off of the matter, bents, bending or bulging, or any other changes in the plates have in no case been noticed."

The Tudor system, with accumulator weight of 3,000 kg., will propel a total weight of 10,000 kg. with a velocity of 10 km. per hour for 2¼ hours = 40 car km. The Schafer-Heinemann system, with accumulator weight of 2,500 kg., will propel a total weight of 12,000 kg. with a velocity of 20 km. per hour for 17 hours = 160 car km.

The following data is taken from the actual working of a tramway from Lichterfelde to Steglitz, near Berlin, which I have personally examined, the tests being made under my supervision.

The line is 2·9 km. = about 2,950 yards in length. Gradient, n=1·21, 2, i.e., 8·25 yards per 1,000. Velocity, v=12 km. per hour, i. e., 3·3 meters per second.

The tests were the simultaneous working of four cars, without tender. Number of seats 32. Time of running 5 minutes. (Herbrandt's car, drawing No. 1,025, 20 persons seated and 12 standing.) An allowance of 15 kg. friction resistance per ton was made. Weight of car on the horizontal=G., consisting of weight of car, 4,500 kg.; motor, 2,250 kg.; accumulator, 2,550 kg.; 32 passengers at 75 kg. each, 2,000 kg. G=11,700 kg.=11·7 tons. N=number of horse powers to overcome the resistance. N=(15+8·25) × 11·7× 3.33÷75=12·07 H. P. per car.

In the course of the run the resistance diminishes through the living force or the momentum of the car, and thus the drawing power amounts to only 2·75 H. P. The average drawing power thus amounts to about 4 H. P. The battery is size D 7 of the Schafer-Heinemann patent.

For each car a tension of 300 volts is assumed, i. e., 150 cells per car. Dimensions per cell: 140 mm. length, about 5 in.; 150 mm. width, about 5¼ in.; 350 mm. height, about 1 ft.; weight, 17 kg.; capacity, 245 amp. hours by 10·5 amperes discharge; 125 amp. hours by 42 amperes discharge; the average discharge is 4 H. P., or 4.736 =2,944 watts, or, with 300 volts tension, 2,944÷300=9·81 amp. or 10 amp. roundly. Thus one charge would suffice to run the cars for 24.5 hours.

As already mentioned, the train was run with a velocity of 12 km. (about 7 English miles) per hour, or 5 minutes per km. The whole of the journey of 2·9 km. is therefore 2·9×5=14·5 minutes. Return journey = 14·5 minutes. Two stoppages = 10 minutes. Total duration = 39 minutes from start to return with an 18 hours' service, 18×60÷39 = about 28 trips per car per day. Thus each car would run 28×2·9×2= 162.4 km. per day, and the 4 cars 4×162·4 = 649·60 or 650 km. per day.

For the working 4 cars were used, and consequently 4 accumulator batteries. Two additional should be in reserve in case of accidents.

For 4 car batteries at 300 volts = 150 cells at 245 A. H. Of the 245 amp. only 180 are used, as there is an 18 and not 24 hour service. The batteries are charged in 5 hours. They are placed in 4 parallel rows, i. e., 4 rows à 300 volts. The row with 36 amp. = 4 × 36 = 144 amp.

In the course of charging the tension of the accumulators increases from 2 to 2·5, or from 300 to 375 volts. Consequently an engine of 375 volts and 144 amperes is required, or 374×144=54,000 watts, or 54,000÷700 = 77·14 H. P. per 5 hours, or in round figures 778 H. P. = 390 H. P. hours.

A 78 H. P. engine requires 78 S. M. heating space (tubular boiler system). 1 H. P. requires 13 kg. steam per hour. Thus, use of steam per charge of 5 hours' duration : 78 × 13 × 5 = 5,070 kg. One kg. coal steams 8·5 lbs. water; thus, use of coal per day, 5,070 ÷ 8·5 = 596·4 kg. coal per 650 km. Use of coal per km. 596·4 ÷ 650 = 0·92 kg. coal. The four accumulator batteries cost 8 250 marks, or about £412.

Supposing an accumulator has to be renewed after having run, a, 118,552 km.; b, 177,828 km.; c, 237,104 km.

As every car runs per day 162·4 km.; this would work out as follows: a, 118,552 ÷ 162·4 = 730 days = 2 years; b, 177,828 ÷ 162 4 = 1095 days = 3 years; c, 237,104 ÷ 162 4 = 1460 days = 4 years. Renewal expenses would therefore be as follows: a, 8,250 ÷ 730 = 11·31 m. = 11s. 3d. about; b, 8,250 ÷ 1,095 = 7 53 m. = 7s. 5d. about; c, 8,250 ÷ 1,460 =5·66 m. = 5s. 6½d. about. Taking an average price of 21·5 marks per 1,000 kg. coal, a high price, we get 1,000 ÷ 21·5 = 46·51 kg. coal for one mark.

A daily deterioration of the accumulator under supposition a to the value of 11·31 m. would equal a quantity of coal = 11·31×46·51 = 526·03 kg. coal per car and 162·4 km. = or per car and km. = 526 03 ÷ 162·4 = 3·25 kg., i. e., deterioration of accumulator per km.: Add a 3 25 kg. coal; add b 2·17 kg. coal; add c 162 kg. coal. To these figures must be added the use of coal by the stationary steam engine of 0·92 kg. per km.; a 0·92 + 3·25 = 3·17 kg. coal per km. and car = 8,965 pfgs.; b 0·92 + 2·17 = 3·09 kg. coal per km. and car = 6·64 pfgs.; c 0·92 + 1·62 = 2·54 kg. coal per km. and car = 5·46 pfgs.

COMPARATIVE TABLE OF COST OF WORKING TRAM LINES.

The expense, inclusive of repairs, per car kilometer is as follows:

Kind of propelling.	Cost.	Authority.
I. Horse cars....	21 pfennigs per car km.	Hamburg tramcars' report for 1887, their cheapest year.
II. Steam cars...	14·6 pfennigs per car km.	Line Lichterfelde—Custom House.
III. Electric trolley system..	11.56 pfenn's per car km.	Line Halle at Saale, built by Berlin General Electric Co.
IV. Electric system by accumulators....	(a) 8·965 pfennigs (b) 6 64 " (c) 5·46 " per car km.	Line Lichterfelde Steglitz.

Judge Henry has dissolved the injunction against the Citizens' Electric Light Company brought at Terre Haute, Ind., by the Terre Haute Electric Light Company, which had obtained a temporary restraining order against the Citizens' Company erecting poles in the streets for lighting purposes. The latter company, of which Russell B. Harrison is president, has a contract to light the city of Terre Haute for five years.

THE CLEVELAND CONVENTION.

Tenth Annual Meeting of the N. E. L. A.

THE PROCEEDINGS IN DETAIL.

A Good Programme and a Large Attendance.

[STAFF REPORT OF ELECTRICITY.]

BANDED together to extend the knowledge of the science of commercial lighting, the members of the National Electric Light Association met in Annual Convention at Cleveland, O., at 11 A. M. on Tuesday, 19th inst., with President M. J. Francisco, of Rutland, Vt., in the chair. The place of meeting was the Army and Navy Hall, a location convenient to the headquarters of the association—Hollenden Hotel—and admirably adapted in every way to the purposes.

When the President rapped for order he faced probably the largest gathering that was ever witnessed at an opening session of the Association, the hall, capable of seating about 800, being nearly full. Among the number of non-members of the Association who graced the occasion were a large number of ladies, the wives, daughters and sweethearts of the members, and some of the ladies of Cleveland who were assiduous in their attentions to the visitors, and who throughout the Convention so successfully catered to the entertainment of their lady guests as to make this meeting a long-to-be-remembered one.

TUESDAY MORNING'S SESSION.

After a few preliminary remarks by President Francisco he introduced the Hon. Robert Blee, Mayor of Cleveland, who in a few brief and well-chosen words welcomed the members of the National Association to the city of Cleveland.

He was followed by Mr. James M. Hoyt, who was introduced as "the silver-tongued orator—the next Governor of Ohio." Mr. Hoyt is a master of elocutionary grace and held his auditors' attention to the very close of his all-too-brief remarks. His speech was also one of welcome. It was interspersed, however, with many witty allusions to electrical matters in general, and in one case it was at the expense of a contemporary. He said: "I was reading yesterday in one of your electrical journals something which caused a feeling of regret, and it seemed to me as if now I had become like the child who learns that Santa Claus is a myth and loses all faith in revealed religion. I was reading in one of your electrical journals yesterday that electricity could no longer be scientifically defined as a viscous fluid. The statement was that it is two fluids, one positive and the other negative—I want to quote from the article correctly—*attracting each other and repelling themselves*, whatever that may be; or at any rate all the results of my careful scientific research have been swept away with a single sentence."

This caused considerable merriment among all but those connected with the paper at whose expense the joke was made. His complimentary allusions to Mr. Brush were enthusiastically received by the audience, and paved the way for the next speaker, who spoke as follows:

Mr. Brush's Remarks.

Mr. President, Ladies and Gentlemen: A few days ago I was asked to make some remarks on this occasion concerning the early history of electric lighting from my own standpoint. Now, as most of you are aware, I retired from the electrical business several years ago to give my competitors a chance on the field. (Applause.) I therefore objected that this ancient history was forgotten and buried, and I pleaded that I could not spare time to take it up again and polish up the bones, and arrange them in sequence, and articulate them, and make the whole thing presentable. I really cannot afford to let you go, now that you are here, and I will say a few words.

I will begin by calling your attention to the fact that dynamo-electric machines for electroplating antedated by a considerable period the use of such machines for lighting purposes. This is interesting from a historical standpoint, because when I invented compound field winding for constant potential, now so generally used in lighting and power transmission, I applied it first to plating machines. That, I believe, is not generally known, and may therefore be interesting. Some of you will remember that all of the early Brush arc lighting machines were single lighters. Two of these machines were exhibited in the summer of 1877 at the Franklin Institute in Philadelphia. My two friends at the left (Messrs. Houston and Kennelly) will remember all about it. It was soon after that when we sold a single lighting machine to Dr. Longworth of Cincinnati. This was one of the very first, if not the first, sale of a Brush arc lighting machine. It was late in 1877 or the very beginning of 1878, and the Doctor paid for it—paid cash for it like a little man. I hear these things are done differently now. (Applause and laughter.) At any rate I went down to Cincinnati to show the Doctor how to run that machine, and one evening while I was there he exhibited the light from the balcony of the building in which he lived, on one of the principal streets. It was a 4,000 candle light and of course it attracted a large crowd of the natives, and every man in that crowd was ready and willing and anxious to tell his neighbors all about it. I mingled in the crowd for a time to hear the comments. I found one man who had collected quite an audience about him. He called attention to the solenoid at the top of the lamp. He said: "That is the can that holds the oil," and speaking of the side rod of the lamp, "that is the tube which conducts the oil from the can to the burner." He did not say anything about electricity at all—a little oversight that was not noticed by his hearers and it was all right.

These early single light machines were quickly followed by two and four light machines; that is to say, machines adapted to furnish two or four separate distinct currents, each adapted to run a single arc light. Several of these machines were sold during the season of 1878 for lighting stores and shops. Among others, Mr. Wanamaker, of Philadelphia, bought a number to light his store. One of the earliest of these four-light machines was exhibited at the works of the Union Steel Screw Company in this city to a number of invited guests. One gentleman on that occasion looked the whole apparatus over very carefully, perhaps a half hour, sized it up, and then pointing to the line wire he said to me: "How large is the hole in that wire that the electricity flows through?" (Laughter). Another gentleman, one connected with the screw company, observed the machine running for perhaps five minutes in complete silence. Then he had fully digested the whole thing and was ready to tell me all about it. He said: "The electricity in that thing is generated by that revolving business there rubbing the air up against those iron blades (meaning the magnets), just as you get sparks when you rub a cat's back." I raised the objection that while that was a good theory, it did not fully meet the facts, but he would not hear anything from me. He said: "The whole thing is plain. If you should run that machine in a vacuum where there is no air you could not get any electricity." His ignorance was so blissful that I thought it would be folly to enlighten him and did not try to do so.

The year of which I am speaking, 1878, was memorable in the history of electrical lighting. It was during that year that I had the great pleasure and good fortune to invent and develop and commercially introduce the modern series arc lamp with the shunt coil. It was this invention—I am sure you will all agree with me—which first made arc lighting from central stations commercially possible, and I think it may justly be considered as marking the birth of the electric lighting industry of the world to-day.

One of the first instances, I think quite the first instance, of the use of arc lighting for purely commercial purposes was in our little public square in this city. Twelve lights were carefully installed in the park on high ornamental poles. The lamps used were of the ordinary so-called 2,000 candle power. In this connection it will be remembered that a professor in New York once said he imagined the electrical companies arrived at the 2,000 candle power by measuring it north, south, east and west, giving 500 each way, and added them all together. That measurement was taken in the interest of the gas company, as I have learned. While we were installing this plant in the public square, a great deal of interest was manifested in the installation by the public, and on the occasion of starting the lights our little park was packed from side to side, and it was evident that many of the people expected a blinding glare of light, as evidenced by the fact that many of them had provided themselves with colored spectacles or smoked glass. Of course, there was a general feeling of disappointment at first in this respect, although every one was ready to admit he could read with perfect ease in any part of the square. After a few weeks, when the novelty had worn off, and the people had got tired of staring at the arcs and had time to see how nicely the little park was lighted, the general verdict was that those electric lights in the park were a pretty good thing after all, and that is the general verdict everywhere.

Of course we had lots of trouble in the early days with carbons. The history of the carbon business is peculiar. Our first carbons were crooked, of course, and were soft, and had high electrical resistance, and burnt out rapidly, and were very expensive. To decrease the electrical resistance, and prolong the life of the carbons, we electroplated them with copper, which is still done. This little scheme of covering the carbons with just enough and not too much copper was the only easy invention that it was my good fortune to make, and it paid fairly well, considering the effort involved, which was mighty small. It yielded, if I remember, something like $150,000 in cash on royalties before the bottom fell out of the carbon business. They were sold at the rate of $240 a thousand. I say at the rate of $240 a thousand, because nobody ever thought of ordering a thousand carbons at once. They could not use them up in a generation. Fifty or a hundred were considered a fair order. As the business increased a little we were able to reduce the price of the carbons, and we did reduce it one step to $150 a thousand. It was at a loss for a time, but then we held our own, and afterwards made a little money. We subsequently reduced them from $150 to $62.50, on the theory that cheaper carbons would stimulate the growth of the electric light industry, and our theory was proven correct. Their use was stimulated, and the business increased enormously, so that while we lost money on the carbons for a good while at that price, later we made a handsome profit at that price. Others seemed to grasp the situation about that time, and competition sprang up, and it knocked the profits of the carbon business all to pieces. I presume now you can get your carbons for next to nothing a thousand, with "a beautiful chromo in each box"; and I have no doubt if you insisted you could get a nice gold frame for each of the chromos. This is a pointer for you.

As to electrical lighting at the present day, most of you know more about it than I do, for I have been accumulating rust for several years, and will not attempt to tell you anything about it, but will simply thank you for your attention.

President Francisco's Address.

After the applause following Mr. Brush's address had subsided, President Francisco delivered his address which was short and to the point. He recalled how ten years ago the Association was formed in Chicago by a few gentlemen who believed in the future enlargement and

success of the electrical industry. This faith had been justified by time. The Association, which began with a very limited number of bold spirits, now embraced the whole country, and had in fact invaded the Queen's dominions on the north, and appropriated one of her subjects (Mr. Nicholls) as its second vice-president. The Association had also, he said, gained two other faithful allies, viz., the ladies and the press. It had attracted to its membership some of the most talented of England's scientists, and had brought within its keeping and solicitude an industry which included 2,500 central stations representing an invested capital of over $300,000,000, not including 7,500 isolated plants valued at $200,000,000 more. Besides these there were to-day 1,000 electric railways in operation with 10,000 miles of track, and assets amounting to $600,000,000—all or nearly all of this being the growth of the last ten years—the measure of life of the Association.

Having congratulated the Association that it was the representative of this vast industry which had revolutionized the civilized world, he endeavored to gaze into the future to discern what the next ten years might have in store. He then turned his attention to the immediate wants and conditions of the Association. Attention was first called to the growing idea favorable to municipal ownership. This, he thought, should be combatted by the Association by every means in its power.

An amendment to the constitution, changing the time of meeting to a more convenient and seasonable time of the year, was recommended, and then he turned his attention to the relations between central station companies and the manufacturers. Here he spoke in no uncertain terms, and it is safe to say his words met a most responsive chord in the hearts of his auditors. He said:

The Relations Between Central Station Companies and Manufacturers.

> The relations between central station companies and manufacturers have been discussed by this Association at every Convention. The time has arrived when the plan adopted by manufacturers for destroying the business of the local company by establishing competing plants in places where there is only business sufficient for one must be abandoned. This has been done with the intention of compelling the local company to either buy them off or see their own business ruined. The infamous scheme of forcing a sale of apparatus for a city plant by representing to city officials that the price charged by local companies is far in excess of the cost if the city owned its own plant, needs the searchlight of electricity thrown upon it by this Association. This is a question of vital importance to every central station in the United States, for sooner or later their own business will be attacked, and it may be through the influence of the very manufacturers whose apparatus they are using.

These ringing words aroused an enthusiasm among his auditors and were a most stinging rebuke to our milk-and-water contemporaries who have not had the manhood to raise their voices against the great octopus which, though dying and almost harmless now largely through ELECTRICITY's course, once threatened to strangle in its tentacles all which could not be bound to its service. The President didn't say so in so many words, but he implied what every central station man knows, and what every supply man knows, that ELECTRICITY was the only friend the electrical industry had during those dark hours of trial.

Lest our thick-headed contemporaries should not understand clearly what he meant, and that he meant us, the President said this business needed the "searchlight of electricity thrown upon it." We were modestly pleased with this official recognition of our humble efforts, and beg to assure the speaker and the other members of the Association that ELECTRICITY's searchlight *will* be turned on those dark methods and that thereby those dark spots shall be made light.

TUESDAY AFTERNOON SESSION.

The session was called to order at 2.30 P. M., and Mr. Nelson W. Perry, E. M., read his paper entitled "The Storage of Energy Essential to Economy of Working in Central Stations," in which he compared the results actually obtained in central station practice with those obtained by the same machinery working under a constant load, the discrepancy between the two showing the necessity of equalizing the load by means of storage of energy of some kind. He then discussed battery storage, the three methods of thermal storage, and gas storage and gas engines, comparing the results obtainable by these methods with each other. The comparison was unfavorable to battery storage, and this aroused the ire of those interested in the storage battery, who, in the person of Mr. Lloyd of the Chloride Accumulator Company, criticised the paper somewhat severely and heatedly. His main point of attack was that the price which Mr. Perry estimated the storage battery at was out of all proportion to the real price, and, unfortunately for him, implied that if Mr. Perry had gone to responsible parties for his data he could have gotten them correct.

Mr. Perry created quite a titter in the audience by replying that he had supposed he had gone to reliable parties for his data, since he had gone to the company that Mr. Lloyd represented. They had made him an estimate on an eight-hour discharge which was larger than he had given for a twelve-hour discharge. Mr. Lloyd questioned whether Mr. Perry had gone to his company, but this was settled by Mr. Perry's statement that he held in his hand the letter containing the estimate.

Mr. C. L. Edgar, of the Boston Edison Station, arose and said that he had come in near the end of the paper, and therefore could not discuss it intelligently, but he thought Mr. Perry's figures were too high, mentioning what batteries cost in his station. It turned out, however, that his own figures were considerably higher than Mr. Perry's, and that he was erroneously discussing an entirely different question from that at issue.

Prof. Wilbur M. Stine, of Chicago, read a somewhat elaborately prepared discussion, in which he took pretty near the same ground as Mr. Perry. Mr. Peter Wright also read from manuscript on the satisfactory performance of the battery plant at the Germantown station, which corroborated Mr. Perry's position. Mr. John A. Seely was the most active participant in the discussion next to Messrs. Perry and Lloyd, and cited several cases where the storage battery had proved a failure. Prof. Richards also spoke of a failure within his experience, but did not cite it as a criterion for the present day since a number of years had elapsed and great improvements had been made since then. He could not say from his own knowledge whether or not a storage plant would to-day be a failure under otherwise similar conditions.

The President interrupted the discussion at this point, announcing that on account of the fact that Prof. Houston had to leave on the evening train it was desirable that he be given an opportunity to read the paper on "A New Method of Measuring Illumination," by himself and Mr. A. E. Kennelly. He considered Mr. Perry's paper of such importance, however, that he would merely postpone its further discussion to a future time, when it would be taken up again.

Prof. Houston next read the paper on the above-named subject and exhibited an instrument, invented jointly by himself and Mr. A. E. Kennelly, by which the illumination at any point of a room could be determined with approximate accuracy by direct methods. This instrument he called an "illuminometer."

The paper was discussed by Prof. Elihu Thomson, Mr. C. D. Haskins and Mr. A. E. Kennelly.

After reading letters of regret for their inability to be present at the Convention from Prof. Silvanus P. Thompson, of England, and Messrs. Nikola Tesla, Marsden J. Perry, George Westinghouse, Jr., Chas. W. Price, Charles A. Coffin and Governor McKinley, President Francisco extended invitations from the telephone and street railway companies of Cleveland to the members to avail themselves of their service free of charge.

The National Electric Light Association is in the same position as Mr. Hill. It seems that letters had been written to President Cleveland, but he paid no attention to them. It remains to be seen whether or not the sequel will be the same. Should President Cleveland invite the Association to dine with him, as he did Mr. Hill, doubtless the Association will do exactly as Mr. Hill did.

WEDNESDAY MORNING.

The first order of business was the report of the Committee on Finance, read by Mr. John A. Seely, Chairman. This showed the Association to be in a highly satisfactory condition—that is, it was satisfactory to everyone but Mr. John I. Beggs, of Cincinnati, who, as representative of the Harrisburg Edison Company, joined the Association in 1892, and had been dropped from membership for non-payment of dues and had recently joined the Association again, but who had never taken a prominent part, and who made a lamentable spectacle of himself and the collar he wears by an attack on the management of the Association. His particular point of attack seemed to be the Secretary. He saw no use for a salaried Secretary. His salary was too high anyhow. He criticised the account for stenographic work, etc., etc., and wanted to have the Association conducted after the manner of the Association of Edison Illuminating Companies.

It is needless to say that his remarks received as chilly a reception as Pudd'nhead did on his way to Cleveland and during his stay there.

The discussion of Mr. Beggs's position was growing somewhat heated when President Francisco put a stop to it, saying that it could go no further at this time, but would receive due attention in executive session.

Mr. W. E. Harrington then read a carefully prepared paper on "Correct Method of Protecting Electric Circuits." He advocated the use of electromagnetic cut-outs, giving a number of curves showing the effect of the time and current elements both in fuse and magnetic cut-outs, which indicated all the advantages of the latter. He then adverted to special methods by which the magnetic cut-out had been still further improved by reducing the time element and consequently the current element.

The next paper read was one by Mr. C. N. Black on "Large Arc Dynamos." This was a most important and timely paper, and deservedly attracted very close attention.

Mr. Black, after referring to the lack of improvement in and the low efficiencies of arc dynamos up to within recent date, compared the relative merits of the closed and open coil machines. Electrically, he expressed the opinion that the closed coil machine was the best, but practically the open coil was the best. He explained how the self-induction in the open coil machine, which had been pointed to as an evil by the advocates of the closed coil, was really an advantage, and purposely made larger for this reason. The advocates of the close coil type had asked the question, "what would become of an open coil machine with large output if the circuit should become suddenly broken?" He answered this by giving figures showing the rise of potential at rupture on circuits supplied by both types of machine under like circumstances. These figures showed that the rise in potential was *less* in the open coil type than in the closed coil type, and gave a very plausible explanation of the reason therefor. He thought that the limit to the number of lamps that could be safely put on a single circuit was considerably beyond even that now in use—120 to 125. It was limited by the possibilities of insulation against the higher voltages. He cited instances where, even in former times when the art of insulation was in its infancy, no inconvenience was experienced with higher voltages than those now used.

The demand now was for larger units, and this was admirably illustrated by Mr. S. M. Hamill, who, after the paper had been read, was called upon to make some remarks. This matter is of such great interest to Central Station men that we must refer them to future issues for the complete reports. We need add nothing further here to indicate the importance of the paper than to give the names of the others who discussed it, viz., Prof. Elihu Thomson, Messrs. I. R. Prentiss, T. Carpenter Smith and John A. Seely. Several other gentlemen desired to discuss the subject, but the hour being late further discussion was cut off.

Mr. John A. Seely then offered resolutions that the Cotton States International Exposition to be held at Atlanta be endorsed by the Association, and that it urge the attendance and cooperation of its members. This was passed unanimously and the meeting adjourned to meet in executive session.

WEDNESDAY AFTERNOON.

The programme stated that the afternoon session would convene at 2:30 P. M. It had been announced verbally by the President that Dr. Bell's paper on the Monocyclic System, which had been postponed by the non-arrival of the drawings in time for the morning session, would be taken up first in the afternoon. The people were on hand pretty promptly, since this paper was looked forward to with perhaps as much interest as any paper announced before the Convention, but in view of the limited time and the crowded calendar, a very annoying and regrettable delay of over an hour ensued before the paper was read. When it became evident that this delay was to be somewhat extended, Vice-President Nicholls proposed that the question "How to Light Large Cities" be taken up out of its order, and this was put as a motion. Upon being put to a vote a division was called for which resulted in a majority vote in its favor. This was a subject which might profitably have occupied the whole time of the Convention during *all* of the three days, and it had been arranged to have Messrs. Nicholls, Ayer, Huntley, Clark, Redmond, Peck, Lindsay and Morrison lead the discussion.

It would have been worth all the trouble of getting up the Convention to have heard these men discuss this question, but because of it having been borne out of time it fell flat. These names having been read over by the President, no one responded. Judge Armstrong rose to the occasion, however, and said that since there was no one to respond to the invitation to speak on "How to Light LARGE Cities," it would be in order to hear from some one who could tell how to light SMALL cities, and called upon Mr. Wilmerding (of Chicago) to tell them something of "How to Light SMALL Cities." [This town, by the way, is the one in which the story of Pygmalion and Galatea is always popular, because the hero's name suggests an industry that has made the city what it is.—Ed.]

Mr. Wilmerding responded gracefully. He couldn't tell how to do it from experience, because that same great genius which had devised the electric belt method of teaching electrical engineering, viz., the National School of Electricity, had also undertaken the job of lighting the village, and was charging more for the municipal lighting than his company was doing by private enterprise. Mr. Wilmerding did not actually refer to the National School, but he referred to the municipal enterprise, which in fact bears the same relation to legitimate private enterprise as the electric belt and the electropoise bear to legitimate electro-therapeutics.

After the conclusion of Mr. Wilmerding's remarks, Mr. Redman, who had come in in the meantime, gave a brief description of the service in Rochester.

By this time the preparations for Dr. Bell's paper had been completed and the author proceeded to read.

The Monocyclic System.

It will be remembered that *the* feature of the Washington Convention was Mr. Scott's paper on "Polyphase Transmission," in which was developed a practically new system of great prospective utility. This received such universal commendation at the time as to constitute the occasion a most distinct triumph for the Westinghouse Company, which by its brilliancy quite overshadowed for the time everything that had been done by the General Electric Company. Dr. Bell's paper was expected by friends of the G. E. Company to do for his company on this occasion what Mr. Scott's paper had done for the Westinghouse Company on the former occasion, and public interest was on the *qui vive* for the discussion which should follow. The keen rivalry which has so long existed between these two concerns was expected to reach a climax at that time, and the Hectors of both armies were present to do battle for their respective colors.

Mr. Kelly of the Stanley Company was the first participant in the discussion. He thought that the monocyclic system had come too late. Had it preceded the polyphase system it might have constituted a decided advance on existing practice, but coming as it did, after the latter had been introduced, it constituted in reality a step backward which the electrical interests would not be likely to take. It accomplished nothing that had not already been accomplished in a somewhat better and more complete manner.

Mr. Steinmetz of the G. E. Company, and the inventor of the monocyclic system, followed and endeavored to point out that the monocyclic system was a system *sui generis* and not in any sense a polyphase system or a modification thereof. In substantiation of his position he defined the meaning of "polyphase," and pointed out how that, according to this definition, his system could not possibly be brought within its meaning.

Prof. Elihu Thomson, of the G. E. Company, indorsed in a few words all that both Dr. Bell and Mr. Steinmetz had said and claimed.

Mr. Scott, of the Westinghouse Company, followed. Referring to Mr. Steinmetz's definition of polyphase phenomena, he said that one had a right to define them anyway he chose. If he was careful to define them in such a manner as to exclude the particular features of the monocyclic, as Mr. Steinmetz had done, then of course according to this definition the monocyclic phenomena were *not* polyphase phenomena. If, on the other hand, the definition included the phenomena and methods of action by which the results were actually obtained, then the monocyclic *were* polyphased phenomena and nothing else.

Referring to the diagrams and data of copper economy of the various methods of periodic current distribution presented by Dr. Bell, he showed that they were in some cases erroneous, and finally he criticised in detail the general economies of the system, which he characterized as but a modification of existing systems, possessing doubtful merits where it resembled them and marked demerits in the features wherein it differed.

Dr. Bell then replied somewhat briefly. The hour for adjournment having now arrived, further discussion was postponed.

As in the case of Mr. Perry's paper, there were many others than those who took part who desired to, and the disappointment was universal that the matter had to be dropped at this point. The hope that the discussion might be continued at one of the succeeding sessions was disappointed on account of the crowded condition of the programme and the backward condition of the calendar.

WEDNESDAY EVENING.

The only evening session of the Convention was that held on Wednesday to witness a practical demonstration of the protection of lines from lightning by means of lightning arrestors. On this occasion Mr. A. J. Wurtz repeated his lecture and demonstration, already fully described in these columns, to a most attentive audience. This lecture, which has been given at New York, Boston, Philadelphia, and in several cities of the West, is one of the most instructive as to the nature of lightning discharge and the means necessary for protection against surgings of this kind that has ever been brought before a popular audience, and has had an educational value of a high order.

THURSDAY MORNING.

After a few remarks from Mr. W. R. Gardener, of Pittsfield, on Dr. Bell's paper, President Francisco called for the report of the Committee on Data, which was read by the chairman, H. M. Swetland, of New York, and supplemented by Mr. Gardener with a description of the methods adopted by him in obtaining the data furnished from his station and the conclusions which he had reached from these data. These formed a valuable addition to the report and will deserve further notice at a later date.

Others who discussed this report were Messrs. Powers, Armstrong, Swetland, Jennings, Hadley, Burleigh, Barker and Ayer, the tenor of whose remarks was to place a high estimate upon the value of the report and to demand a continuance of the same.

Some of the gentlemen desired that the committee assist the central station men in collecting the data desired by indicating more clearly just what was desired.

In line with this Mr. Ayer offered the following resolution: "That the Committee on Data be directed to send out as soon as possible after the adjournment of this meeting blanks upon which records of central stations may be kept with full instructions how to make the returns." Carried.

The meeting then adjourned to executive session. At this session the report of the Committee on Relations Between Manufacturing and Central Station Companies was fully considered, and the following special committee appointed in connection therewith: Messrs. A. J. DeCamp, John I. Beggs, E. A. Armstrong, T. Carpenter Smith and F. Gilbert.

Messrs. Seely, Armstrong and Colburn were appointed a committee to nominate officers for the ensuing year.

Messrs. Ayer, Nicholls and Burleigh were appointed a Committee on Resolutions.

The constitution was also amended, providing for the holding of one meeting in each year in the month of May or June.

A motion was passed recommending that the next meeting be held in New York City.

THURSDAY AFTERNOON.

The next paper was one by Mr. L. B. Marks on "Arc Carbons and the Rating of Arc Lamps." In this and the discussion following, the rating of arc lamps by a watt standard was advocated, the variation of voltage of the various makes of carbons between hissing and flaming points was discussed, and the effects of variation in composition and structure upon economy of various carbons pointed out.

Prof. Thomas, of Columbus, gave some interesting results of tests made upon carbons obtained from a large number of central stations in Ohio at the Ohio State University. These tests were made for the purpose of getting at the facts as to the light actually given by the carbons. The point of the investigation was to determine how much variation there was in the candle power afforded by arcs which were maintained at an expenditure of a constant amount in watts. The figures given show a somewhat wide variation with practically constant consumption of watts, and led Prof. Thomas to conclude that a watt rating for arc lamps was simply taking a step in one direction which did not tend in any degree to remove the trouble—that it merely shifted the trouble from one basis to another.

He believed with Messrs. Houston and Kennelly that the proper basis for a contract between a municipality and a corporation was that of illumination solely.

He did not indorse Messrs. Houston and Kennelly's instrument for determining this illumination, however, as the principle upon which it was based had proved fallacious and unsatisfactory.

Mr. Ayer rather favored the watt rating, not as an ultimate resort, however, but as a step from something entirely indefinite to something that was definite.

Judge Armstrong took the same view as Mr. Ayer.

The report of the Committee on Rules for Safe Wiring was then presented by Mr. Ayer, and consisted of a recommendation that the present rules be approved and continued.

Following this the subject of the Welsbach light was discussed by Messrs. Gardener, of Pittsfield; Edgar, of Boston; Cairnes, of Memphis; Seely, of New York; Peck, of Brooklyn; Armstrong, of Camden; Stetson, of New Bedford; Mr. Francisco, of Rutland, and Mr. Corriveau, of Montreal. All of these gentlemen confirmed the position taken by ELECTRICITY on this subject, that the competition while ephemeral must be met, and that when met by good service would be short lived.

The following resolution, offered by Mr. James I. Ayer and seconded by Frederic Nicholls, was then passed:

"That the thanks of the Association are hereby tendered to Mrs. Sidney Short and the ladies of the Local Committee, to Mr. Wason and the gentlemen of the Reception Committee, the Cleveland Telephone Company, the Long Distance Telephone Company, the Cleveland City Railway Company, the Cleveland Electric Railway Company, and the gentlemen of the local press.

"The many courtesies extended to the visiting members have been fully appreciated, and the result has been that this Cleveland meeting will be remembered as one of the most pleasant, from a social standpoint, and also one of the most interesting and instructive, in the history of the Association."

The Committee on Nominations presented the names of the following gentlemen:

President—C. H. Wilmerding, Chicago, Ill.; First Vice-President—Frederic Nicholls, Toronto, Canada; Second Vice-President—E. F. Peck, Brooklyn, N. Y.

Members of Executive Committee—E. H. Davis, Williamsport, Pa. (one year); W. R. Gardener, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J.

The gentlemen were duly balloted for and elected.

Mr. Armstrong—"I move, with the unanimous consent of the members, that the next annual meeting of this Association be held in the month of May or June, as selected by the Executive Committee, in the year 1896." Carried.

On motion adjourned.

THE SOCIAL SIDE.

The entertainment of the guests by the citizens of Cleveland was all that could be desired. Carriages were provided at stated times for those who wished to visit any of the points of interest.

On Wednesday evening an enjoyable reception was tendered at the rooms of the Art Club, which was well attended.

The social event of the meeting, however, was the reception given to the ladies by Mrs. Sidney Short and her friends. Reserved for the fair sex, it cannot be described by us—in print.

THE SPECIAL TRAINS.

Both New York and Chicago sent goodly delegations by special train. The New York party was in charge of Mr. C. O. Baker, which means that everyone enjoyed himself in the customary manner. This train left New York at 9.30 A. M. and arrived in Cleveland about 12 at night, picking up the delegations of the interior cities en route. The roster was as follows:

Ayer, Jas. I., Marks-Ayer Electric Co., New York.
Alberger, L. R., Henry R. Worthington, New York.
Adams, H. C., Phillips Insulated Wire Co., New York.
Almstead, J. A., Citizens' Light and Power Co., Rochester, N. Y.
Baker, Jr., C. O., Baker & Co., Newark, N. J.
Bergtheil, Edward, electrical engineer, London.
Bakewell, Allen C., Interior Conduit and Insulation Co., New York.
Brady, F. H., Specialties, New Britain, Ct.
Burke, J., Herrick & Burke, New York.
Baird, M. E., Eddy Electric Manufacturing Co., New York.
Badger, F. H., Montmorency Electric Power Co., Quebec.
Belden, A. J., Belden & Seely, Syracuse, N. Y.
Burns, Charles T., Rochester, N. Y.
Crouse, J. B., Crouse-Tremaine Carbon Co., Fostoria, O.
Coles, Stephen L., "Electrical Review," New York.
Chesley, C. C., Stanley Electric Mfg. Co., Pittsfield, Mass.
Carpenter, C. E., Carpenter Enamel Rheostat Co., Hoboken, N. J.
Coughlan, W. F., Worcester Electric Light Co., Worcester, Mass.
Cram, H. B., Bernstein Electric Co., Boston, Mass.
Colvin, F. R., Interior Telephone Co., New York.
Corriveau, A. J., Montreal.
Douglas, S. A., Ft. Wayne Electric Corporation, New York.
Duffie, Jr., New York.
DeRonde, F. S., Standard Paint Co., New York.
Davis, H. M., "Electric Power," New York.
Fairbanks, H. H., Worcester Electric Light Co., Worcester, Mass.
Francisco, M. J., Rutland Electric Light Co., Rutland, Vt.
Francisco, Don C., Rutland Electric Light Co., Rutland, Vt.
Francisco, Jr., M. J., Rutland Electric Light Co., Rutland, Vt.
Flanagan, Thomas J., Rutland Electric Light Co., Rutland, Vt.
Gardner, F. F., Newark Electric Light and Power Co., Newark, N. Y.
Gilbert F. A., Boston Electric Light Co., Boston, Mass.
Gates, J. J., Perkins Electric Switch Mfg. Co., Hartford, Ct.
Greene, B. E., "Electricity," New York.
Gallaher, C., National Conduit Mfg. Co., New York.
Hambey, J. D., Beacon Vacuum Pump and Electrical Co., Boston, Mass.
Heinrich, R. O., Weston Electrical Instrument Co., Newark, N. J.
Hart, Gerald W., Hart & Hegeman Mfg. Co., Hartford, Ct.
Harrington, F. W., India Rubber and Gutta-Percha Ins. Co., New York.
Huntley, C. R., Buffalo General Electric Co., Buffalo, N. Y.
Hatch, E. D., H. W. Johns Mfg. Co., New York.
Herrick, A. B., Herrick & Burke, New York.
Herrick, Charles H., W. S. Hill Electric Co., Boston, Mass.
Higgins, E. N., Citizens' Illuminating Co., Rochester, N. Y.
Holmes, W. E., Newton and Watertown Gas Light Co., Newton, Mass.
Holtzer, Charles W., Holtzer-Cabot Electric Co., Boston, Mass.
Hine, Henry, Stanley Electrical Mfg. Co., Pittsfield, Mass.
Hotchkiss, , Electrical Engineer and Supply Co., Syracuse, N. Y.
Hinds, Syracuse N Y
Jones, A. J., Edison Illuminating Co., New Brunswick, N. J.
Johnston, W. J. "Electrical World," New York.
Kimball, General Electric Co., Boston, Mass.
Kelly, J. F., Stanley Electric Mfg. Co., Pittsfield, Mass.
Kittle, E. B., Pettingell-Andrews Co., New York.
Lindsley, S., Essex County Electric Co., Orange, N. J.
Little, E. W., Interior Conduit and Insulation Co., New York.
Leonard, H. Ward, electrical engineer, New York.
Learned, C. A., Hudson County Electric Co., Jersey City, N. J.
McIntire, C. H., The C. McIntire Co., Newark, N. J.
Martin, A. J., Complete Electrical Construction Co., New York.
Martin, T. C., electrical engineer, New York.
Mackie, C. P., Electric Selector and Signal Co., New York
Mackay, W. H., Imperial Electric Lamp Co., New York
McConnell, W. J., American Electric Mfg. Co., St. Louis, Mo.
Marks, L. B., Marks-Ayer Electrical Co., New York.
Marshall, Norman, Andover Electric Light Co., Andover, Mass.
Millett, C. W., Dolgeville Electric Light and Power Co., Dolgeville, N. Y.
McLaren, P. M., Abendroth & Root Mfg. Co., New York
McQuaide, J. P., National Conduit Mfg. Co., New York
Nunn, Paul N., San Miguel G. M. Co., Telluride, Col.
Newton, C. E., Jewell Belting Co., Hartford, Ct.
Osborne, W. F., "Western Electrician," New York.
Perry, Nelson W., "Electricity," New York.
Phipps, E. H., Connecticut Pipe Mfg. Co., New Haven, Ct
Peck, E. H., Citizens' Electric Illuminating Co., Brooklyn, N. Y.
Redman, G. A., Rochester Gas and Electric Co., Rochester, N. Y.
Pentz, James A., Philadelphia, Pa.
Phelps, Geo. M., electrical engineer, New York.
Purington, A. J., Stamford Gas and Electrical Co., Stamford, Ct.
Renehan, J. J., Specialties, New Britain, Ct.
Sachs, Joseph, electrical engineer, New York.
Seely, John A., Complete Electrical Construction Co., New York.
Stieringer, Luther, New York.
Shain, Charles D., Manufacturers' Agent, New York
Shaw, A. C., electrical engineer, Boston, Mass.
Smith, Geo. L.
Smith, J. Brodie, Manchester Electric Light Co., Manchester, N. H.
Smith, Harrison J., Edison Electric Illuminating Co., New York.
Swetland, H. M., "Power," New York.
Towles, C. L., Jewell Belting Co., Hartford, Ct.
Thomson, Elihu, Lynn, Mass.
Wood, E. E., "Electrical Industries," New York.
Wheeler, S. Bowman, Morris, Tasker & Co., Philadelphia, Pa.
Wintner, St. Louis, Brooklyn Electric Mfg. Co., Brooklyn, N. Y.
Wiley, Geo. L., Standard Underground Cable Co., New York.
Walter, H. H., American Carbon Co., Noblesville, Ind.
Welch, J. W., New York Central Railroad, New York.

LADIES.

Mrs. M. J. Francisco, Mrs. C. O. Baker, Jr., Mrs. G. A. Redman, Mrs. C. H. McIntire, Mrs. H. J. Smith, Mrs. F. S. DeRonde, Mrs. C. W. Millett, Mrs. W. J. Johnston.

The Chicago Special.

The list of the Chicago pilgrims is as follows, others who were not on these trains being listed elsewhere:

CHICAGO.

B. E. Sunny, General Electric Company.
C. H. Wilmerding, Chicago Edison Company.
M. A. Sullivan, Charles A. Schieren & Company.
W. H. McKinlock, Metropolitan Electric Company.
C. E. Gregory, Charles E. Gregory Company.
J. B. Wallace, Wallace Electric Company.
William S. Hine, Wallace Electric Company.
S. F. B. Morse, S. F. B. Morse & Company.
George S. Searing, Hart & Hegeman Mfg. Company.
F. S. Terry, Sunbeam Lamp Mfg. Company.
Charles G. Burton, Central Electric Company.
J. C. Shainwald, Standard Paint Company.
R. J. Randolph, Excelsior Electric Company.
M. B. Austin, Safety Wire and Cable Company.
E. H. Fox, Phœnix Glass Company.
Carl K. McFadden, Nutting Electric Company.
George Cutter.
H. H. Cutler, Cutler-Hammer Mfg. Company.
H. H. Conover, J.A. Roebling's Sons' Company.
Prof. W. M. Stine, Armour Institute.
W. F. Collins, "Western Electrician."
F. L. Perry, "Western Electrician."
W. E. Kelly, "Western Electrician."
M. J. Sullivan, "Electrical World."
Mrs. M. J. Sullivan.
H. M. Angle, Chicago Cross-Arm Company
Carl Kammeyer, "Electrical Engineer."
E. L. Powers, "Electrical Industries."
E. Nashold, Nashold Cleat Company.
Charles F. Foster.
Thomas G. Grier, Bryant Electric Company.
M. M. Wood.
F. E. Donohoe, American Electrical Works.
Charles S. Marshall, Chicago Cross-Arm Company.
J. W. Wolff, New York Insulated Wire Company.
W. A. Remington, "Electrical Industries."
W. A. Hurd, Crane Elevator Company.
J. H. McGill, Peru Carbon Co.
Hugo Benedix.
W. B. McDonald, Calumet Gas Company.
H. F. Tate, National Conduit Mfg. Company.
Charles E. Wilson, Ft. Wayne Electric Corporation.

DETROIT.

At Toledo the Chicago delegation was joined by several Detroit gentlemen whose names follow:

W. H. Fitzgerald, Detroit Electric Light and Power Company.
George E. Fisher, Commercial Electric Company.
J.F. Cummings, Cummings & Engleman Conduit Company.
W. H. Yawkey, Cummings & Engelman Conduit Company.
J. E. Lockwood, Michigan Electric Company.
J. E. Livesey, General Electric Company.
A. Chase.

DES MOINES, IA.

J. A. Colby, Des Moines Illuminating Company.
Mrs. J. A. Colby.

PEORIA, ILL.

A. M. Searles, Diamond Electric Company.

ROCKFORD, ILL.

M. A. Beal, Forest City Electric Light and Power Company.

BOSTON.

C. L. Edgar, Edison Illuminating Company.

MILWAUKEE.

S. G. Coleman, Badger Illuminating Company.

NEW YORK.

C. B. Fairchild, "Street Railway Journal."

CEDAR RAPIDS, IA.

W. A. Green.

HOOPESTOWN, ILL.

W. M. Chase.

Storage of Energy Essential to Economy of Working in Central Stations.[*]

BY N. W. PERRY, E. M.

Mr. President and Gentlemen of the National Electric Light Association: The Committee on Data reporting at the Washington meeting stated that 1.5 pounds of coal per indicated horse-power with a combined engine and dynamo efficiency of eighty-one per cent would produce 402.84 watt hours per pound of coal. In the tabulated statement of data collected by this same committee the highest results of practice given were 208 watt hours per pound of coal. The next highest was 192, the lowest 25, and the average 91.7 watt hours, or only 22.7 per cent of that which the best practice under favorable conditions should give.

By far the larger number of stations reporting are small ones, in which the highest economies would not be expected, and we find as a matter of fact that most of these report results below the average. Discarding all results based on a consumption of less than 10,000 pounds of coal, we have an average for the largest stations of 127.7 watt hours per pound of coal. This is equivalent to a consumption of about five pounds of coal per indicated horse-power. The best results given (208) are equivalent to about three pounds per indicated horse power, or more than twice as much as the machinery involved requires for the best results. Bad as this showing is, it seems to compare favorably with foreign practice, for Professor Unwin[†] says: "Probably up to the present (1893), the consumption has in no case been less than 3.3 pounds per indicated horse-power."

When we consider how enormously short the results of actual practice in lighting stations are of those which are obtainable under the most favorable conditions with the same machinery, it behooves us to inquire into the cause of this deficiency and to see how far we can remedy it.

Professor Kennedy has made some very careful tests to indicate the effect of variable load upon coal consumption. Dividing the day into three portions, he determined the fuel consumption, the feed water evaporated and the indicated and electric horse-power developed during each period in an English lighting station. It will be seen that during the periods of light load the fuel consumption per horse-power is very large:

Coal Consumption in Boilers with Variable Load.

	11 A. M. to 6 P. M. 7 hours.	6 P. M. to Midnight 6 hours.	Midnight to 11 A. M. 11 hours.	Mean for 24 hours.
Total indicated horse-power hours	562	1,366	407	......
Total electric horse-power hours.	400	979	260	......
Coal per indicated horse-power hours pounds	6.88	3.26	6.26	4.65
Coal per electric horse-power hours pounds	9.67	4.55	9.80	6.62
Pounds water evaporated per pound coal.	5.92	9.60	9.27	8.21
Pounds water per indicated horse-power hour	40.7	31.3	57.7	38.3
Pounds water per electric horse-power hour	57.2	43.8	91.0	51.4

Comparing the consumption of steam and coal during mean load with that during the hours of heavy load (6 P. M. to midnight) we find that the mean steam consumption per electric horse-power hour was twenty-four per cent greater and the mean coal consumption per electric horse-power hour was forty-six per cent greater—the difference of twenty-two per cent being attributable to waste at boilers, due to irregular working. During the whole twenty-four hours the mean evaporation in pounds of water per pound of coal was only eighty-five per cent of the evaporation during the period of maximum load.

To show more clearly at what relative cost we produce power in our lighting stations with their variable loads and under other commercial conditions where the load is fairly constant, I quote Professor Unwin:

I. *Engines working on a very regular load, in conditions similar to those of an engine pumping to a reservoir.* Here for one effective horse-power exerted during 7,884 hours annually, engines of 1.47 indicated horse-power must be provided. Such engines may be taken to use fourteen pounds of steam per indicated horse-power hour in test trials, but in ordinary work seven and one-half per cent more must be allowed for leakage, working auxiliary engines and less careful attention; this makes the consumption fifteen pounds per indicated horse-power, or $15 \times 1{,}176\ (\frac{1}{.85})$ = eighteen pounds per effective horse-power hour. At nine pounds of steam per pound of coal, allowing also five per cent for lighting and banking fires, the engine would use 2.1 pounds of coal per effective horse-power hour.

Cost of Installation per Effective Horse-Power.

Cost of engines or with reserve 1.47 indicated horse-power= 1.47×$44.5	$65.42	
Cost of boilers=1.47×$24	35.28	
Cost of buildings=1.47×$30	44.10	
Total	$144 80	

Annual Cost of Working per Effective Horse-Power.

Interest on $144.80 at 4 per cent..	$5.79	
Maintenance and depreciation—		
Buildings at 2 per cent	.88	
Machinery at 7½ per cent	7.61	
Total fixed annual cost		14.28
Coal 2.1 pounds for 8,760 hours at $1.75 per ton	$16.10	
Petty stores	1.64	
Driving, stoking and cleaning	11.67	
		29.41
Total annual cost		$43.69

Steady Working Cost of One Electrical Horse-Power.

Cost of engines, 1.547 at $44.5	$68.84	
Cost of boilers, 1.547 at $24	37.13	
Cost of dynamo, 1 at $30	30.00	
Cost of buildings, 1.547 at $30	46.41	
	$182.38	
Interest on $182.38 at 4 per cent.	7.30	
Maintenance and depreciation—		
Buildings at 2 per cent	.93	
Machinery at 7½ per cent	10.20	
Total fixed annual cost		18.43
Cost of coal, 2.21 pounds, 8,760 hours, at $1.75 per ton	$16.94	
Cost of petty stores	1.64	
Cost of driving, stoking and cleaning	11.67	
		30.25
Total annual cost per electrical horse power		$48.68

II. *Engines working with variable load under conditions similar to those of an electric lighting station.* Here for one effective horse-power supplied on the average throughout the year engines of 5.87 indicated horse-power have to be provided. On account of the inefficiency and waste, due to variation of the load, it is best to estimate the steam and coal from experience in similar cases. Probably no electric lighting station at present works with quite so low a consumption as six pounds of coal per hour per electrical unit supplied. A consumption of nine pounds is probably much more common in the best managed stations. Six pounds of coal per electrical unit corresponds to 3.8 pounds per effective horse-power hour.

Cost of Installation.

Cost of engines for one average effective horse power with reserve, 5.87 indicated horse-power=5.87× $44.5	$261.22	
Cost of boilers=5.87× $24	140.88	
Cost of buildings=5.87× $30	176.10	
Total	$578.20	

Annual Cost of Working per Effective Horse-Power.

Interest on $578.20 at 4 per cent.	$23.13	
Maintenance and depreciation—		
Machinery at 7½ per cent	30.25	
Buildings at 2 per cent	3.50	
Total fixed annual cost		56 88
Cost of coal, 3.8 pounds for 8,760 hours at $1.75 per ton	$26.00	
Cost of petty stores	1.64	
Cost of driving, stoking and cleaning	11.67	
		39.91
Total annual cost		$96.19

In other words our power costs us 2.188 times as much in an electric light station as it should. If we figure out the relative costs per electrical horse-power the disparity will be still greater.

Using these same data, but carrying the results out to electrical horse-power, assuming a dynamo efficiency of ninety-five per cent., we have four pounds of coal per electrical horse-power.

Cost of Installation per Electrical Horse-Power.

Cost of engines, 6.17× $44.05	$274.56	
Cost of boilers, 6.17 × $24	148.08	
Cost of buildings, 6.17 × $30	185.10	
Cost of dynamos, 4, at $30	120.00	
Total	$727.74	
Interest on $727.74 at 4 per cent..	29.11	
Maintenance and depreciation—		
Machinery, $542.64, at 7½ per cent	40.70	
Buildings, $185.10, at 2 %	8.70	
Total fixed cost		78.51
Cost of coal, 4 pounds for 8,760 hours, at $1.75 per ton	$30.63	
Cost of petty stores	1.64	
Cost of driving, stoking and cleaning	12.00	
		44.27
Total annual cost electrical horse-power		$117.78

When we compare this with the cost resulting from steady working, viz., $48.68, we see what an effective method of storage means in our central stations. If our storage costs us nothing, it would result in a saving for each electrical horse-power generated per year of $117.78—$48.68= $69.10. But any system of storage which we may employ will involve expenditures, both in the way of losses in storage, which will have to be provided against by an increased plant to provide for the same ultimate output, and in the way of interest on the additional investment required by the storage plant. As a matter of fact, these additional costs must in all cases be less than the saving otherwise effected, else we are paying more for our economy than it amounts to. In the present case, our storage must cost us less than $69.10.

If we could take the variable load off between the boiler and engine, viz., devise some means by which the same amount of energy could be supplied by the continuous operation of a boiler plant working at its most economical rate, we would at once do away with one of the most serious losses due to irregular working. Let us see how much the saving would be if the irregular working of the boilers could be obviated without cost:

Cost of engines, 6.17 at $14.5	$247.56	
Cost of boilers, 1.547 at $24	37.13	
Cost of buildings, 4, at $30	120.00	
Cost of dynamos, 4, at $30	120.00	
Total	$551.69	
Interest on $551.69 at 4 per cent.	22.07	
Maintenance and depreciation—		
Machinery, $431.69, at 7½ per cent	32.38	
Buildings, $120, at 2 per cent..	2.40	
Total fixed annual cost		56.85
Cost of coal, 2.21 pounds for 8,760 hours, at $1.75 per ton	$16.93	
Cost of petty stores	1.64	
Cost of driving, stoking and cleaning	11.67	
		30.24
Total annual cost per electrical horse-power		$87.09

If we move our storage forward one step and introduce it between our engine and dynamo, so that everything previous to the dynamo would work continuously at its maximum economy, the account would stand thus:

Storage Between Engine and Dynamo. Cost of One Electrical Horse-Power.

Cost of engines, 1.547 at $44.5	$68.84	
Cost of boilers, 1.547 at $24	37.13	
Cost of dynamos, 4, at $30	120.00	
Cost of buildings, 4, at $30	120.00	
Total	$346.97	
Interest on $346.97 at 4 per cent..	$13.86	
Maintenance and depreciation—		
Machinery, $226.27, at 7½ per cent	17.02	
Buildings, $120, at 2 per cent...	2.40	
Total fixed annual cost		$33.28

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[*] Read before the National Electric Light Association at its Eighteenth Convention, held at Cleveland, O., February 19, 20 and 21, 1895.

[†] On the Development and Transmission of Power, page 28.

Cost of coal, 2.21 pounds, 8,760 hours, at $1.75 per ton..........	$16.94	
Cost of petty stores....................	1.64	
Cost of driving, stoking and cleaning	11.67	
		30.25
Total annual cost per electrical horse-power.......		$63.53

Recapitulating, we have possible gains by introducing the storage by successive steps forward:

		Cost of Horse-Power at this stage.
Between boiler and engine......	$30.69	$48.68
Between engine and dynamo...	28.56	87.09
Between dynamo and distribution..................................	14.85	117.78
Total..............................	$69.10	

Battery Storage.

Supposing, in the case assumed, we endeavor to equalize the load by means of the storage battery. This will allow the boilers, engines and dynamos to work continuously at their most economical rate and would seem to provide ideal conditions of working. We are not, however, storing the product we have to sell as is the gas manufacturer—we are not storing electrical energy, as some suppose, but chemical energy, which must be transformed again into electrical energy before we can distribute it. These two transformations, of course, involve a loss of energy which must be provided for in boilers, engines and dynamos, and also in coal. To be entirely fair with the storage battery, let us assume that its efficiency under all conditions is seventy-five per cent. Then in order that we may have at average working one electrical horse-power, we must provide:

Boilers,	$\frac{1.547}{.75}$ = 2.07 at $24.........	$49.68
Engines,	$\frac{1.547}{.75}$ = 2.07 at $44.5..	92.12
Dynamos,	$\frac{1}{.75}$ = 1.333 at $30.........	40.00
Buildings, say.........	....	125.00
Total investment, without storage battery..........		$306.80

If we are to produce an average of one electrical horse-power per hour, we will produce twenty four horse-power hours during the twenty-four hours, half of which must be stored, viz., we must have storage battery capacity for twelve horse-power hours. Of course, the rate of discharge will have some bearing upon the cost of this storage battery capacity, but taking an abstract case, we may assume, I think, without being unfair, that it will cost $35 per electrical horse-power hour capacity erected. We must, therefore, add to our former figures 12× $35=$420, which is more for the batteries than we have allowed for all the rest of the plant put together, including the buildings.

The total fixed investment therefore becomes............$726.80		
Interest on $726.80 at 4 per cent.	29.07	
Maintenance and depreciation—		
Buildings, $125 at 2 per cent...	2.50	
Machinery, $181.80 at 7½ %.......	13.64	
Storage battery, $420 at 10 %...	42.00	
Total fixed annual cost......		87.21
Coal 2.95 pounds for 8,760 hours, at $1.75 per ton.....................	$22.61	
Petty stores, attendance, etc.......	13.31	
		35.92
Total annual cost per electrical horse-power.......		$123.13

which would be an actual loss over that of irregular working of $123.13—117.78=$5.35. It will cost with the storage battery thus used, $123.13—$48.68=$74.45 more than the same machinery working continuously on a steady load could produce it for.

If we assume coal to cost $3.50 instead of $1.75, the cost per electrical horse-power will be:

Steady load without storage battery..........	$52.31
Variable load without storage battery......................................	148.40
With storage battery..................	145.74

We thus see that the storage battery on account of its high price costs more than it saves where fuel is cheap, but shows an economy as the price of fuel advances until with coal at $3.50 the economy becomes $2.66. This does not condemn its use in central stations in other ways, however, for there are many cases in which its use may contribute to economy, but these cases cannot be determined by any general rational formula. Each case must be determined for itself, and the result will depend primarily upon the shape of the load line, and secondly, upon the ability of the battery to rise above normal discharge rate economically. In the case of a station previously equipped, without storage, so that the units are already determined, the question of economy of introducing storage batteries will be determined in some cases entirely by the sizes of those units.

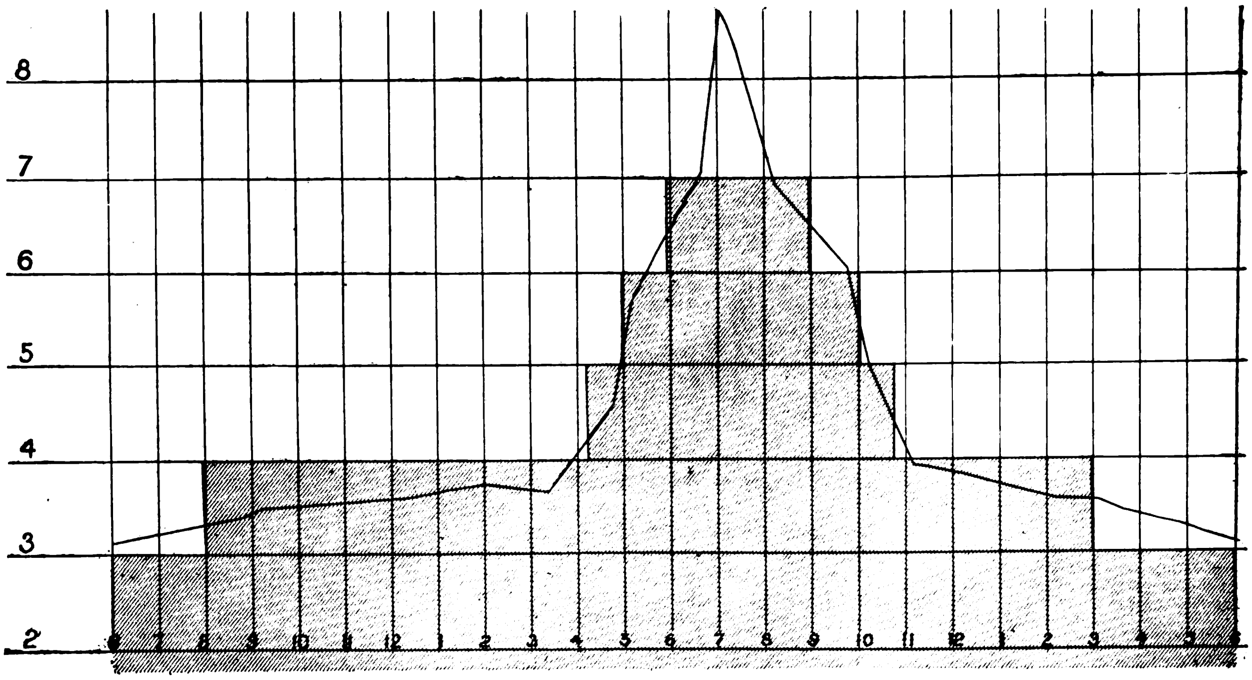
In some cases where the day load is exceedingly light it will not warrant the operation of the plant at all—the load costs more than it will bring in. In such cases there can be no question as to the economy of the storage battery, since it can be charged during the night by power that would otherwise be practically wasted, and during the daylight hours it may carry the whole load. In such cases it will effect an economy in another way also, viz., by carrying up to its capacity the peak of the load. The economy in this direction will be the greater the sharper the peak and will disappear as this flattens out.

But the manner in which the storage battery is most frequently employed to advantage in a central station is by changing the load line from the irregular one, due to the natural load, to one which would be formed by a series of rectangles which would in the aggregate have about the same area.

I have endeavored to illustrate this in the accompanying diagram. The irregular black line represents the natural load line. The spaces between the horizontal lines represent the units into which the equipment is divided, and the vertical lines the time at intervals of two hours.

Beginning at 6 A. M. the load is a little above the best output for three units, but without too much overloading these three units can carry it. The line gradually rises, however, until at 8 A.M. it becomes too much of an overload for three units. If a fourth unit were thrown in it would at first have to operate at only about one-third load, and hence very uneconomically. A storage battery load sufficient to make up a full load for this unit would, therefore, be thrown in at 8 A.M., and the new unit would thus work economically from the start. The part of the load furnished by the battery is represented by the shaded portion outside the natural load line—that is to say, this much energy is being absorbed by the battery and will be available at another time—less the loss due to inefficiency of the battery. I have assumed a battery efficiency of seventy-five per cent. We see from the diagram that the battery is charged 8 A. M. to about 4 P. M. Twenty-five per cent of the energy *thus* stored will therefore be lost. It will be apparent that this bears no relation whatever to the total amount of energy being generated at the time, for units 1, 2 and 3 are working directly into the feeders and are not affected at all. The energy thus lost bears an exceedingly small ratio to the total energy generated.

At 4 P. M. the natural load consumes all the energy of the third unit, and in about twelve minutes has increased so as to be an overload.



ADJUSTING BATTERY STORAGE TO ELECTRIC LIGHT LOAD.

Now it depends upon circumstances whether we will bring our stored energy to the assistance of the fourth unit to carry the increasing load further or not. For the purpose of illustration I have assumed that we will not, but will throw in our fifth unit and complete its load by charging the battery. At ten minutes to 5 the load crosses the fifth unit line, rising very rapidly, and the same question arises again, but I throw in my sixth unit at once, completing its load; the shaded area outside the natural load line again being the energy taken by the battery, seventy-five per cent of which will be available. At 5.30 the load exceeds the normal capacity of all six units, but the diagram represents them as carrying the increasing load until 6 P. M., when the seventh unit is thrown in, and the load completed by the storage battery until 6.40, when the natural load requires the whole attention of all seven units.

Now the question arises, will it be necessary to add first an eighth and then a ninth unit to take this peak? If so, it will add considerably to the fixed charges on our power account. Will it be cheaper to supply battery capacity to carry this peak? That is a question to be decided separately for each individual case. Storage batteries will stand an abnormal discharge for a short time without serious injury. Some will stand it better than others. If it be too rapid the depreciation charge will be increased, also if this abnormal discharge be continued too long. Then, too, at rapid discharge the battery becomes less efficient and the loss will become greater than twenty-five per cent. It is only by balancing these losses against the advantages that the question can be decided whether it will be more advantageous to throw in an eighth unit and let the battery take care of only the tip of the peak beyond that, or let the battery take the whole of the peak beyond the seventh unit line. In the diagram I have assumed that the latter is more advantageous. The battery, therefore, discharges until 8.20, when it begins to recharge, supplementing the seventh unit load until 9 P. M., when the seventh unit is thrown out entirely, and the battery carries the remaining seventh unit load until 9.25, the battery load being represented by the unshaded triangle within the load line. And so the battery and units continue supplementing each other throughout the remaining hours.

In this way the battery will prove economical with some curves. In others it may not, but whether or not it will depends upon so many contingencies that it is utterly impossible to state *á priori*. There are other considerations than economy that might balance its absence, such as convenience as a regulator of potential; the facility it affords for distribution to sub-stations at high potential, resulting in an economy of copper; and the subsequent transformation down for local distribution; and some others which will suggest themselves. Some of these might be controlling in special cases.

Then, on the other hand, the employment of the storage battery is limited entirely to the storage of energy when generated in the form of electricity; not only this, but it is still further limited to direct currents, and is therefore of no avail in stations sending out alternating currents.

(*To be continued.*)

London Notes.

(From our London Correspondent.)

ELECTRIC CURRENTS AND THE HUMAN BODY.

One of the highest medical authorities in England has just made a splendid attack upon the medical electrician in a lecture delivered by him on February 11th before the London Institution. Taking as his subject "Truth and Falsehood as to the Effect of Electric Currents on the Body," he showed the present state of our knowledge regarding the subject. Referring to the effects of the various currents on nerves, he showed a number of experiments and quoted Galvani's celebrated frog experiment. Some of our "quacks" advertise their electric belts and such wares in the stereotyped phrase "Electricity is the Life," and Prof. Horsley showed the falsehood and deceit therein contained. The only legitimate purpose for which an electrical current could be used in medicine or surgery was to stimulate or call out action in some particular muscle, or to stimulate some other physiological action such as secretion. But the currents required to do this must be powerful and intense. After speaking in very strong terms of C. B. Harness's Company and its quackery, he referred to electrical quackery having had to be slaughtered by public-spirited private individuals instead of by the public prosecutor, whose real duty it was.

ELECTRIC LIGHT WORKS BURNED DOWN.

On Tuesday, February 12, the electric light station of the Kensington and Knightsbridge Electric Lighting Company was burned down. Fortunately the engines and other plant escaped with very little injury, and under the able management of the engineer in chief (Mr. R. E. B. Crompton) a constant supply was maintained throughout the night.

ELECTRIC MOTIVE POWER IN MINING.

Before the Midland branch of the National Association of Colliery Managers on the 9th inst. Mr. Albion T. Snell, M. I. E. E. and A. M. I. C. E., delivered a lecture on this subject. He said that the large success attained by electric plants in collieries was due as much to their simplicity as to their efficiency. Hitherto in this country mining plants have always been worked by a continuous current system. The alternate current systems have not been applied owing to various reasons. The simplest way of transmitting power was by two series wound machines as used in the large pumping and hauling plant at St. John's Colliery, Normanton, and at many other pits. The necessary conditions for transmitting power were that both machines must be designed for the same maximum current, the dynamo must be run at constant speed, and the characteristic curves of the two machines must be such that the differences in pressure between the total electromotive force of the dynamo and the counter electromotive force of the motor and the working part of the curves must be equal to the pressure lost over the resistance of the entire circuit. It is not easy to fulfil these conditions in practice, but a sufficiently near approximation is obtainable without difficulty. The simplicity of this arrangement had done much to commend the use of electric power. This system, however, was not suitable for the supply of a number of motors, and therefore the parallel system in one of its forms had to be adopted, because in order to run motors in series the high pressure is required, and governors are necessary to control the speed of each motor. The parallel systems suitable for power work are: simple parallel or tree systems; feeder systems with two wire distributors; three-wire systems; three-wire feeder systems, and dynamotor sub-station systems. The simple parallel system was not suitable for a plant in which the power is taken off at a number of points relatively far apart, as in a coal-pit. The feeder system was that upon which most of the underground plants are laid when a compound dynamo is employed. Each district is supplied by a separate pair of mains joined to the omnibus bars at the shaft bottom, and lamps and motors are coupled in parallel. The weak point with the feeder system is the fall of pressure between the distributing point at the pit bottom and the motors when they are a long way in-bye, and hence a difficulty of regulating the speed of each motor independently of the others, although the pressure at the end of the feeders might be kept fairly constant. The lecturer had never heard of a satisfactory plant even in a colliery in which the line loss at full load exceeded about 30 per cent.; but there are many in which it is from 25 to 30 per cent. which would probably correspond to a 15 per cent loss at average load. Regarding the alternate current systems experts agreed that these would ultimately supersede the continuous current ones, at any rate for long distance transmission, and he himself thought they would be likely to play an important part in the working of mines during the next decade. He next explained the difference between an alternate current and a continuous current system, and after further lengthy remarks regarding the selection of plant for mines and some comments regarding shaft cables, underground cables, bare returns, safety cables and motors, and mechanical coal-getting, Mr. Snell concluded a very interesting lecture by describing some electrical coal cutters.

American Institute of Electrical Engineers.

The 94th meeting of the Institute will be held at 12 West 31st street, New York City, on Wednesday, February 27, at 8 P. M.

A paper will be presented by Mr. H. Ward Leonard, of New York City, entitled "Notes on Recent Electrical Engineering Developments in France and England." Among the topics treated will be Rotary Transformers, the Parsons Steam Turbine, the Laval Steam Turbine, English and French Central Stations, the Heilmann Locomotive, etc.

A meeting of Western members will be held the same evening, Wednesday, February 27th.

The Commercial Side.

Hustlers for Business at the Cleveland Convention.

Mr. R. B. Corey arrived a little late, but was as eloquent as ever in discussing the merits of the latest types of arc lamps for all circuits.

The interests of the Wallace Electric Company were thoroughly cared for by Mr. John B. Wallace and Mr. William Hine, who also chanted the praises of the S. K. C. system of transmission.

In the absence of Mr. L. F. Requa, M. B. Austin, of Chicago, was a capable representative of Safety Insulated Wires and Cables.

Mr. J. Holt Gates, of Chicago, looked out for the credit of the Mather Company and the other companies which he has represented so successfully in the West.

Morse, of Chicago, S. F. B. of course, had the old but true story to tell of the staying qualities of Day's Kerite.

The American Electrical Manufacturing Company of St. Louis were well and capably represented by Mr. Louis Nahm, secretary, and his assistants, Messrs. Gerleman and McConnell.

Mr. Hugo Benedix in politest manner introduced to the fraternity the Boudreaux Dynamo Brush.

Among the larger representatives who were not so far very well known at the Light Conventions was Mr. S. Bowman Wheeler, of Morris, Tasker & Company, Philadelphia. He will be remembered for certain next time.

Among the attractive exhibits that of the Sweet Electric and Manufacturing Company of Grand Rapids was entitled to special mention.

Mr. E. G. Bernard, of Troy, was industrious and successful in booming the well known Powers Arc Light Cut-Out and the newer Adams Dynamo and Motor.

The Clonbrock Steam Boiler Company's exhibit was in the new station of the Cleveland Lighting Company and made them many new friends.

Mr. R. J. Randolph, of Chicago, was in sight again after missing one or two Conventions, and his Excelsior story was as loud and strong as ever.

In their large parlor at the Hollenden the American Circular Loom Company of Boston had one of the most striking exhibits of the Convention.

The Eureka Compound Company of Sioux Falls, S. D., gave out samples of their material which resembled a small stick of candy in size but not in aroma.

Mr. Charles F. Munder was on deck in the interests of the Bryan Marsh Company and their incandescent lamps.

Mr. C. I. Hills of the New York office was the man who guarded the good reputation of the Columbia Incandescent Lamp Company, being fully equal to the occasion.

Messrs. Stettinius and Faber allowed no interested party to remain in ignorance of the special merits of the Stirling Water Tube Boiler, and literature was abundant showing the great popularity of that type of boiler.

Mr. Elmer P. Morris, who has as many friends in the trade as in the old days, introduced the Phœnix Rubber Insulating Paint, and had at all times an appreciative audience of central station men and others who have for a long time felt the need of an article such as Phœnix Paint promises to be.

Messrs. James W. Godfrey and Frank Harrington, who were in sight for twenty-four hours a day during the entire meeting, were never weary of telling their story of the strong points of Habishaw Wire, which has had a new boom since their connection with the company.

The most elaborate display of the entire meeting, and one well worth looking at, was that of the Buckeye Lamps. Messrs. Rockwell, Potter, and assistants were constant in attendance, and in addition to getting a splendid advertisement took several handsome orders.

The American Electrical Works had no exhibit, but Mr. P. C. Ackerman, their representative, landed easily a very good order between handshakes with his friends. Mr. F. E. Donohoe of the Chicago office was also in attendance.

Messrs. Charles D. Shain and R. O. Heinrichs gave a good imitation of the spider in the old poem. Their parlor was the scene of many quiet conferences at which several thousand dollars' worth of Weston instruments were sold to men who needed them—as all central station men do.

Mr. James F. Kelly, who is one of the old-time Convention delegates, was very much in evidence as the representative of the New York Insulated Wire Company.

Dr. G. A. Gessner and Mr. Edmund Dickey were constant in attendance, and it goes without saying that the American Carbon Company were well represented.

Micanite and the Mica Insulator Company were well taken care of by the Cleveland agents, the Cuyahoga Supply Company.

The Wagner Electric Manufacturing Company of St. Louis, through Mr. Herbert Wagner, president of the company, were prominent among the exhibitors with their well known transformers, motors, switches, regulators, switchboards, etc., etc.

The Packard Lamps and Transformers occupied a conspicuous space in the exhibit hall, the main feature being their Great Mogul lamps and a novel arrangement for showing a transformer in which the heat was dissipated by water circulation.

Messrs. Crouse and Tremaine of the Fostoria Carbon Works were both on hand full of fighting blood and the courage of their convictions on their product.

Mr. S. Marsh Young and his partner were kept busy with the display of the Manhattan General Construction Company. The new 100-hour lamp, on which one pair of ½ inch carbons do the work of eight pairs in the standard lamps, attracted wide attention.

One of the newer arc lamp companies represented was the Imperial of New York, with a good lamp and a good hustler.

Mr. Charles Rodman, of the Globe Carbon Works, without whom no Convention could be successful, was on hand and in good spirits.

George Cutter, of Chicago, was as earnest as ever in his efforts to push his specialties—street-hoods, pulleys, windlasses, etc.

Mr. F. Houghton, who is the regular Cleveland representative of the C. and C. Electric Company, was constant in attendance, with a good record to show for himself, his company and their machines.

Mr. F. L. Babcock had not far to come, but he would have been there if it had been a journey of 1,000 miles to let the people know that the Falls Rivet and Machine Company is still as lively as ever.

Frank R. Colvin, no longer the associate of advertising men, but now their victim, aroused considerable fresh interest in the Interior Telephone, with which 300 buildings have already been equipped.

The Stanley Company of Pittsfield were very much in evidence through Messrs. Henry Hine and John F. Kelly, who had little trouble in holding up their end of the tri-cornered contest for supremacy in transmission apparatus.

Mr. George H. McKinlock, of the Central Electric Co., was there in a dual capacity as representative of his own company and of the Okonite Co., whose special agents the Central Co. are in the West.

With Mr. McKinlock, Capt. Candee, and George Manson the Okonite trademark was as prominent in the lobby as it was in the crazy-quilt imitation in the newspapers—always in preferred position.

The Metropolitan Electric Company of Chicago was represented by its president, Mr. W. H. McKinlock, who holds with some reason that the large line of supplies carried by the firm are so well known that no large exhibit was necessary.

Messrs. Seely and Belden of the Complete Electric Construction Co. were on hand to take any construction contract in sight if the terms were right, and to put up bonds in any amount to guarantee a good job.

H. T. Paiste, of Philadelphia, was as popular as ever with his Xentric switch.

The Partridge Carbon Co. of Sandusky, makers of high-class motor brushes, were represented by Mr. Partridge, who was one of the early Brush men and formerly lived in Cleveland.

McIntyre, of Newark, C. H., had a true and interesting tale to tell of the merits of his line of terminals, connectors, etc., which have secured for them a large sale.

The Multifuse Switch Company of Cleveland, exploiting a new and desirable switch, had no trouble in convincing many central station men that the Multifuse is a good thing.

The Holtzer-Cabot Electric Company of Boston had a creditable representation showing their standard types of Fan Motors, alternating and direct, and displayed a handsome line of literature.

The Beacon Lamp Company of Boston was represented by Mr. J. D. Hambey.

The Bryant Electric Company's interests were carefully looked after by Mr. W. C. Bryant and Mr. Thos. Grier, the company's Western agent. A choice bit of their literature was a little pamphlet containing good stories—and descriptions of Bryant specialties.

The Helios Lamp Company of Philadelphia had an instructive exhibit showing the peculiar merits of the Helios Lamp. The lamps were focussed upon a screen in a manner to prove the perfection of feed arrangements and the satisfactory conduct of the lamps. Mr. Frank S. Marr, the president, was in charge.

The Diamond Electric Company made an attractive exhibit embracing the Scheeffer wattmeter and the Diamond transformer. This exhibit was in charge of Mr. A. M. Searles, one of the old-timers in the business, who was welcomed by many friends.

The Electric Storage Battery Company of Philadelphia showed the highest development in this branch of the art in their well known Chloride cell. Mr. Herbert Lloyd was present part of the time, but was called away on important business.

Mr. James S. Humbird made his first Convention appearance for several years, looking just the same as he did eight years ago when he was one of the leading salesmen of electrical apparatus. He was ably assisted by Mr. J. S. Crider, and the new cored carbon of the Washington Carbon Company—the Helios—was well advertised. The central station men were much interested, as the orders in Mr. Crider's pocket showed.

The National Carbon Company was represented by Messrs. B. F. Miles and George Hackenburg, who both appeared serene and content.

Mr. W. B. Cleveland had an interesting exhibit of Roll-Drop Commutator Bars from the Forest City Electric Works, of which he is at the head. The remarkable feature of these bars is that they are sold mystery-off, no lost art being needed in their production.

Mr. E. W. Little of the Interior Conduit Company, assisted by Mr. Kittel and Romaine Mace, had no trouble in taking several good orders and in representing his company properly. Their parlors were a recognized headquarters and were always open.

Mr. Henry B. Cutter of Philadelphia was, as usual, on hand with the full line of C. S. Special ties, which have been a feature of the exhibits at every recent Convention.

The Electric Selector and Signal Company was ably represented by Messrs. C. P. Mackie and P. H. Alexander, both of them old-timers and up to date in showing the merits of a good thing.

The Shultz Belting Company of St. Louis were represented by their Cleveland agents, Messrs. Parkin & Bosworth.

Mr. J. J. Gates was hustling in old-style manner in the interests of the Perkins Switch Company of Hartford, and had an attractive display to assist him in proving the truth of his story.

Mr. Jos. E. Lockwood of the Michigan Electric Company was on deck with a Detroit dynamo, and also recounting the merits of the choice line of specialties for which his company has the Michigan agency.

Mr. J. P. McQuaid of the National Conduit Company was well assisted by Messrs. Gallaher of New York and H. T. Tate of the Chicago office.

The Western Electric Company sent as representatives Messrs. S. A. Chase of New York and Wilkinson of Chicago.

The Abendroth & Root Boiler was boomed by Mr. P. H. McLaren, who knows as much about boilers as any man in the country and never wearies of telling his story. Moreover, he commands attention.

Mr. G. W. Hart, who has been familiar with the progress of the art since 1880, presented the well known Hart & Hegeman line of switches, assisted by Mr. George S. Searing of Chicago.

The Fort Wayne Electric Corporation had, as is customary, handsome entertainment quarters and the liveliest corps of hustlers in sight. Charles S. Knight got in a little late but made up for lost time. The others were: G. A. Miller Philadelphia; S. A. Douglass, New York; T. J. Ryan, Cincinnati; Tom Cooper, Columbus, O.; C. E. Wilson, Chicago, and Mr. Wilbur of Philadelphia.

Mr. F. S. Terry of the Sunbeam Lamp Company was on hand because he could not stay away, and incidentally to serve notice that in a few weeks he would be very much in sight again.

The G. E. Company had a large delegation, eighteen in all, including S. D. Greene, Professors Thomson and Steinmetz, and Messrs. Paige and Howells of the Lamp Works.

The headquarters of the Westinghouse Company were in front—as the company itself usually is. The delegation included: C. A. Bragg, C. Townley, Chas. F. Scott, F. S. Smith, J. A. Rutherford, R. D. Mershon, B. Lamme, H. P. Davis, A. J. Wurts, H. D. Shute, E. H. Heinrichs, M. Crompton, Jas. C. Hubner, Geo. B. Dusinberre, E. N. Sanderson, H. L. Craigin, J. S. Tebbetts, P. T. Brady, George H. Lewars, and Mr. Terry of the legal department.

The Brush Company and the Swan Lamp Company were in the large parlor on the first floor with an exceptionally attractive exhibit, Col. L. H. Rogers commanded.

Prof. Sidney H. Short of the Walker Manufacturing Company, with assistants, entertained quite a party of tourists by taking them in carriages for an inspection of the large works of the company on the West Side.

The Standard Underground Cable Company was represented by J. W. Marsh, vice-president; G. L. Wiley, Eastern manager; J. R. Wiley, Western manager, and H. W. Fisher, electrician—who were fully able to protect the reputation of Standard Underground.

A basement exhibit which attracted well-deserved attention was that of the improved Leonard heater. H. Ward himself was in charge; adjoining was the exhibit of the Carpenter rheostats guarded by Mr. C. E. Carpenter.

The Electric Engineering and Supply Company of Syracuse were on hand with a handsome exhibit and a new catalogue describing the many old specialties of the company and several new ones. They were ably represented by Messrs. J. D. McIntyre, J. L. Hinds and H. C. Hodgkins.

The Libbey Glass Company of Toledo were well represented by Mr. S. C. Richardson, who was busy looking after lamp men.

Among the other concerns represented by good hustlers were: The Chicago Cross-Arm Company; the Chas. E. Gregory Company, Chicago; Triumph Electric Company of Cincinnati; Nutting Arc Lamp Company, M. M. Wood; Chicago Rawhide Company; Cutler & Hammer, Chicago; Henry R. Worthington, New York; Rouse & Hills; Elliott Lincoln Electric Company, Cleveland; Akron Insulator and Marble Company, Akron; Solar Arc Lamp Company; McCreary Specialty Company; Rossiter & McGovern, New York; Anchor Electric Company, Boston; Phœnix Iron Works, Meadville; Cleveland Electrical Manufacturing Company, Reliance Gauge Company, Tucker Electrical Construction Company, Standard Paint Company, Munson Belting Company, John A. Roebling's Sons, Penn Electric Manufacturing Company, Canton Glass Company, Aylsworth & Jackson, Pass & Seymour, Brooklyn Electric Manufacturing Company.

Professor George Forbes says of the Niagara Falls power transmission scheme: "It is difficult for me to say who are the bolder, the capitalists who are embarking into the scheme or the manufacturers who are moving their factories before a single result has been achieved. The action of both is typical American, and their confidence was not misplaced, as the success of the scheme is now assured."

Electric conduits made of small, vitrified stoneware sewer pipe laid in concrete on brick subways have been introduced in England. The conductors employed are naked copper strips which rest on insulators, the pipes themselves, each two feet long, resting on porcelain bridges. In order to join the conductor with a house connection, a special length of pipe is furnished, which is U-shaped for a part of its length. The house lead is taken out through an insulated removable cover forming the top of this part of the pipe. The joints are made on the Doulton system, and require no cement.

The Monocyclic System.*

BY DR. LOUIS BELL.

To the Central Station man no recent change in engineering practice can have more interest than the renaissance of alternating current work which is now in progress. Truth to tell, until quite recently the alternating current was somewhat under a cloud in the estimation of both station managers and engineers. It has served an immensely useful purpose in the extension of electric lighting to places where it would have been utterly impracticable to install a direct current system of any sort, on account of the scattered nature of the work. A very large number of stations have been installed on the alternating system, and I am sorry to say that a large proportion of them have been somewhat unsatisfactory, not in their general operation, but in the character of their service and the commercial results. It is quite common to find alternating stations with a plant efficiency considerably below 50 per cent., and in which the regulation is maintained only within, perhaps, about ten per cent. Under these circumstances, it is small wonder that the advocates of the direct current, the uses of which as an engineering problem have been very completely worked out, have been often somewhat violent in their animadversions on alternating currents in general. Nevertheless, in the last two or three years, there has been a vast change for the better in alternating practice : a change not yet rapid, but bidding fair to be far-reaching. This change has taken up a three-fold path towards progress :

First, the use of large transformers is becoming more frequent.

Next, these transformers are more and more used in conjunction with systems of secondary mains ; and, finally, it is now possible to install an alternating plant that shall be able to operate motors as successfully as can be done with direct current. In ordinary central station practice the motor service does not usually play a very important part : nevertheless, the ability to run motors is most valuable. It is more profitable, speaking broadly, to sell current for light, for a better price per kilowatt hour can be obtained ; at the same time, if motors can be readily furnished, a useful day load can be obtained when it is needed, and the plant becomes the greater service to the community, a thing which, in these days of more or less friction with common councils, is of no small importance. Not only can motors now be successfully worked off alternating circuits, but off a wide variety of such circuits. As yet, however, there is no successful motor for use on the simple alternating system which has, for the most part, been installed in this country. While it is possible to construct a single-phase motor even for 120 or 130 cycles per second, the frequency most used in America, it is at present very doubtful whether such a motor can be made to start and run in a way which will be generally satisfactory. Abroad, where low periodicities are used, better results can be obtained, but even there, there is a noticeable silence on several important points in describing alternating motor practice. Appearances indicate that even with the advantage of low frequency, motors for use on simple alternating circuits still start badly, and particularly require enormous currents at the moment of starting ; hence the growth of various modified alternating systems, of which the polyphase are the best known, by the use of which it becomes possible to avoid this difficulty entirely and to work alternating current motors in every respect as satisfactorily as those operated by direct current.

The polyphase motor has solved the problem of securing good motor service with alternating currents in a very complete manner, although at the cost of slight complications, which, while generally overestimated, are nevertheless distasteful to central station men, especially where the use of such a system would involve an extensive and costly re-arrangement of the distribution service. It is the purpose of this paper to call your attention to the various methods of central station distribution, involving motor service on the alternating current system, and more especially to a modified single-phase alternating system, which lends itself very readily to a very simple and straightforward distribution for lighting without sacrificing the excellent motor service, which makes the true polyphase system so desirable. For all around central station work, the lighting service is of most fundamental importance, and convenience and economy in this particular must, in a vast majority of cases, be the first consideration. Let me invite your attention to this chart, which shows in a diagrammatic manner the general arrangement of various alternating circuits, including those already familiar and the polyphase and monocyclic systems.

First in order, both of time and extended use, comes the simple alternating system, single-phase, with an ordinary two-wire distributing circuit. In operating the secondaries of such a system, we run immediately into limitations imposed by the feasible voltage for lamps, limitations which have acted as a brake on alternating current work, and which are responsible for a good many difficulties in the operation of alternating plants. Opposite the diagram of this circuit I have placed the relative amount of copper required for lighting with such a distribution.

Next comes the alternating circuit modified for Edison three-wire distribution, which is so familiar in its character that it needs no description here. The amount of copper needed, on the supposition that neutral is half the size of either of the others, is, of course, enormously reduced, amounting, as you see, to less than one-third of that needed with the two-wire system; consequently the secondary main distribution, so important to economical operation, can be carried out with the greatest facility. We are justified, at present, in saying that neither of these systems lends itself to the ready operation of motors.

We may next consider the two-phase alternating system, worked with four wires, giving, if desired, two separate circuits for each machine. The copper here required is the same as that used with the single-phase, and so long as the four wires are kept together, motors can be freely operated. Here is assuredly a step in advance. The operation of two separate circuits, however, from a single machine, involves certain complications. In the first place, unless these circuits are balanced as to load, the operation of the system is somewhat difficult to make satisfactory in point of regulation. The circuits themselves have absolutely no influence on each other, but they are derived from the same machine, and with a given excitation of that machine, unless the loss in the two circuits is the same, the voltages must necessarily be different, consequently the generator cannot be compounded for both circuits unless the circuits are balanced. There are three ways out of this difficulty; none of them, unfortunately, is altogether unobjectionable.

In the first place, one can make the loss on the line so small that the difference in voltage, due to any reasonable difference in load, is of no moment. This can sometimes successfully be done, but more often it involves a very unnecessary cost for copper, and even at its best is likely to give regulation, which, although better than that found on most simple alternating systems, is yet not good enough to suit the requirements of the best modern engineering.

Second, the machine can be compounded for loss on one of the lines, a feeder regulator being used on the other. This practically means hand regulation of one circuit.

Or, finally, both circuits can be operated by such regulators. In any case, if motors are to be operated, the two phases must be interlinked at least by one wire.

A somewhat simpler two-phase distribution is that shown in the next diagram where the two phases unite into a common three-wire-circuit. The amount of copper here required differs very materially according to the limitations of voltage that one chooses to fix. If the maximum voltage of the system is limited to the same maximum voltage used on the single phase, two-wire or two-phase, four-wire system, the amount of copper required is very largely increased by the third wire, owing to the fact that the two circuits combined are out of place with each other by ninety degrees. The relative amount of copper required here is, as you see, 145.5. If, on the other hand, the question of maximum voltage between wires is neglected, and the voltage is determined by the use of lamps of the same voltages as on the other systems, then the amount of copper is materially reduced, being a trifle less than three-fourths of that required on the systems before mentioned. In this case, we neglect the fact of there being an excessive voltage between the two outside wires, and connect lamps between the middle wire and the two outside ones, much in the manner of an Edison three-wire system, with the exception, of course, that the saving in copper is not anything like the same amount. Such a system allows the distribution of the whole load for lights and power in a single circuit containing only three wires. It, therefore, avoids the difficulty of regulating two separate circuits. On the other hand, it causes a new and very curious difficulty, owing to the fact that the two combined phases are unsymmetrical with regard to the inductance of the system. The voltages between the middle wire and the two outside wires are unequal, when the systems are equally loaded, by an amount depending on the inductive loss on the line. Consequently, when in balance for regulation, the system is unbalanced as regards the load on the two sides; a condition which, although it may not lead to trouble in some cases, is still a menace to the successful operation of the system, unless the distribution be skillfully engineered. There is, however, the possibility of a noticeable saving in copper.

We may next pass to the three-phase alternating system. The system which corresponds to the two-phase, four-wire system, I pass by, as the use of three separate circuits would be even more troublesome than that of two, and would have no compensating advantages. The ordinary three-phase circuit is that shown in the figure wherein the three phases are united into three wires and taken everywhere the motors and lights are wanted. In this case, for the same voltage between wires, the amount of copper demanded is just three-fourths of that demanded for a single phase, two-wire or two-phase, four-wire circuit. To compensate for this, there is the possibility of unequal voltages in case the three legs of the circuit are unequally loaded owing to interaction in transformers and in the generator. So far as inductance on the line is concerned, the system is symmetrical and balanced.

If the load on three branches is very unequal, as, for example, if one branch is entirely unloaded or very lightly loaded, while the other two are worked to their full capacity, there will be a perceptible unbalancing of the voltage. Experience, however, shows that with anything like the same care in balancing that would apply to an Edison three-wire system, this theoretical difficulty of balance is absolutely negligible. I say this advisedly, as the question has been so often raised that I have taken pains to investigate the conditions in three plants operating lights with reference to this particular thing, and the statement just made is the result of actual practice, It might be thought at first sight that good results could be obtained by combining with either a two-phase or three-phase system the Edison three-wire distribution. As a matter of fact, such a system would be unreasonably complicated with either two or three phases, as any central station man will readily appreciate, inasmuch as it would be necessary to have two or three three-wire systems, each balanced, and mutually balanced with respect to each other, covering the territory if motors are to be run, or at least interlinked in a somewhat complicated way,

There is, however, a three-phase system which does secure a very great advantage in copper. This is the three-phase, four-wire system shown in the figure. It consists of the ordinary three wires employed on the three-phase system, with the addition of a balance wire proceeding from the common connection of the generator or the transformer and forming a part of the general distribution system. The lights are, as can be seen from the diagram, connected between either of the three-phase wires and the balance wire. Between each of the outside wires there are, therefore, what may be considered two lamps in series, having, however, a phase difference of 120 degrees. The voltage of transmission, then, between each of the three main wires, 1.73 times the voltage employed in the lamp connected, nearly 200 volts for 110 volt lamps. This necessarily means a large saving in copper, which is still further enhanced by the fact the three-phase, three-wire system requires intrinsically only 75 per cent. of the copper used on the single-phase or direct current system. The total result with this particular connection is but twenty-nine and one-half per cent. of the copper required on the single-phase system, supposing, as in the Edison three-wire distribution, the neutral wire to be half the size of either of the others. Such a system is in successful use at St. Hyacinth, Canada, in connection with long secondary mains. The price paid for this saving in copper is the introduction of a fourth wire into the distributing system.

Comparing, then, the lighting distributions on the two and three-phase system, we find that if three wires only are used, both have nearly the same amount of copper. The extreme voltage between wires on the two-phase circuit is, however, considerably greater, and both are liable, but not likely, to become unbalanced.

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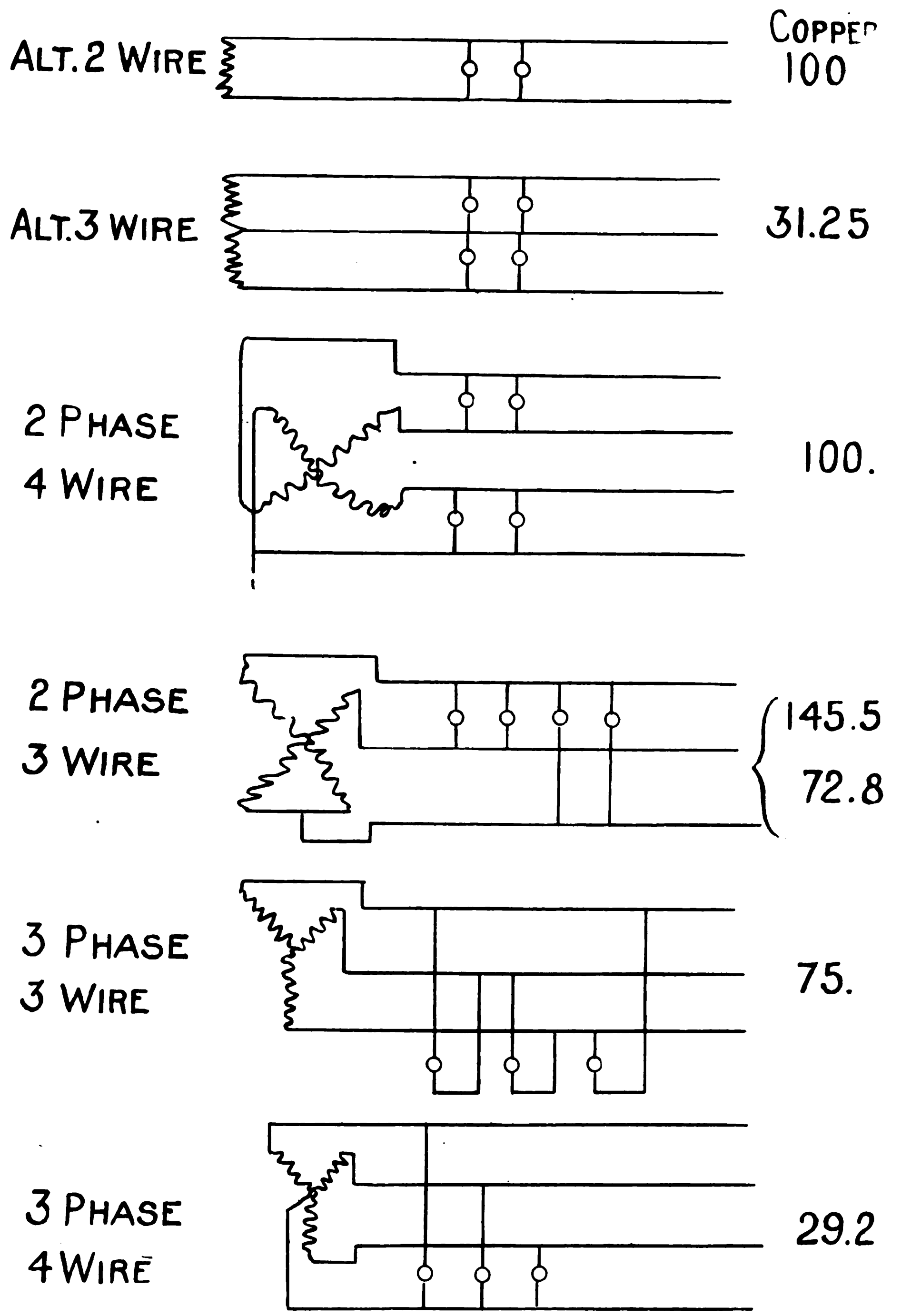
* Paper read before the National Electric Light Convention. Held Feb. 19, 20, 21, at Cleveland.

There is this difference, however, that if we are to balance a three-phase system in respect to voltage, we need only to see that the load is equally distributed between the three branches. If we are to balance a two-phase, three-wire system, we must see that this load is unequally distributed between the three branches by an amount depending on the inductance of the line. We, therefore, see, comparing the polyphase with the single-phase system, that the price we have to pay for the privilege of successfully operating motors is a certain amount of complication in circuits, which, while not of great importance in new installations, hinders the ready adaptation of a polyphase system in a plant having already a large number of circuits installed. Attractive as the single phase is in its beautiful simplicity of wiring, we cannot yet successfully run motors from it. It was for the purpose of preserving that simplicity of distribution which is peculiarly valuable in connection with large central stations, especially those already installed, and joining to this the same ability of running motors found on the polyphase system, that the monocyclic system, to which I am about to call your attention, has been perfected. You see it first in its two wire form. Here, so far as the lighting distribution is concerned, it is absolutely identical with any of the alternating systems now installed, in simplicity, convenience and in the amount of copper necessary. The main circuit of the monocyclic machine constitutes a simple single-phase alternator, and so far as the lighting on the system is concerned.is identical with it, connected in precisely the same way, feeding, if desirable, into the same circuits without change. There is, however, on the armature of the monocyclic machine a supplemental coil, shown on the diagram as connected to the middle point of the main winding on the monocyclic machine, from which a power wire may be led. This need be of but small cross section, and only has to be carried to those points in the system at which it is desired to operate motors, and, as I shall presently show, this power wire enables one to run motors possessing the same desireable. Characteristics as the polyphaes motors, and, indeed, generally identical with them, without in any way disturbing the lighting distribution, except in so far as Ohm's law is a necessary limitation on all combined power and lighting circuits. In the next diagram here we see the same device applied to an Edison three-wire system for the distribution of lights, along with which is carried the same insignificant power wire which permits the successful operation of motors. The value of the three-wire feature in the distribution of lights is evident, the amount of copper being the same as in an Edison system of the same voltage. With this monocyclic system, we can compound the generators for any reasonable loss in the line, and can arrange the lighting system without incurring any troublesome questions of balance, so far as to give as good regulation even as can be obtained on a direct current system. Beyond this, we have the power of running motors.



It is instructive to glance over this list of alternating lighting systems to see their relative complexity and advantages. It is especially noteworthy that any and every method of distribution that saves copper introduces in some form or other the question of balance. This is the price we pay for reduction in cost of conductors. It has not seriously interfered with the use of the Edison three-wire system; in fact, those most familiar with that system were the first to make light of the difficulty; nor do I think it stands as a valid objection to the use of the polyphase systems in cases where they are desirable, as none of them are more sensitive in the matter of balance than the Edison three-wire system which is now in such extensive and uniformly successful use. We may further note, that in each of the alternating systems where a very great saving of copper is accomplished, a fourth wire is necessary, at least if both lights and motors are to be operated; in each case, however, of trifling size.

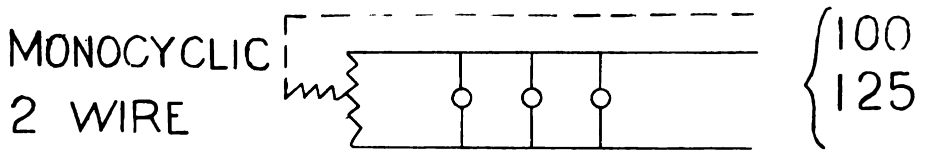
Having now looked over the field in general, we may pass to the more minute consideration of the somewhat striking electrical peculiarities of the monocyclic system; peculiarities which, although they do not involve any particular complexity, are yet of decided interest.

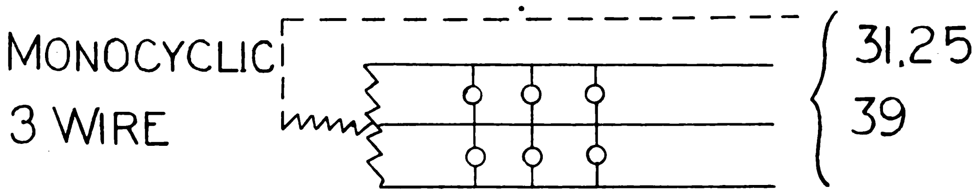
The general principle of the system is well shown in this diagram. So far as the main work of the generator is concerned, its winding is closely similar to that of any well-designed alternator. The armature is of the ironclad type, and the winding is made in machine wound coils which are invariably insulated, and can be very readily slipped into place. There is, however, upon the armature a second set of coils of cross section equivalent to that of the main coil, but composed of comparatively few turns, so that the room taken up on the armatnre is very small, and owing to the shallowness of the slots necessary to accommodate this second or teaser coil,' the output of the machine, considered as a single-phase generator, is not affected. This teaser coil is located with reference to the main coil as shown in the diagram. Its place on the armature is midway between the other coils, and the electromotive force generated is in a direction at right angles to that of the principal coil. It is evident, now, that if we connect the terminal of this teaser coil with either of the terminals of the main coil, we shall get an electromotive force compounded of the two, and in some intermediate direction. In general, by varying the proportions of the two coils, and hence their electromotive forces, we could obtain a resultant electromotive force between their terminals having any angle we pleased with either the main or the teaser coil. If, then, wires are taken upon the line from the terminals of the main coil, and also from the teaser coil, we can obtain from the main line three electromotive forces, two of which are symmetrically situated with reference to the E. M. F. of the teaser coil, and bear to it any phase relation that we please. One of the most convenient arrangements, and that which is most generally adopted, involves such a relation of the electromotive force of the teaser coil to that of the main coil, that we shall have on the line three electromotive forces approximately 60 degrees apart. In other words, the resultant E. M. F.'s between teasers and main coils are each 60 degrees from the E. M. F. of the teaser coil. Such an arrangement is that shown in the diagram. Under these circumstances, it is clear that if one of these electromotive forces were reversed, either in transformers or anywhere in the translating devices, the result would be three electromotive forces 120 degrees apart, one of them having been turned through an angle of 180 degrees. Meanwhile, the relation between the power wire, which is connected to the teaser coil, and the outside wire has no effect upon the electromotive force between these outside wires, since the electromotive force of the main coil itself does not interact with the power wire, except in so far as a portion of it may act with the power wire to form a resultant phase, and electromotive force for running motors. Consequently, so far as lights are concerned, the two outside wires behave precisely like the leads from any other alternating generator, while so far as motors are concerned, we have the power of getting our three electromotive forces 120 degrees apart, and hence have the same magnetic effect as with a three-phase system. The arrangement of lights and motors with this device is clearly shown in the diagram. It is evident that we can take from the outside wires of the monocyclic system either arc or incandescent lights anywhere and to any extent the capacity of the machine permits, working for the incandescents either two or three wire distribution at option. For a motor, two transformers are connected anywhere we please, one between the power wire and each of the outside wires. At this point the resultant phases come into play and the necessary reversal of one of the electromotive forces is accomplished by the very simple and obvious device of reversing one of the secondaries, as shown in the diagram. To the secondary circuit thus constituted, we can connect a standard induction motor which will start and run as well as if connected to a regular three-phase system, or instead of reversing one of the transformer secondaries we may accomplish the same virtual reversal of the electromotive force by reversing one of the coils in the motor itself. We therefore have a system which, so far as lights are concerned, is a simple alternating system ; so far as motors are concerned, the dynamical equivalent of a polyphase system. With a differently proportioned formation we could place upon the secondaries two electromotive forces 90 degrees apart if necessary, and then run two-phase motors instead of three-phase motors, if there were any object in so doing. Such an arrangement, however, would be less desireable than that of the quasi three-phase system, for the reason that without gaining anything in the motors we should have to generate a larger electromotive force in the teaser coil, and hence take up more room on the armature with it, perhaps enough to have an effect upon the output of the machine considered as a single-phase generator. It is sufficiently evident that the method shown would not be the only way of getting the same result. For example, in this second diagram a somewhat different arrangement is shown accomplishing precisely the same end. Here our object is to operate secondary mains on the Edison three-wire system, and in connection with them to run motors at any point we please. A large transformer, to which the secondary is connected on the three-wire system, is, therefore, installed, and the secondary mains distributed in any manner we please. A second and small transformer, proportioned to the total amount of motor service desired, is connected as shown in the diagram, and the power wire leading from it is taken through the whole or part of the three-wire system. The device is analogous to the arrangement of the generating coils themselves, and the result is the ability to operate a standard induction motor by connecting it anywhere on the three-wire system to the two inside wires and to the power wire. Such an arrangement as this is immensely convenient in distributing power and light in cities where, for example, it is desired to establish an extensive system of secondary mains through Edison tubes, or other convenient underground distribution. It is, furthermore, interesting to know that one is not confined to the use of either two or three-phase induction motors, since a monocyclic generator connected to the primary circuit makes an excellent synchronous speed without the assistance of a starting motor, in this particular being vastly superior to the pure single-phase synchronous machine. But, it may be asked, how about this power wire? In case, for example, of a transmission over a considerable distance before the distributing point is reached, must the power wire be part of the transmission system? In answer, I need only call your attention to the fact that the essential point of the monocyclic system, so far as motors are concerned, is the establishing of an electromotive force bearing the same relation to the system as is borne by the teaser coil of the generator. Consequently, in case of a transmission plant, the main generators at the distant station may be simple single-phase machines, the subsidiary electromotive force being furnished by a synchronous motor or similar device at any point in the system. So we might readily have an extensive transmission with a monocyclic machine in the sub-station of such size as is necessary to furnish current for what motors may be upon the system. The power wire would then run only to the sub-station. Another interesting peculiarity of the monocyclic system, and one which is not without importance in case of an extensive power distribution, is the following:

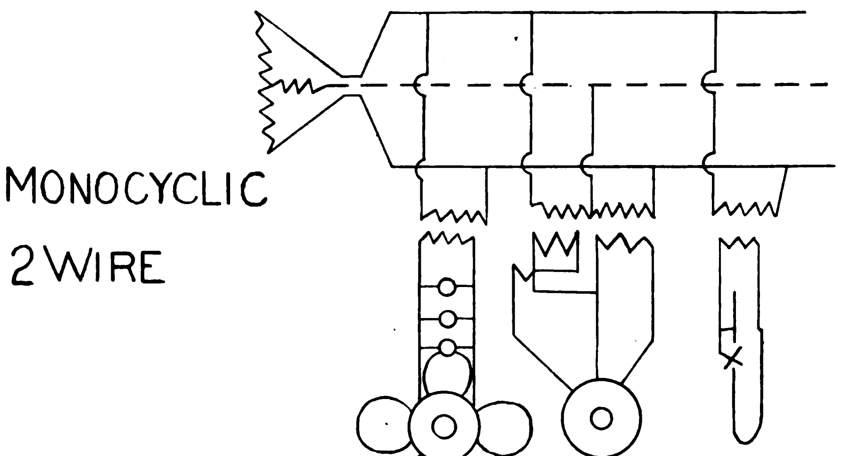
Under ordinary circumstances, induction and synchronous motors are wound so that the counter electromotive force affects the system in a perfectly symmetrical manner, and the current flows over all the wires with some degree of symmetry in response to the demands of the motors on the system. It is customary, however, in the monocyclic system, to employ motors so wound as to throw a high counter electromotive force into the power wire when the motor is at speed and loaded, thereby reducing the normal current carried over the power wire to a purely nominal amount, and this can evidently be done without sacrificing much in the matter of starting, since at the start all the counter electromotive forces in the motors are zero. We have, then, a motor system of a type really peculiar to the monocyclic system, in that each motor will start under the same conditions of impressed electromotive force as if it were a polyphase motor ; while, when at speed and loaded, it would be operating virtually as a single-phase machine. If, however, it were overloaded so that it would tend to slow down or stop, sufficient energy would flow over the power wire to bring it back to speed, just as if it were a polyphase machine. This is only one of various interesting ramifications in the system when developed to meet special conditions.

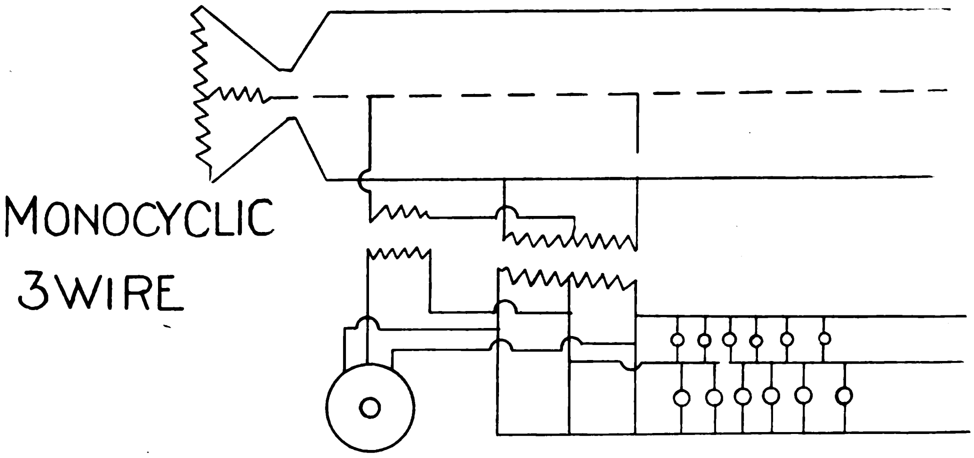
The connections shown in the diagram, however, are those of the most direct applicability and probably which would be most extensively used for central station service. At this point it may be appropriate to ask what is the disadvantage of such a system. It evidently secures exceedingly marked advantages in the ability to operate the lights on existing circuits or with the simplest possible kind of distribution, and at the same time to run at any point in the system synchronous or induction motors of well tried and familiar types. The question can be readily answered ; in fact, the question is almost obvious. The price which we have to pay for this advantage is the installation of the power wire which necessarily adds something to the weight of copper in the system and to the trouble of installation. Under all ordinary circumstances the power wire need be of trivial cross-section compared to that of the other wires, since, as a rule, the energy required for operating the motors from the given central station is small compared with the total capacity of the stations ; and further, it is worth remarking that the monocyclic motors, either synchronous or induction, will run perfectly well if the power wire is disconnected after the motor is at speed, operating them as single-phase machines. It is, of course, well known that the single-phase synchronous motor gives admirable results, and it is also true that a single-phase induction motor can be constructed of excellent efficiency and other electrical properties. The only material difficulty in this case is to get the motor to start with a good torque. The monocyclic connection enables this to be accomplished. After the motor is at speed the power wire becomes no longer necessary to successful operation, so that in spite of the necessary existence of the power wire it is easy to see that the additional amount of copper is not likely to be burdensome in central station operation. It would hardly ever be necessary to install a power wire of more than one-fourth the joint cross-section of the others, as given in the diagram, and generally a much smaller wire will suffice.

I have thus endeavored in a brief space to give a good working idea of the monocyclic method of combined light and power distribution which has been devised, and is urged upon the public as specially adapted for the work of central station distribution on account of its unique simplicity in practice. As to what has already been done in the installation of such apparatus, a considerable number of these monocyclic generators are in









daily use in central stations, for the most part operating over circuits already established, and displacing the higher frequency alternators which had been previously used. They are giving excellent results, and the operation of the motors, wherever employed, has been highly satisfactory. The system, therefore, needs no extensive exploitation on paper. After once pointing out here the principal and general advantages of the system, it is better to let the plants already running speak for themselves, and let their verdict be final.

BOOK REVIEWS.

Elementary Lessons in Electricity and Magnetism. By Silvanus P. Thompson, D. Sc., B. A., F. R. S., F. R. A. S. Cloth, 8vo, 607 + xix. pp. Illustrated. Price, $1.40. New York and London: Macmillan & Co., 1895.

The complaint is frequently heard that we have no good elementary text book of electricity, and while this has not been entirely without foundation, the fact has remained that the literature on the subject of electricity that has been of a suitable character to be safely placed in the hands of the student in preparation for a course of training in electrical engineering has been lamentably small. Better, however, that there should be a single good text book than that there should be thousands of bad ones, and in this little work we have what we can praise without reserve.

Prof. Thompson is too well known as an author to require any introduction to the readers of Electricity, for his works, so far as they cover the electrical field, are acknowledged everywhere as standard. But the writing of a text book for experts, or for those who have already had an introduction into the science, and the writing of one which shall in every way be suitable to those who are seeking to qualify themselves for such an introduction, are two entirely different and distinct undertakings.

Of the two the latter is by far the more difficult of fulfilment, requiring the qualifications both of the teacher and of the constructor. Fortunately the author combines both of these in a high degree, and brings to his assistance an unusually broad knowledge of the science, such as few writers of elementary text books possess. Added to these is that clearness of diction and perspicuity of statement which have characterized his larger works, and to which they owe so much of their popularity.

Among the most successful of elementary text books of science are Roscoe's Elementary Chemistry and Lockyear's Elementary Astronomy. In both of these the attempt has been very successfully made to give a clear skeleton outline of the science, upon which later the student may build the more substantial structure. The plan in both has been to give without too much detail *all* the essential fundamental facts of the science. Other authors have attempted this, but most of them have failed of success in that they gave too much. It requires a nice discrimination to stop just at the proper point, to give neither too little nor too much, for both faults would be equally fatal. In the text books referred to the plan is adopted of giving at the end of the book a series of questions, including problems, covering all that is embodied in the various chapters. These questions are also arranged under the same headings as the chapters to which they refer, and as every student who has been fortunate enough to have been brought up on them knows, form one of the most useful features of the books. It makes them self-teachers, as it were, and proves likewise of assistance to the instructor.

Prof. Thompson has constructed this book exactly on these lines, and has used rare judgment in collecting a mass of facts underlying the science which will be useful in further study and upon which further study must be based.

Of course such a text book to continue of value must be kept up with the times, and the new facts in the science added from time to time in new editions.

The original edition of this work appeared in 1881. The one under review bears the imprint of 1895, and involves many changes and additions rendered necessary by the progress of the science.

As stated in the preface, "In the thirteen years which have elapsed much addition has been made to our knowledge, and many points then in controversy have been settled." The book is therefore now up to date, and we congratulate ourselves, as well as others interested in the cause of education, on the possession of a text book on electricity in every way the equal of Roscoe's elementary text book on chemistry. We think we can scarcely accord higher praise than this.

Electric Transmission of Energy. By Gisbert Kapp, Mem. Inst. C. E., M. Inst. El. E. Fourth Edition. 8vo, 445 pp. 166 Illustrations. Price, $3.50. New York: D. Van Nostrand Co.

Since the issue of the third edition of this well known work in 1891 an enormous development has taken place in every branch of electric power transmission, and the polyphase system has had its development entire. Installations such as those at Lauffen, Rome, Genoa, etc., have made long distance transmission an accomplished fact where before it was at best but a promise of the future. Electric motors in lieu of long lines of shafting and many other developments in the line of electrical transmission have come into practical use, making a new edition almost imperative. In preparing this it became necessary to re-write a large portion of it, incorporate what was new, and omit that which the author thought would best bear omission. He wisely concluded to omit entirely the historical part, the detailed descriptions of plants, and comparisons of electric with other systems of transmission, which in the present state of development no longer add to the value of the book. Special works devoted to certain branches upon which he had touched in the previous edition, such as electrical traction, etc., both overhead and underground, also rendered the continuance of these portions no longer desirable. On the other hand, the theory of continuous current machines has been somewhat extended, and that of alternators and multiphase apparatus added. This we consider the most valuable feature of the work. The chapter on the line has been considerably enlarged, especially that portion relating to the most economical proportioning of the weight of copper to the line losses. In fact this chapter seems to be a complete development of Sir Wm. Thomson's economic law to meet every contingency, and adds very much to the value of the book.

An omission that we are sorry to see in a book in other respects so fully up with the times is that of sufficient attention to the subject of transmission of energy at constant current. Some space is devoted to the governing of motors, etc., operated by this system, but practically nothing is said of the economies resulting therefrom or attainable under the trying conditions imposed by electric traction. Heretofore our electric railways have had to deal with areas rather than with distances, and under these conditions the constant potential method of distribution has proved fairly satisfactory and economical, but with the extension of these lines to meet interurban service, distances instead of areas must be considered. With the constant potential distribution the best that can be done will involve an investment in copper proportional to the *square* of the distance and a loss in transmission in proportion to the *square* of the distance, whereas the expected traffic can be expected to increase only as the distance. On the other hand, in distributing by constant current both investment in copper and line losses will be proportional to the traffic or as the distance. It would seem, therefore, that the claims of the constant current, which must eventually supplant the constant potential method of distribution in long lines, should have received more attention, especially since the author has given elsewhere so much attention to economies in line construction under the constant potential method. He can scarcely be ignorant of the recent developments in the adaptation of the constant current to traction, for they have been widely published both in this country and abroad.

With this striking fault of omission, which we hope to see rectified in a future edition, the present seems to be fairly well up to the times, and will make a valuable addition to the specialist's library.

Method for Obtaining Alternating Current Curves.

BY DR. LOUIS DUNCAN, JOHNS HOPKINS UNIVERSITY.

In some cases a telephone method for obtaining the curves of alternating currents and electromotive forces is very convenient.

The method ordinarily employed for obtaining current curves is to shunt from a non-inductive resistance in the circuit, and include in the shunt circuit a contact-making arrangement on the dynamo shaft, a telephone, and an electromotive force, due to a constant current. This constant current is adjusted until there is silence in the telephone. When this occurs, the fall of potential due to the alternating current is equal to the fall of potential due to the continuous current, and knowing the latter, we get the value of the alternating current at the instant the contact on the shaft is made. Electromotive forces may be obtained in the same way by balancing a continuous electromotive force against the instantaneous value of the alternating electromotive force when the contact on the shaft is made.

There are several difficulties in this arrangement. Any small thermal electromotive force at the contact makes it difficult to get even an approximate balance, while only one curve may be obtained from a single contact-making arrangement on the shaft. I have employed with some success a method in which some of these difficulties are eliminated. To a telephone diaphragm, made preferably of mica, I attach a small coil of fine wire. Beneath the diaphragm are two coils wound together, and so placed that the diaphragm coil is in a magnetic field due to currents flowing in them. Through the diaphragm coil I send instantaneous currents obtained from a contact-making device on the shaft, there being a battery in circuit with the coil and the contact maker. Through one of the stationary coils I send a current proportional to the electromotive force to be measured, or a current obtained from a shunt on a non-inductive resistance in the dynamo circuit. The other coil has a continuous current flowing through it, which latter is measured. I now adjust the continuous current until the sound in the telephone is zero. If the coils are equal, this will mean that the continuous current is equal to the instantaneous value of the alternating current when the intermittent current is made. It will be seen that the method is independent of any small electromotive forces due to the contact, and any number of curves may be obtained from the same contact making device.

This method is fairly sensitive, and gives good results. It has, however, the difficulty of all telephone methods, that unless the contact only lasts for an infinitely short time there will always be a sound in the telephone. By making a sharp contact, and after some practice, the results are good.

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Flick D. T., New Castle Electric Co., New Castle, Pa.
Foote J. B., Battle Creek Electric Light Co., Battle Creek, Mich.
Foote W. A., Jackson Electric Light Co., Jackson, Mich.
Fox Edward H., Phœnix Glass Co., Chicago.
Francisco, M. J., Rutland Electric Light Co., Rutland, Vt.
Francisco Mrs. M. J., Rutland, Vt.
Francisco I. H., Rutland, Vt.
Francisco Don, Rutland, Vt.
Freshney Sam. A., Muskegon Electric Light and Power Co., Muskegon, Mich.
Foster B. G., Cleveland.
Gans John L., C. N. D. L. Street Railway, Connellsville, Pa.
Gates C. A., Russell Engine Co., Massillon.
Gardner F. F., Newark E. L. and P. Co., Newark, N. Y.
Gardener W. H., Pittsfield Electric Co., Pittsfield, Mass.
Galloway John R., Washington, D. C.
Gartland C. C., Buffalo General Electric Co., Buffalo, N. Y.
Gerleman J. F., American Electrical Mfg. Co., St. Louis.
Gessner G. A., The American Carbon Co., Dayton, Ohio.
Gibson C. L., Cleveland.
Glover Sam'l W., The Post-Glover Electric Co., Cincinnati.
Godfrey J. W., New York Insulated Wire Co., New York.
Gould J. Edgar, Philadelphia.
Greene B. E., "Electricity," New York.
Greene L. W., City Electrician, Hillsdale, Ia.
Greene L. W., Brooklyn Electric Light Co., Brooklyn, Mich.
Greene W. J., Cedar Rapids Electric Light and Power Co., Cedar Rapids, Ia.
Gregory Chas. E., Chas. E. Gregory Co., Chicago.
Gwynn, J., Steubenville Gas and Electric Co., Steubenville, Ohio.
Hackenberg H. E., The National Carbon Co., Cleveland, O.
Hadley J. C., Pana El. Lt. Pr. & St. Ry. Co., Pana, Ill.
Hanley W. J., General Electric Co., Cincinnati, O.
Harding McL., Walker Mfg. Co., New York.
Harrington F. W., India Rubber and Gutta Percha Ins Co., New York.
Harrington Walter E., The Cutter Electric and Mfg. Co., Philadelphia.
Hart Gerald W., The Hart and Hegeman Mfg. Co., Hartford, Ct.
Harthan, W. C., General Electric Co., Schenectady, N. Y
Hatch Edward B., H. W. Johns Mfg. Co., Hartford, Ct.
Hayden M. M., National Carbon Co., Cleveland, O.
Hayes Geo. H. R., The Brush Electric Co., Cleveland, O.
Hayes Webb C., The National Carbon Co., Cleveland, O
Hedges Wm. C., Mansfield, O.
Heinrich E. H. Westinghouse Electric and Mfg. Co., Pittsburg.
Herrick Albert B., Herrick & Burke, New York.
Herrick Chas. H., W. S. Hill Electric Co., Boston.
Higgins E. M., Rochester, N. Y.
Hill H. P., Hill Clutch Co., Cleveland, O.
Hills C. I., Columbia Incandescent Lamp Co., New York.
Hinds J. L., Electric Engineering and Supply Co., Syracuse, N. Y.
Hinds P. A., Peninsular Electric Light Co., Detroit, Mich.
Hine Henry, Stanley Electric Mfg. Co., Pittsfield, Mass.
Hine Wm. S., Wallace Electric Co., Chicago.
Hoag Geo. M., City Electrician, Cleveland.
Hobart J. C., Triumph Electric Co., Cincinnati.
Hodgkins H. C., Electric Engineering and Supply Co., Syracuse, N. Y.
Holmes B. P., Youngstown Electric Light Co., Youngstown, Ohio.
Holmes Welles E., Newton and Watertown Gas Light Co., Boston.
Holtzer C. W., Holtzer-Cabot Co., Boston.
Hough A. H., Brush Electric Co., Cleveland.
Houghton F., C. & C. Electric Co., Cleveland.
Houston Edwin J., Houston-Kennelly, Philadelphia.
Howell Wilson S., Edison Lamp Works, Harrison, N. J.
Hudson H. W., Brush Electric Co., Cleveland.
Humphrey C. R., Heine Safety Boiler Co., Pittsburg.
Hunt W. J., "Electrical Age," New York.
Huntley C. R., Buffalo General Electric Co., Buffalo, N. Y.
Hurd Capt. G. A., Chicago.
Jackson F. E., Aylesworth & Jackson, Orange, N. J.
Jenney C. D., Jenney Electric Motor Co., Indianapolis Ind.
Jennings John J., Wilkinsburg Electric Co., Wilkinsburg, Pa.
Johns S. A., Cleveland Electric Illuminating Co., Cleveland.
Johnston W. J., "The Electrical World," New York.
Johnston Mrs. W. J., New York.
Jones A. H., Suburban Electric Co., Philadelphia.
Jones A. J., Edison Electric Illuminating Co., New Brunswick, N. J.

Kammeyer C., "The Electrical Engineer," Chicago.
Kammerer J. H., The Royal Electric Co., Montreal, Can.
Kearfott W. D., Henry R. Worthington New York.
Kennedy James, Kennedy & Du Perow, Washington, D. C
Kennelly A. E., Houston-Kennelly, Philadelphia.
Knight C. S., Ft. Wayne Electric Corporation, Fort Wayne Ind.

Lamme B. J., Westinghouse Electric and Mfg. Co., Pittsburg.
Langton John, Toronto, Can.
Lasell Edward, Chicago.
Latham C. A., Loraine County Light and Power Co Elyria, Ohio.
Laughlin Homer, Wellsville Electric Light Co., Wellsville Ohio.
Learned Chas. A., Hudson County Electric Co., Jersey City.
Lewars, Geo. H., Westinghouse Electric and Mfg. Co. Pittsburg.
Lewis Chas. E., Cleveland.
Lilley, Luke, Underwriters' Electrician, Cincinnati.
Lindsley Stuart, Essex County Electric Co., Orange, N. J.
Little, E. W., Interior Conduit and Insulation Co., New York.
Livesey J. H., General Electric Co., Chicago.
Lockwood Jos. E., Michigan Electric Co., Detroit.
Lounits Jr., Geo., Savings and Trust Co., Cleveland.
Lovejoy J. R., General Electric Co., Schenectady.
Low W. W., Electric Appliance Co., Chicago.
Lyman H. M., Canton Electric Light and Power Co., Canton, Ohio.
MacFadden Carl H., Nutting Electric Co., Chicago.
MacLeod, W. S., Washington, D. C.
McBrier D. N., Ball Engine Co., Erie, Pa.
McCoubray Thomas, Tucker Electrical Construction Co. New York.
McDonald L., Duquesne Electric Co., Duquesne, Pa.
McDonald W. B., Calumet Gas Co., Chicago.
McDonough, T. P., Cleveland.
McChie J., General Electric Co., New York.
McGraw F. H., Penn. Ind. Reformatory, Huntingdon, Pa.
McIntyre J. D., Electric Engineering and Supply Co. Syracuse, N. Y.
McIntyre Mrs. J. D.
McKnight E. H., Electric Light Co., Middletown, Ohio.
Mace Romaine, Interior Conduit and Insulation Co., New York.
Marks L. B., Marks-Ayer Electric Co., New York.
Manson George T., Okonite Co., New York.
Manwaring A. H., Brush Electric Light Co., Philadelphia.
Manwaring Mrs. A. H., Philadelphia.
Marlatt Walter, Galion O.
Marr Frank S., Helios Electric Co., Philadelphia.
Marsh Joseph W., Standard Underground Cable Co., Pittsburg.
Marshall Charles S., Chicago Cross Arms Co., Chicago.
Martin John K., James J. Murray & Co., Philadelphia.
Melton A. H., The Brush Electric Co., Cleveland.
Mix E. W., Cie. Francaise Thomson-Houston, Paris, Philadelphia.
Moore A. T., Walker Mfg. Co., Buffalo.
Morris Wm. L., J. F. Randall & Co., Cleveland.
Morse S. F. B., Kerite Iron and Cables, Chicago.
Muirhead James G., Batesville Electric Co., Batesville, Ind
Munder C. F., Bryan-Marsh Co., New York.
Murphy M., Second Ave. R. R. Co., Pittsburg.
Mustard A. H., Washington Carbon Co., Pittsburg.

Mustard John, Wagner Electric Mfg. Co., Philadelphia.
Myers George M., Kansas City, Mo.
Myers Mrs. George M., Kansas City.
Nahm Louis, American Electrical Mfg. Co., St. Louis.
Nash K. L., Swan Lamp Mfg. Co., Cleveland.
Nashold E., The Nashold Cleat Co., Chicago.
Newton C. E., Jewell Belting Co., Hartford.
Nicholls Frederic, Toronto Incandescent Light Co., Toronto.
Nunn P. N., San Miguel Cons. and Mfg. Co., Telluride, Colo.

O'Dea Thomas, Edison Electric Light and Power Co., Erie, Pa.
Outwater J. F., Edison Electric Illuminating Co., Brooklyn, N. Y.
Pabst A., Mahoning Electric Light Co., Youngstown, O.
Packard, W. D., New York and Ohio Co., Warren, O.
Packard, Mrs. W. D., Warren, O.
Paiste, H. T., H. T. Paiste Co., Philadelphia.
Partridge James, Partridge Carbon Co., Sandusky, O.
Peck E. F., Citizens' Electric Illuminating Co., Brooklyn.
Perry Frank S., "Western Electrician," Chicago.
Perry J. C., Indianapolis Light and Power Co. Indianapolis, Ind.
Ponn Jerome, Washington Gas and Electric Co., Washington, O.
Pentz James A., U. S. Electric Lighting Co., Philadelphia.
Phipps C. W., Cleveland, O.
Possons N. S., Universal, Cleveland, O.
Powers E. L., "Electrical Industries," Chicago.
Pratt H. T., Washburn & Moen Mfg. Co., Worcester, Mass.
Prentiss J. R., The Brush Electric Co., Cleveland.
Prentiss T. H., Manhattan General Con. Co., New York.
Price Charles R., New Bedford Gas and Edison Light Co., New Bedford, Mass.
Purinton A. J., Stamford Gas and Electric Co., Stamford, Conn.
Pyle J. E., West Chester, Pa.
Redman George A., Brush Electric Light Co., Rochester.
Redman Mrs. George A., Rochester.
Reilly W. E., "Western Electrician," Chicago.
Rhetts J. E., Salem Electric Light and Power Co., Salem, Ind.
Richardson Jr., S. O., Libbey Glass Co., Toledo, O.
Richmond C. T., Thomson-Houston Carbon Co., Fremont, O.
Riggs, C. D., Electrical Engineering and Supply Co., Syracuse, N. Y.
Ritchie James, Manufacturers' Electric Co., Philadelphia
Roberts O. A., Electric Belt Co., Sandusky, O.
Rodman Charles E., Globe Carbon Co., Ravenna, O.
Rogers S. H., Brush Electric Co., Cleveland, O.
Rogers W. S., Brush Electric Co., Cleveland, O.
Root S. N., Partridge Carbon Co., Sandusky, O.
Rossman James G., Georgia Electric Light Co., Atlanta.
Royce Fred W., Washington, D. C.
Sachs Joseph, E. E., New York.
Sanderson E. M., Westinghouse Electric and Mfg. Co., Boston, Mass.
Scheible Albert, George Cutter, Chicago.
Schmidt Emil C., Sandusky Electric Light Co., Sandusky, O.
Schuyler H. P., General Electric Co., Schenectady, N. Y.
Scott Charles F., Westinghouse Electric and Mfg. Co., Pittsburg.
Searles A. L., Electric Selector and Signal Co., New York.
Seely John A., Complete Electric Construction Co., New York.
Seymour J. Alward, McIntosh, Seymour & Co., Auburn, N. Y.
Shainwald J. C., The Standard Paint Co., Chicago.
Shaw A. C., "Electrical Engineer," Boston, Mass.
Shay M. D., The Raymond A. Disinfectant Co. (Detroit), Cleveland.
Shippy H. L., John A. Roebling's Sons' Co., New York.
Short G. H., Cleveland, O.
Sloat Frank J. J., Sandusky, O.
Smith C. D., National Carbon Co., Cleveland, O.
Smith F. S., Westinghouse Electric and Mfg. Co., Pittsburg, Pa.
Smith Harrison J., Edison Electric Illuminating Co., New York.
Smith Mrs. Harrison J., New York.
Smith J. Brodie, Manchester Electric Light Co., Manchester, N. H.
Smith R. B., Belknap Motor Co., Philadelphia.
Smith T. Carpenter, Keystone Light and Power Co., Philadelphia.
Spencer Thomas, Helios Electric Co., Philadelphia.
Stearnes R.S., Cincinnati General Electric Co., Cincinnati, O.
Stetson Geo. R., New Bedford Gas and Edison Light Co., New Bedford, Mass.
Stieringer Luther, New York.
Stine W. M., Armour Institute, Chicago.
Stump Clarence S., Columbian Equipment Co., New York.
Sullivan M. A., Chas. A. Schieren & Co., Chicago.
Sullivan M. J., "Electric World," Chicago.
Sullivan Mrs. M. J., Chicago.
Sunny B. E., Chicago Edison Co., Chicago.
Swaney F. R., Ceramic City Light Co., East Liverpool, O.
Swetland H. M., "Power" Publishing Co., New York.
Taltavall J. B., "Electrical Age," New York.
Tandy L. D., General Electric Co., Schenectady, N. Y.
Taylor J. W., Peterboro, Canada.
Terry F. S., Sunbeam Lamp Co., Chicago.
Thayer Wm. C., Cleveland.
Thomas B. F., Ohio State University, Columbus.
Thomson Elihu General Electric Co., Swampscott, Mass.
Thresher A. A., Shawan Thrust Electric Co., Dayton, O.
Thullen L. H., Leetonia, O.
Thullen J. C., Leetonia, O.
Toll Edward C., Sterling Cycle Works, Chicago.
Townley Calvert, Westinghouse Electric and Mfg. Co., Pittsburg.
Turner Oscar C., Georgia Electric Light Co, Atlanta.
Ullman Ike, Meridian Gas Co., Birmingham, Ala.
Uptegraff J. M., Sewickley Electric Co.
Urquhart D. F., Thomson-Houston Carbon Co., Boston.
Van Trump C. R., Wilmington City Electric Co., Wilmington, Del.
Wade E. E., El Paso Electric Co., Colorado Springs, Col.
Wallace J. B., Wallace Electric Co., Chicago.
Walter H. H., American Carbon Co. (Dayton), New York.
Walton Allyn B., "W. C. Thayer," Cleveland, O.
Washington L. W., Washington Carbon Co., Pittsburg.
Waymire E. O., Dayton Fan and Motor Co., Dayton, O.
Wehrly E. J., Arbuckle, Ryan & Co., Toledo, O.
Weierbach, Wm., Standard Paint Co., New York.
Wells C. J., Electric Appliance Co., Chicago.
Welscher F. H., Citizens' Electric Co., Battle Creek, Mich.
Whalen Jno. B., J. B. Whalen & Co., W. P. Wire.
Wheeler S. Bowman, Morris, Tasker & Co., Philadelphia.
Whipple Bailey S., The Buckeye Electric Co., Cleveland, O.
White C. P., Evansville, Ind.
Wilberg G. A., Ft. Wayne Electric Corporation, Philadelphia.
Wiley C. L., Standard Underground Cable Co., New York.
Wilkins E. Ward, Partrick & Carter Co., Philadelphia.
Wilkinson E. T., Philadelphia.
Williams F. A., Safety Insulated Wire and Cable Co., New York.
Wilmerding C. H., Chicago Edison Co., Chicago.
Wilson Jas. S., American Circular Loom Co., Boston.
Wintner St. Louis, Brooklyn Electric Mfg. Co., Brooklyn.
Wirt H. C., Schenectady, N. Y.
Wise Stuart M., Manhattan Gen. Cons. Co., New York.
Woodbury C. J. H., American Bell Telephone Co., Boston.
Wright C. F., Eberhart & Wright, Cleveland, O.
Wright Peter, United Gas Improvement Co., Philadelphia.
Wurtz Alexander Jay, Westinghouse Electric and Mfg. Co., Pittsburg.
Young E. P., Sewickley Electric Co., Sewickley, Pa.
Young Mrs. E. P., Sewickley, Pa.
Young Richard, Faraday Heat, Light and Power Co., Morton, Pa.
Young S. Marsh, Manhattan General Cons. Co., New York.

General News.

What is Going on in the Electrical World.

Gainesville, Ga.—A movement is on foot to organize a company to build an electric street railroad in Gainesville.

Fremont, O.—Smith & Schertzer have purchased the Gibsonburg electric light plant, which recently made an assignment.

Ft. Worth, Tex.—D. R. Fant has been appointed receiver of the Weatherford Electric Light, Power and Water Company.

Winchester, Ind.—The electric light building here was totally destroyed by fire on the 15th, entailing a loss of about $10,000.

Toronto, Can.—City Engineer Keating recommends the installation of a municipal plant for the electric illumination of the city streets.

Troy, N. Y.—City Engineer Sherwood claims that Troy pays too much for its light, and favors competition in the awarding of the contract for lighting.

Lorain, O.—A survey is to be made at once of three suggested routes for the proposed Lorain and Wellington electric railway and the best one adopted.

Portland, Me.—The mayor and aldermen have given the Portland Railroad Company permission to use electricity for propelling its street cars.

Winona, Minn.—It is understood here that a reorganization of the Winona General Electric and Street Railway Companies will soon take place.

Sheboygan, Wis.—The electric lighting company's contract for lighting the city has expired, and the council has called for bids by advertisement.

Manston, Wis.—A number of our citizens have decided to form an organization for the purpose of securing electric lights, waterworks, etc.

Shelburne Falls, Mass.—Arrangements have been made for a survey of a route for the proposed electric railway between this place and Coleraine.

Frostburg, Md.—The Frostburg electric light plant was sold on the 18th inst. at trustees' sale. Dr. J. J. Jones, a former stockholder, bought it for $7,100.

Chicago.—The Calumet Electric Street Railway Company has filed a trust deed to the Equitable Trust Company to secure $3,000,000 gold construction bonds.

Wallingford, Conn.—The people of this borough have voted in favor of electric lights, and will ask the Legislature for permission to erect and operate a plant.

Stanton, Mich.—Stanton has decided to submit to the people the question of bonding the city for $6,000 for the purpose of putting in an electric lighting plant.

Bristol, Tenn.—The Bristol gas, electric light and power plant has been purchased at public sale by the Glamorgan Iron Works of Lynchburg, Va., for $20,000.

Philadelphia, Pa.—The new Hotel Philadelphia, work on which will begin early in March, will have five electric elevators, electric lights throughout, electric call bells, etc.

Galveston, Tex.—The Woollam's Lake street car line is being changed to an electric system. In a short time the drowsy tinkle of the mule car-bell will cease to be heard in Galveston.

Gloucester, Mass.—The Worcester Construction Company has contracted to build the electric street railway from Gloucester through Essex to Beverly. The line will be eighteen miles long.

Atlanta, Ga.—The Atlanta Electric Railroad Company, recently organized, will build a trolley road from some central point in the city to the old waterworks property as soon as they obtain a franchise.

Indianapolis, Ind.—The Citizens' Street Railroad Company are getting twenty-five new motor cars from St. Louis. The new cars are of large capacity and provided with the latest devices.

Helena, Mont.—In a discussion in the city council on the electric lighting contract last week one of the aldermen intimated that a new electric company would probably be organized here at an early day.

Buffalo, N. Y.—Mayor Jewett suggests the utilization of the trolley railways for carrying all street garbage out of the city from collecting stations established at convenient places along the railway routes.

Niagara Falls.—Petitions have been circulated here to raise funds for an electrical celebration on a grand scale when the first of the big dynamos is set in motion and the wheels and shafts begin to turn.

New York.—The Brotherhood of Electrical Workers submitted a proposition to the Electrical Contractors' Association making eight hours a work day which the latter refused to accept, and the workers to the number of eight or nine hundred went on strike Tuesday of last week and are still there.

Brooklyn, N. Y.—The board of aldermen have voted to extend the rights of the Municipal Electric Light Company over the entire city, with the understanding that at the end of ten years the municipality may take possession of the plant upon the payment of a sum equal to the cost of the plant.

Savannah, Ga.—It is probable that in a few days the receiver of the Electric Railway Company will be dismissed, the company reorganized and financial arrangements made that will give permanency to the concern.

Quincy, Ill.—The ordinance committee of council has reported in favor of granting a franchise to the Empire Electric Light and Power Company to erect poles and wires in the streets for lighting purposes.

Washington, D. C.—The District Commissioners have granted a permit to the Eckington and Soldiers' Home Railroad to equip four miles of its line with the underground electric system owned and controlled by the Electro-Magnetic Traction Company, of which organization Senator Stewart is president and Senator Hunton vice-president.

Albany, N. Y.—The common council has resolved "that the Committee on Applications to the Legislature, together with the corporation counsel, be and they hereby are authorized and directed to secure such necessary legislation as may be required to submit to the citizens of Albany at the next charter election to be held in said city of Albany, a proposition that the said city of Albany be authorized and empowered to erect, maintain and equip an electric lighting plant for the purpose of lighting the streets of said city by electricity, and for furnishing light and power for commercial purposes, and for the further purposes of lighting by electricity the public buildings, school houses, station houses and engine houses in said city."—A bill introduced in the Senate provides for the appointment of an inspector of electric meters at $5,000 salary, by the Governor; he to appoint five deputies who shall respectively reside in Buffalo, Brooklyn, Rochester, Syracuse and Utica; salary, $1,500. –The Senate Cities Committee on the 19th gave a hearing on the Owens bill fixing the price of electric lights in cities of 800,000 or over at one-half cent. per hour per light for incandescent lights, and not more than 4 cents per hour for arc lights. Paul D. Cravath, representing several electric light companies, opposed the bill. He said that not one of the companies had paid a dividend in five years. Mr. U. G. Lewis, representing the Edison Electric Illuminating Company, argued against any interference with the business at this stage. Robert Payne, representing the Municipal Light and Power Company of Brooklyn, spoke in the same strain and closed the hearing.

Telephone and Telegraph.

A movement is now on foot in Tonawanda, N. Y., to organize a local telephone company to operate wires and instruments in the Tonawandas. Though the scheme is yet in embryo, it is securing the sanction and support of local business men.

Live Oak, Fla., has shown itself entitled to the spirited adjective in its name—it has a telephone line, electric lights and a new ice-making plant, and the lumber mills there have more orders than they can fill.

An opposition telephone company has secured a franchise in Port Huron, Mich., and, having obtained 350 subscribers, is ready to do business at rates of $24 for residences and $30 for business houses. Now the Bell people announce that hereafter all their telephones within a mile of the exchange will be rated at $18 for residences and $24 for business houses, which is half the old figures.

The business men of Catlettsburg, Ky., have decided to put in a telephone system there to be operated at the lowest possible rates. At Ashland also there is talk of opposition to the East Tennessee Company.

T. C. Duncan, George H. Oetzel, W. E. Thomason, Wm. A. Nicholson and W. D. Wilbur have been commissioned by the State as corporators of the Union Telephone Company, the object of which is to operate a telephone exchange at Union, S. C. The capital stock is $1,000.

A charter has been granted the Anderson Telephone Company of Anderson, S. C. R. E. Ligon has been elected president, W. R. Osborn vice-president, and L. R. Brock secretary and treasurer.

The Virginia Telephone Company, of Norfolk, Va., having obtained a charter, have asked the Norfolk council for a franchise permitting them to establish a telephone plant. They guarantee an efficient service for two thirds of the current rates.

The hearing of the motion of Lawyer Simon Sterne for a permanent injunction against the Metropolitan Telephone and Telegraph Company of New York, which was down for Feb. 18, has been adjourned until March 7 as the result of an agreement between counsel on either side. The injunction is pending an action to restrain the company from increasing the present rate of $150 paid by Sterne for the company's service to a yearly rental of $240.

J. H. Childers, of Hermitage, Hickory County, Mo., will commence at an early day the construction of a telephone line from Sedalia to Springfield, Mo.

The Central New York Telephone and Telegraph Company are preparing to make important additions and changes in their plant for the purpose of improving their service in Syracuse, N. Y.

The business men of Beaumont, Texas, have petitioned the Western Union Telegraph Company to establish a telegraph line between Beaumont and Sabine Pass.

Some enterprising citizens propose erecting a telephone line between Perry and Elcho, Ga.

Several hearings have been given at Albany by the legislative committees to business men and representatives of the telephone companies in regard to the provisions of the Parsons Gerst telephone rate reduction bill. At the hearing on the 19th inst. arguments were made against the bill by General B. F. Tracy on behalf of the Metropolitan Telephone and Telegraph Company of New York City; by John G. Milburn for the Buffalo Telephone Company, and by Mr. Babcock, of Elmira, representing the New York and Pennsylvania Telegraph and Telephone Company. The hearing was then adjourned for two weeks.

The city council at Lansing, Mich., has passed a resolution instructing the city clerk to correspond with the Harrison and Standard Telephone companies with a view of inducing them to establish a telephone system in Lansing to compete with the present company.

The Indiana Telephone and Construction Company have applied for a franchise to establish a telephone system in Muncie.

Frankfort, Ind., has lately been surfeited with telephone promoters and projects. The Stetaphone Company has its plant about ready for operation, and test lines have been put up in the city by the Phœnix and the Stroger companies. The Phœnix and the Stetaphone people have secured a large number of subscribers. In the meantime, the Central Union, which has been in operation about four years, is losing its customers by the dozen.

The break in the Commercial Cable Company's cable off Robbins Reef in New York harbor has been repaired. This was the cable laid in the harbor and through the Narrows to Coney Island a couple of months ago to connect the ocean line directly with the office in the city. The cable was broken by the dragging anchor of some vessel forced from its moorings by drift ice.

The Southwestern Telephone and Telegraph Company has begun work for the erection of poles in Taylor, Texas. Other work for putting in the telephone plant will be pushed along as rapidly as expedient.

The Harrison Company reports having between 400 and 500 contracts for telephones in Terre Haute, Ind.

The Bell Telephone Company is preparing to spend $160,000 for underground conduits in Cincinnati the coming summer.

The annual report of the Central New York Telegraph and Telephone Company read at the meeting held in Utica gives its total subscribers as 2,951, a gain during the year of 66. There are 353 toll stations and 234,047 toll line messages were transmitted at the average rate of $24\frac{3}{8}$ cents each, which covers the message and reply. The average cost of each call to each subscriber in Utica is $2\frac{3}{10}$ cents.

Attorney-General C. C. Watts, of West Virginia, about a year ago instituted a suit against the Bell Telephone Company for $9,000 damages, which he claimed for the destruction of his residence and contents by fire communicated by the electric wires of that company at the point where they entered the building. The case resulted in a verdict for the plaintiff for the full amount with costs. The defence appealed it to the United States Court of Appeals, and a few days ago Justice Morris handed down an opinion affirming the judgment.

Within a radius of 33 miles of New York City there are 3,500,000 people and 25,000 telephones. In New York City proper there are 10,500 telephone stations, 90 per cent. of which are equipped on the metallic circuit system. In that city the Metropolitan Telephone and Telegraph Company operates ten central exchanges, seven of which are entirely for metallic circuit service. The New York and New Jersey Telephone Company has 10,000 subscribers, about 75 per cent. of whom enjoy the metallic circuit system.

The House of Representatives has refused to adopt the Senate amendment appropriating $500,000 to begin the laying of a cable to Hawaii. It seems likely that the large majority—152 nays to 114 yeas—against the cable will prevent its acceptance in conference.

A telephone company is forming in Pensacola, Fla. Three-fourths of the $8,000 capital stock has already been subscribed.

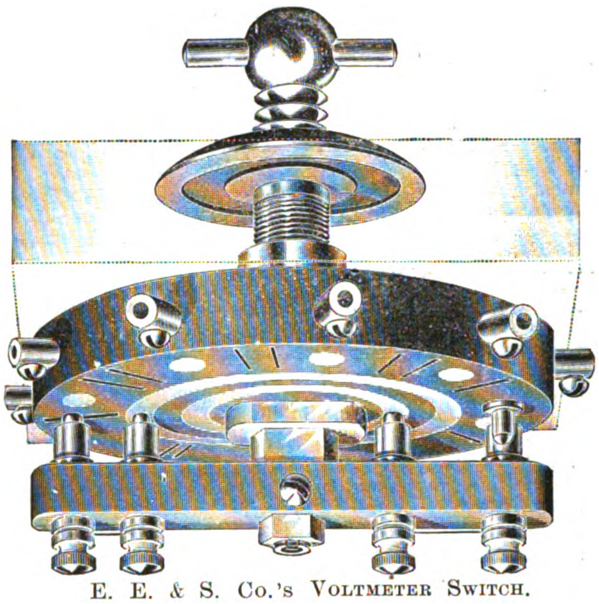
A new telephone system is being considered in Albany. It is proposed to place telephones in several places easy of access where anyone who wishes to send a notice or a paid advertisement to any of the Albany papers can do so with very little trouble. The plan was submitted some time ago to several of the newspapers of Albany It has been proposed to place these instruments in branch offices, in stationery or drug stores in remote parts of the city and suburban adjuncts. The offices will be kept open all day and until late at night. The promoters of the scheme have tested five telephones connected with a mile of wire with satisfactory results. The tested instruments were the Phœnix, Harrison, D'Unger National and Colvin.

A New Voltmeter Switch.

Among the new switchboard appliances manufactured by the Electric Engineering and Supply Company, Syracuse, N. Y., is that of a Voltmeter Switch, shown in the accompanying cut, and described in brief as follows:

From the front of the switchboard nothing is visible but a 2½-inch dial plate, similar to that of a safe lock, and upon which are numbered graduations corresponding to the respective number of circuits. A movable dial carrying a pointer, is rigidly fastened to a fiber or hard rubber cross-bar that sweeps over the surface of the switch base.

It will be noted that there are two metallic rings embedded in the base. To these the voltmeter leads are electrically connected; the line contact points are spaced around the outer edge of the base. All wire connections of contact points, and both rings, radiate from the edge of the base, the connector of the inner ring being insulated by a hard rubber tube where it passes through the outer ring.



E. E. & S. Co.'s Voltmeter Switch.

The cross-bar carries on each radius a pair of plungers, connected together in pairs with fuse wire, held under thumb nuts, to protect the voltmeter against possible raise in potential. This combination completes the circuit between the voltmeter and the lines terminating in the diametrically opposite contact points upon which the outside plungers rest.

The standard size of swicth is adjustable to boards varying in thickness from three-fourths to an inch and five-eighths. To obviate accidental short circuiting of contact points, because of wiping of plungers over the base, two cuts are made in the base between each pair of contacts and in the path of the plungers.

The chief merit of this switch is that it is compact and self-contained, the only labor necessary in applying it to a switchboard being that of boring an inch hole, screwing the parts together and making the electrical connections at the back of the board.

The Electrical Engineering Company's Catalogue.

Catalogue No. 3 of the Electrical Engineering Company of Minneapolis, Minn., just published, is a book of 298 pages, large 8vo, and is the most comprehensive work of the kind that has come under our notice for a long time. It is neatly printed, full of engravings portraying almost every article used in the electrical business, and has remarks and tables giving every particular—whether of size, weight, gauge, dimension, application, composition, quality or price—which might serve to enlighten the purchaser on the various points of the article he is seeking. In the latter part of the book there are tables showing differences between wire gauges in decimals of an inch; diameter of magnet wire insulation: dimensions and resistance of pure copper wire; weights of iron, steel, copper and brass wire, diameters determined by American gauge. There are also rules for estimating resistance; wiring rule for determining the proper size of wire for electric light and power circuits, either direct or alternating, at any pressure; and rules and requirements for the installation of wiring and apparatus for electric light and power, taken from the National Code, as recommended by he Underwriters' National Electric Association, January, 1895. An alphabetical index is appended which enables one to find what he is after without loss of time or patience. The Catalogue, taken as a whole, does great credit to the compiler and to the enterprising company whose extensive business it so well illustrates.

COMMERCIAL PARAGRAPHS.

Business with the Metropolitan Electric Company of Chicago is brightening up and increasing considerably. They are having a great many inquiries for their I. X. L. Triple Braided Weatherproof Line Wire. Electric light, electric power and street railway, telephone, telegraph, police, messenger and fire alarm service companies and all others interested in the use of insulated wires for overhead or aerial work, and desiring a superior article at a moderate cost, will do well to confer with them before purchasing elsewhere. The indications are that the spring and year of 1895 business with them will be very large.

Mr. N. S. Amstutz, Mechanical and Electrical Engineer, located at Cleveland, O., has recently moved his office from 506 The Cuyahoga to Room 29 Blackstone Building, where he is prepared to carry on all the details of his profession. A number of new electrical devices are about ready for the market, and will soon be placed on sale by prominent concerns for whom Mr. Amstutz has designed their entire line of specialties. This class of work, as well as general installation supervision, is carefully attended to by Mr. Amstutz.

The Metropolitan Electric Company of Chicago are sending out circulars, advising the trade that they carry in stock the celebrated Hoffman Rod Polish.

The Metropolitan Electric Company, 186 Fifth avenue, Chicago, have found that the Knapp Sellner Adjustable Desk Lamp Holder is attracting considerable attention. It is found to be just what is required for desk light.

RECENT COMPANY ELECTIONS.

Detroit Citizens' Railway Company, Detroit, Mich. Hon. Tom L. Johnson has been elected president in place of J. M. Edwards, who resigned; vice-president. J. C. Hutchins. Directors: Tom L. Johnson, vice J. I. Johnston, resigned; R. T. Wilson, M. O. Wilson, R. T. Wilson, Jr., J. M. Edwards, J. C. Hutchins, F. W. Van Name, Cameron Currie, John C. Donnelly.

Bell Telephone Company, Philadelphia. President, James Merihew; secretary, Samuel B. Huey: treasurer. A. A. Ziegler. The old board of directors were re-elected.

New York, Westchester and Connecticut Traction Company, New York. President, Ex-Senator Wm. Cauldwell; vice-president, Daniel F. Cohalan; treasurer, Philip Katz; secretary, John Foley, Jr. Executive committee: Martin J. Keogh, Franklin A. Wilcox, Daniel F. Cohalan.

Detroit Electric Light and Power Company, Detroit, Mich. President, F. F. Palms; vice-president, George Vail; treasurer, W. S. Crane. Wm. B. Moran, who resigned the presidency a short time ago, was retained on the board of directors.

Parkersburg Electric Light and Power Company, Parkersburg, W. Va. President and treasurer, C. C. Martin; secretary, W. W. Van Winkle. Directors: C. C. Martin, W. N. Chancell r, W. Vrooman, W. W. Van Winkle, J. A Wetherell, B. D. Spilman and John Busch.

Cohoes City Electric Railway Company, Cohoes, N. Y. President, Urban Weldon; vice-president, J. W. Himes; treasurer, Murray Hubbard; secretary, Sil s Owen. Directors: Urban Weldon, J. W. Himes, John Garside, G. E. Simmons, Hugh Graham, Silas Owen, Egbert W. Lansing, Herman Kahn, Murray Hubbard.

Central New York Telephone and Telegraph Company, Utica. Directors: A. C. Belden and Martin A. Knapp, Syracuse; David B. Parker, Buffalo; L. H. Lawrence, C. A. Nicholson, R. S. Williams and F. G. Wood, Utica.

Hartford Electric Light Company, Hartford, Conn. President, A. C. Dunham; vice-president, E. B. Bennett; treasurer, D. W. Barney; secretary, D. P. Cotton. Directors: A. C. Dunham, William H. Bulkeley, W. O. Burr, Atwood Collins, E. B. Bennett, Henry Roberts, Rodney Dennis, D. W. Barney, E. K. Root, Lucius F. Robinson and W. L. Robb.

Gulf Coast Electric Railroad Company, Biloxi, Miss. President, A. M. Dahlgren; first vice-president and general manager, J. B. Cable; second vice-president and auditor, S. W. Bennett; secretary, J. V. Ross. The capital stock of the company was placed at $500,000 at a recent meeting of the grantees and projectors.

Wisconsin Telephone Company, Milwaukee. President, H. C. Payne; vice-president and treasurer, F. G. Bigelow; secretary and general manager, John D. McLeod; general superintendent, E. B. Cottrill. Directors: H. C. Payne, F. G. Bigelow, Charles Ray, B. K. Miller, Sr., C. G. Stark, A. G. Fuller, Charles F. Pfister, Jesse Stone of Watertown, and W. A. Jackson of Detroit.

INCORPORATIONS.

The Sigourney Electric Light and Power Company, Sigourney, Iowa—to generate and furnish electricity for light and power in Sigourney. Capital stock, $8,000. Promoters: H. C. Brown, W. S. Harlan, H. O. Schipper, C. M. Harlan, E. Laffer, Sigourney.

O. I. Newton's Sons Company, Sparta, Wis.—to operate and own electric light plant, etc. Capital stock, $50,000. Promoters: Harry N. Newton, Geo. N. Newton, F. N. Newton.

The Florence Belt Line Railway Company, Florence, Col.—to build and operate an electric street railway in Florence. Capital stock, $25,000. Promoters: E. M. Weil, S. Siess, Leon Siess, C. L. Huff, all of Florence; James B Crandall, Denver.

The Universal Engineering Company of Baltimore City, Baltimore, Md.—to do a manufacturing, mechanical, and industrial business; to manufacture and sell electrical instruments, machinery, and supplies; construct, own, and operate telegraph and telephone lines. Capital stock, $10,000. Promoters: Geo. W. F. Vernon, Theo. F. Wilcox, Wm. J. Klug, Julius Stern, Leopold Stern.

The Little Falls and Herkimer Street Railway Company, Little Falls, N. Y.—to build and operate a street surface railroad, from Herkimer to Little Falls, a distance of eight miles. Capital stock, $10,000. Directors: Clinton Beckwith, John F. Henderson, Horatio P. Witherstine, Robert Earl, George A. May, Earnest R. Steele, of Herkimer; John V. Quackenbush, of Mohawk; Nelson J. Davis, of Utica; R. F Lansing and Charles Bailey, of Little Falls.

The Nantasket Electric Street Railway Company, Hull, Mass.—to operate and construct an electric street railway from Hull. Capital stock, $12,500. Promoters: Jno. L. Mitchell, Geo. E. David, Wm. F. Taylor, Hull: Jno. C. Flood, Boston, Mass.

The New York, Westchester and Connecticut Traction Company, New Rochelle, N. Y.—to build and operate a street surface road, sixteen miles long, in Westchester County. Promoters: M. J. Keogh, New Rochelle, N. Y.; F. A. Wilcox, D. F. Cohalan, J. A. Bensel, all of New York City.

The Suburban Gas and Electric Company, Revere, Mass.—to generate and furnish electricity for light, heat and power. Capital stock, $75,000. Promoters: Arthur Perry, Wm. Whitney, Allston Burr.

The Marion Water Company, Jersey City, N. J.—to construct, maintain, and operate water works, gas works, and electric light works in the city of Marion, Ohio, and elsewhere, etc. Capital stock, $250,000. Promoters: Alfred G. Brown, Lewis Hallock, Jr., Robert H. Dillingham, Herbert F. Hatch, East Orange, N. J.; Chas. N. Brown, Jersey City.

The California Telephone and Construction Company, San Jose, Cal.—to buy, rent, sell and otherwise deal in telephones and in all instruments used in connection therewith; to own and control telephone lines, all kinds of electrical instruments, etc. Capital stock, $500,000. Incorporators: H. O. Hickox, L. M. Hale, F. M. Burkholder, Walter M. Field, Wallace C. Stratton, Thomas Clark, Nicholas Bowden, Chas. E. Severance, Thomas B. Hussey.

A certificate of reorganization of the Schenectady Railway Company by the purchasers at the foreclosure sale, has been filed in the office of the Secretary of State, Albany, N. Y. Capital stock, $300,000. Directors: P. F. Knowles, William Henry White, A. G. Macandrew, Geo. W. Hebard, Lewis L. Clarke and Charles A. Lieb, of New York City: Joseph Ford, George W. Jones and John Kruesi, of Schenectady.

The Atlanta Electric Railway Company, Atlanta, Ga. Capital stock, $100,000. President, Dayton Hale; secretary and treasurer, D. H. Livermore. Directors: T. B. Felder, Jr., J. C. Dayton, James W. English, Jr., William C. Hale, Charles Runette, Dayton Hale, D. H. Livermore, W. L. Seddon, L. Z. Rosser, James R. Collins, H. P. Williams.

The Fuller Electric Engineering Company, East St. Louis, Mo.—to manufacture electric apparatus. Capital stock, $30,000. Incorporators: W. A. Fuller, Charles T. Dana and G. H. Dudley.

The Phœnix Telephone and Manufacturing Company, Chicago—to manufacture electrical apparatus. Capital stock $100,000. Incorporators: R. Brown, E. E. Yaxby, J. H. Riley.

The Pacific Storage Battery Company, San Francisco, Cal.—to manufacture, buy, sell, rent and deal in electric storage batteries, dynamos and electrical supplies, machinery and apparatus; to act as agents and factors for other corporations, firms and persons transacting similar business. Capital stock, $20,000. Promoters: Thomas Addison, Berkley, Cal.; Robert B. Elder, Samuel E. Kearney, San Francisco: Fred F. Barbour, F. M. Ray, Oakland, Cal.

The West Chester and Downington Street Railway Company, West Chester, Pa.—to operate an electric street railway. Capital stock, $100,000. Promoters: Jas. McGraw, West Chester; R. J. Malone, J. W. Clark, Philadelphia.

The Felts Electric Light and Power Company, Colusa, Cal.—to purchase, lease or sell electrical rights, patents, licenses, etc., and other property pertaining to electric lighting, telegraph, telephone and electro plating. Capital stock, $100,000. Promoters: W. W. Felts, W. F. Ford, W. W. Brown, Colusa; F. F. Peart, Geo. F. Scott, J. K. Bartholomew, C. G. Felts, Geo. B. Harden, E. E. Scott, Maxwell, Cal.

The General Electric Railway Company, Chicago, Ill.—to make, acquire, own, use, manage, sell and otherwise handle or dispose of inventions, improvements, patents in railway appliances and devices, and the model patterns and samples thereof, and to acquire and operate street railways. Capital stock, $5,000,000. Promoters: Daniel M. Simmons, Wm. A. Youmans, Geo. Pfloger.

The United States and Hayti Cable Company (incorporated in W. Va.), New York, N. Y.—to construct and maintain a line of electric telegraphs, cable (submarine, etc. between the United States and West Indies, etc. Capital stock, $500,000. Promoters: Jno. W. Mackay, Virginia City, Nev.; Geo. C. Ward, Brooklyn, N. Y.; *W. Mackay, Jr.* New York City, N. Y.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED FEBRUARY *19, 1895.*

ELECTRIC RAILROADS AND APPLIANCES.

534,411. Trolley-Wire Support. **Marmaduke F.** Van Buren, Philadelphia, Pa. Filed Oct. 5, 1894.

534,454. Conduit Electric Railway. Wilhelm Simon, Nuremberg, Germany. Filed March 3, 1894. *Renewed* Jan. 11, 1895.

534,475. Conduit Electric-Railway System. William L Hedenberg, New York, N. Y. Filed June 5, 1894.

534,495. Conduit Electric Railway. *Octavus* Cohen, New York, N. Y., assignor to Rebecca O. Cohen, same place. Filed May 15, 1894.

534,519. Conduit Electric Railway. Alfred *Rosenholz*, San Francisco, Cal., assignor of one-*half* to Samuel J. Clarke and Harvey S. Brown, same place. Filed May 22, 1894.

534,605. Trolley-Wire Crossing. Charles S. *Hersh* and Edwin F. Weaver, Philadelphia, Pa., assignors of one-third to Alfred E. Clarke, same place. Filed March 13, 1894.

534,613. Trolley-Wire Support. Marcus T. *Murphy*, New Orleans, La., assignor of one-half to Robert Bensberg, same place. Filed Sept. 14, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

534,269. Electric-Light Switch. Harry W. Lawrence, Denver, Colo. Filed May 31, 1894.

534,424. Reflector for Arc Lamps. Carl Coerper, *Cologne*, Germany. Filed May 15, 1894.

DYNAMOS, MOTORS, ETC.

534,281. Electric-Current Distributing System. *Geo. B.* Pennock, Boston, Mass. Filed June 1, 1894.

534,288. Magneto-Electric Machine. Henry J. Smith, Pompton Lakes, N. J. Filed June 8, 1894.

534,536. Electrically-Operated Dental Engine. William E. Wheeler, Dayton, Tenn., assignor of one-half to Geo. W. Johnson and James F. Johnson, same place. Filed Oct. 6, 1893.

BATTERIES.

534,603. Storage-Battery. George A. Ford, Cleveland Ohio. Filed Aug. 11, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

534,359. Switch Device for Telephone-Circuits. Charles Clamond, Paris, France. Filed July 5, 1894.

534,373. Telephone and Signaling Circuit. Frank A. Pickernell, Newark, N. J., assignor to the American Telephone and Telegraph Company, of New York. Filed May 3, 1894.

534,547. Telephonic Apparatus. Norval L. Burchell, Washington, D. C. Filed Sept. 20, 1894.

SIGNALING APPARATUS, BELLS, ALARMS, ETC.

534,330. Electric Bell. William A. Harvey, Scranton, Pa. Filed Oct. 19, 1894.

534,364. Signaling System. William E. Decrow, Boston, Mass. Filed Dec. 31, 1892.

534,405. Electric Signaling Apparatus. Jonathan D. Price, Chicago, Ill. Filed May 5, 1894.

534,414. Railway Signaling Apparatus. William H. Walsh, Albany, N. Y. Filed Sept. 26, 1894.

534,485. Electric-Bell System for Street-Railways. Edward L. Stansberry and Jacob Bettinger, St. Louis, Mo. Filed May 7, 1894.

534,595. Electrical Alarm or Bell. George F. Atwood, Orange, and Jonas W. Aylsworth, Newark, N. J. Filed May 28, 1894.

534,597. Electrical Alarm for Street-Cars. George F. Atwood, Orange, Jonas W. Aylsworth, Newark, and Walter H. Miller, Orange, N. J. Filed May 28, 1894.

MISCELLANEOUS.

534,311. Alarm-Gauge Testing Mechanism. William H Bradt, Troy, N. Y. Filed Feb. 10, 1894.

534,318. Electric Winding and Synchronizing Device for Clocks. Charles M. Crook, Chicago, Ill. Filed June 23, 1894.

534,319. Electric Clock-Synchronizer. Charles M. Crook, Chicago, Ill. Filed July 2, 1894.

534,320. Electric Winding Mechanism for Clocks. Charles M. Crook, Chicago, Ill. Filed Dec. 15, 1894.

534,374. Electrical Apparatus for Operating Dental Implements. Oscar H. Pieper and Alphonse F. Pieper, San Jose, Cal. Filed April 30 1894.

534,481. Electric Rotary and Revoluble Air-Circulating Fan. Sherman M. Pierce, Kansas City, Mo., assignor of one-half to Chauncey S. Colton, same place. Filed Oct. 20, 1894.

534,528. Electrical Brush. Anson L. Sonn, Lansingburg, N. Y. Filed Oct. 15, 1894.

534,586. Circuit Making and Breaking Device. Samuel W. Stratton, Chicago, Ill. Filed July 2, 1894.

534,596. Electrical Conductor. George F. Atwood, Orange, and Jonas W. Aylsworth, Newark, N. J. Filed May 28, 1894.

534,608. Tower-Wagon for Electric-Line Work. John H. Leonhardt, Baltimore, Md., assignor to the Leonhardt Wagon Manufacturing Company, same place. Filed Dec. 29, 1894.

ELECTRICITY.

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EDITORIAL NOTES.

The Niagara Power Company Propositions. We print elsewhere a communication from Mr. Frank C. Perkins which furnishes much food for reflection, and which is likely to attract wide attention as containing an authoritative statement of what the Niagara Power Company is willing to do or is not willing to do in the way of attracting customers at a distance.

Statements have gone abroad as to the practicability of furnishing power at distant points from Niagara in competition with locally generated steam power which have been so exaggerated as to have called for comment from us before. All such statements as these are based upon a continuous operation of the Niagara plant to its maximum capacity, which cannot be expected even under the most favorable circumstances for years to come, if ever. Until that time the fixed charges must form such a large item as to seriously interfere with commercial competition. To make this more clear let us suppose that the invested capital at Niagara is $3,000,000. At 5 per cent. on the investment, and not including depreciation, labor, taxes, etc., or interest during the constructive period, this will mean $150,000 per annum which must be made good before profits can be thought of. In other words, this will be a standing charge in lieu of a coal bill.

The Niagara Power Company offer to sell undeveloped power in 10,000 horse power lots at $10 per horse-power. At this rate they would have to have custom for 15,000 horse-power to just meet this one item. In practice it would probably amount to $200,000 or 20,000 annual horse-power. If we count in labor, taxes, interest during construction period, depreciation, and the other little items which go to swell an expense account, it seems doubtful if the scheme would be on an even paying basis until it was supplying between 40,000 and 50,000 annual horse-power at a rate of $10 per undeveloped horse-power on the company's premises. So much for the basis of our belief that the project must be a losing one for some years to come even under these most favorable conditions for the company.

They are, however, willing to bear this loss in the hopes of finally recouping themselves, so that this feature need not concern the public further than to indicate the difficulties against which the company must contend during the first few years at least in meeting competition in distant cities. The question of Buffalo is the first one to present itself, and in Mr. Perkins's paper we are given the propositions submitted by the Niagara Power Company which it may be well to consider.

The power company states that it cannot *economically* transmit to Buffalo less than 10,000 horse-power and it cannot consider the transmission of any less amount. It probably knows pretty closely what it is talking about, for Prof. Forbes has frequently stated in public that the cost of *transmission* to that point has been very carefully figured out. If this be true it also means that the city of Buffalo cannot do it any more cheaply. But 10,000 horse-power delivered at the outskirts of Buffalo does not by any means mean 10,000 horse-power that will be salable there. Nor is the problem by any means solved when the power is so transmitted. How to get it there in the most economical manner has been a matter of heated discussion, and the method finally adopted is still open to serious question, but difficult as this is as an engineering question it is a mere bagatelle as compared with that other one, of how to distribute the power when it is once delivered.

The Lauffen experiment, in which 300 horse-power was delivered at Frankfort over 100 miles of wire with a loss of but 25 per cent. in transmission, was a glorious technical triumph but a most miserable commercial failure, and yet this involved only transmission. It was the Frankfort experiment that rendered the Niagara experiment possible, but if the power company proposes to do nothing more than transmit the current it proposes to do nothing that has not already been successfully done. But it seems from the propositions before us that it does not even propose to do this. It proposes to furnish the power *at* Niagara and allow the city of Buffalo to solve the problems both of transmission and of distribution. If there were no other reasons than this shifting of responsibility, any proposition of this kind would be preposterous in the extreme. We would consider it hazardous in the present state of our experience for any one to undertake to transmit and distribute the power in Buffalo under a guarantee of satisfactory working even if he received a bonus of $10 per horse-power instead of being required to pay that sum for it undeveloped.

Then let us look at the figures offered and see what they really mean. We think it is safe to say that this transformation of the water power into electricity will not be with an efficiency of more than 85 per cent.; that the transmission efficiency will not exceed 75 per cent.; that the transformation at Buffalo will not average 75 per cent., and that the distribution in Buffalo will not be at greater efficiency than 80 per cent. This would give an ultimate efficiency of but 38.25 per cent. and make the power cost delivered over $26 per horse power. This is assuming neither fixed charges nor load factor. We know from ample experience what the effect of a given load factor is upon the cost of energy. In electric lighting stations in this country the best load factor is about 40 per cent., and this about doubles the cost of energy. We may assume that the load factor for the city of Buffalo will not exceed 60 per cent. This alone would bring the cost up somewhere near $43, and to this must be added the interest on the investment in wheelpits, wheels, side tunnels, transmission line, transformers, administration, taxes, etc., which will amount to—we do not know how much more, but it is easy to see that the figure $10 per undeveloped horse-power is not so very enticing after all. Some clue is given to one of these necessary additional charges by the power company's second proposition, which is to furnish power at $13 on the turbine shaft, and to another from its third proposition, which is $18 at the terminals of the power company's generators. Assuming it to cost $8 additional to convert the water power into electricity, we have already a cost of $51 per horse-power without considering at all the other items, which would doubtless bring the cost up, even with an honest administration, to a figure that is almost appalling in comparison with that of the undeveloped power at the Falls.

Further along in the power company's statement we are informed what it places the cost of transmission to a short distance at—viz., within the neighborhood of its hydraulic works. It states that it has contracted for $20,000 per annum to deliver 1,000 electrical horse-power to a user near by. This is a charge of $2.00 for transmission. As to the cost of transmission to Buffalo it says it cannot name a price, "as in the question of transmission are involved the *uncertainties of the loss and cost* of operation and maintenance." If the power company cannot estimate the value of these uncertainties after having some of the best engineering talent in the world engaged upon it for several years, we should like to know who can?

We think this pretty effectually settles in the negative the question of the advisability of the municipality considering these propositions.

Now as to the other statements in the proposition. The statement that the company cannot accept a time limit less than the term of its bonds is entirely reasonable. In view of all that has been done, and all that remains to be done, before the plant could be reasonably expected to be on a paying basis, a limit of thirty-five or forty years is none too long if a favorable contract can be obtained for that period. But the other statement, that the company cannot consent to the fixing of a maximum or other price within the city, is a confession of weakness and an acknowledgment of the difficulties yet to be solved that we are surprised to see made. We repeat the question—if the Niagara Power Company cannot fix a maximum price, or rather a minimum price at which they can make a profit, who can? If the city of Buffalo should buy power as suggested, it might and in all probability would, find that when it got it to Buffalo it would have something it could not get rid of at anything like what it cost. Better would the city vote a subsidy to the company to enable it to bring the power to its doors and then let it compete in the open market with other producers on the merits of its service and its price.

Mr. Perkins is sanguine of the success and honesty of municipal control. We would be more sanguine were it not for two very big "*ifs*" in the way. *If* a municipal government were as honest and efficient in business matters as a private corporation *must* be to succeed, and IF the business entrusted to its care involved no unsettled questions or untried problems, then municipal control *might* be advantageous. Unhappily, those two "*ifs*" will not down, but stand out in bold obtrusiveness in the present case.

Mr. Perkins quotes Dr. Emery's figures per annual H. P., with coal at $2 per ton, as $22. This is correct for steady working for ten hours per day. The other figures in his article are, however, for twenty-four hours per day. Dr. Emery's figures for twenty hours per day are $38. These figures, however, are only true for engines having a pretty constant load, and would be at least double if the same machinery were employed on loads similar to those obtaining in ordinary central stations. They cannot, therefore, be taken as any criterion by which to judge performance with low load factor.

* * *

Another Triumph for Young Blood. While three of our toothless contemporaries are chattering about their senility, and a fourth about its wildness and woolliness, the young blood of ELECTRICITY steps in and again carries off the palm for enterprise. We published Scott's paper with all the drawings last year a week ahead of our contemporaries, and we did the same thing this year with Bell's paper. While they are chattering, ELECTRICITY gets in its work.

* * *

The price of incandescent lamps has fallen within a few years from $1 *to* 20 *cents each. What was the cause? The competition of the independent lamp companies. For the service they have performed for the user, should they not now be remembered liberally?*

The Edison lamp is the one lamp which should be ignored.

Under the Searchlight.

Views and Opinions on Timely Topics.

The Milk in the Cocoanut.

(From the Boston Commercial Bulletin.)

The booming of Welsbach Light stock in Philadelphia continues, and about 1,000 per cent. of water is to be injected into the capital.

* * *

GENERAL ELECTRIC.

(From the Boston News Bureau.)

The General Electric Company is now earning upon the basis of above $2,500,000 net per annum, and if orders, as they have come in for the past two months, continue well into the present fiscal year which began February 1, there need be no action as respects the impairment of the capital of the company for the concern will earn itself into sound position.

The company is earning five times the amount of the preferred dividends daily accumulating, and there would seem to be no reason why, in time, these *should* not be paid.

The G. E. Company is doing the largest business *in its* history as respects the volume of its output measured in tonnage or pieces of machinery, and were the prices equal to those of three years ago, it would be earning *about 30* per cent. per annum upon its entire capital instead of having its capital selling at 30 per cent. of what it has cost most of its owners.

But even with prices on the present low basis the cost sheets have been liberally reduced by the introduction of machinery and labor-saving devices. The *company has* probably earned the past fiscal year above $1,500,000, but it has continued to charge off with a liberal hand and will shrink its assets still further in the final accounting, so that probably very little margin of earnings above what may be necessary will be shown, and the capital account, which is now all a matter of bookkeeping may be still further written down, swelling the capital deficit of last year.

But the foundation will be laid for the business of 1895, and the exhibit next year, if times are even as good as at present, should give stockholders encouragement.

General Electric directors will not talk; they have "resolved" to neither talk themselves nor allow anybody else to talk for them, but the above is not "talk": just fact which it is not our duty to conceal.

G. E. Directors will not talk. This is true. But evidently they are still ready to pay sycophants and serfs to talk for them.

If the G. E. Company is earning $2,500,000 net annually, who is stealing the money?

One thing is certain, it is not in sight.

The bank account does not grow, cumulative interest on the preferred stock is not paid, and no important investments are reported.

Meantime assets are sold from the treasury, old accounts are cleaned up, and the next annual report will show a reduction of several millions in assets.

We will grant that the company is doing as large a business as ever—in VOLUME. But what are the results?

They are losing money on every dollar's worth of goods sold.

If we consult the official records we find that, taking every article of G. E. manufacture into consideration, *their selling prices average less than* 50 *per cent. of those in force in* 1892.

They did not make money then, but paid current expenses out of the sale of bonds.

How can they make money now?

The annual meeting has been postponed as long as possible. When it is held, there will be many questions to answer, and ELECTRICITY'S representative will be there to report the proceedings.

So far Charles Albert Coffin is the only man publicly disgraced by the brief career of this remarkable company.

How long will it be until the representatives of the ancient and honorable house of Drexel, Morgan & Co. will stand, in public estimation, in the same rank as Mr. Charles A. Coffin?

THE LAMP FIELD FREE FOREVER!

Decision in the Bate Case Ends Litigation.

THE BEST LAMPS WILL WIN.

G. E.'s "Vicious" Policy Judicially Ended.

The United States Supreme Court on Monday, March 4, decided, in the Bate Refrigerator case, that the date of issue, and not the date of application, controls in deciding the date of expiration of an American patent previously patented in a foreign country.

This decision settles finally a question in patent law which has long been hanging over the industry like the sword of Damocles, ever threatening to fall and cut asunder interests of the greatest magnitude, and therefore creating a feeling of extreme unrest among those who might be affected by its descent.

The question involved is whether the date of filing an application for a patent or its date of grant is controlling in the life of a patent which is affected by the expiration of a foreign patent granted for substantially the same thing.

Section 4,887 of the Revised Statutes says that every patent granted for an invention which has been *previously* patented in a foreign country shall be so limited as to expire at the same time with the foreign patent having the shortest term.

It so happened that in the Bate Refrigerator case the patent had been applied for in this country and subsequently in Canada. The patent was not granted in this country, however, until *after* it was granted in Canada. The question arose whether the Bate patent, having been *applied* for here first, should enjoy a life of seventeen years from date of issue, or whether its life was limited by that of the Canadian patent which was first *issued* and had a life of fourteen years.

The question has been decided a number of times by the Circuit Courts that the date of *application* had nothing whatever to do with the life of the patent and that the date of issue alone controlled.

According to this decision the Bate patent, although *applied* for first in the United States, expired with the Canadian patent, which was *granted* first.

An appeal was taken from this decision to the United States Supreme Court, and since many other important patents are in the same condition precisely as was the Bate patent, the final decision has been awaited with the utmost anxiety. Among the patents so affected was the Edison lamp patent No. 223,898. The application for this was filed in the United States, November 4, 1879, and the patent was granted January 27, 1880. It would therefore expire by expiration of full term of seventeen years on January 27, 1897. Edison subsequently applied for a patent on the same thing in England on November 10, 1879. The complete specifications were filed February 6, 1880, and the great seal was attached on May 10, 1880. The life of this patent was fourteen years, and it would expire on May 10, 1894. According to the Supreme Court decision, this lamp patent also expired in the United States on this same date. Thus the hopes of a continuance of the lamp monopoly until January 27, 1897, which would have been realized had the decision been the other way, have been blasted. This decision will also have the effect of throwing out of court those cases for infringement of the lamp patent brought by the General Electric Company since the date of May 10, 1894, and doubtless affect other litigation of the same character.

The telephone patents are also affected. It will be remembered that Judge Carpenter decided the Berliner microphone patents void. These patents though only granted on November 17, 1891, had been applied for fourteen years before. An appeal was taken from Judge Carpenter's decision in the hope that it might be reversed by the Supreme Court. If a reversal could be obtained, the broad principle of variable contact transmitters might have been monopolized for seventeen years from November 17, 1891, or until November 17, 1908, provided also that the present decision had gone the other way. It matters not, however, now, whether on appeal the Berliner patents be declared valid or invalid, since by the present decision the broad principle of microphone transmitters is public property anyway.

There are still other patents affected favorably to the public by this decision. Edison obtained three patents covering broadly the use of carbon transmitters. These were all granted on May 3, 1892, and had a history very similar to the Berliner patents.

So long as these were alive they constituted a practical monopoly of microphone transmitters. These were issued to the Western Union Telegraph Company and by them transferred to the Bell Company. The validity of these patents was not affected by Judge Carpenter's decision and by their natural life would not expire until 1909. But previous to the granting of these American patents, other patents upon the same invention had been granted in foreign countries; some of these expired last year. Hence by the present decision the United States patents have also expired.

The manufacture of incandescent lamps is now free forever.

A decision in the McKeesport case is expected next Monday, deciding whether or not the Westinghouse Company has valid and unquestioned claims against the Edison interests and other manufacturers of lamps for past damages for infringement of the Sawyer-Man patent on fibrous or vegetable filaments. But inasmuch as all good lamp makers now use a structural filament, interest in this case is confined to the question of *past* damages.

Outside of the electric lighting field the decision is one of supreme interest.

The contract by which the Bell Company obtained control of the Edison microphone patents restrained the Bell Company from engaging in the telegraph business.

Within the present year this contract will have expired, leaving the Long Distance Telephone Company free to engage in the telegraph business. The injurious effect of this move upon the Western Union business cannot be easily computed, and this company may be injured more by the decision than the Bell Company itself.

However, monopoly in the telephone business, as in the electric lighting business, is broken forever, and the next year or two will witness a complete change in the situation.

The next annual report of the G. E. Company will now undergo another revision, and $4,000,000 more will be taken off the item of patent assets—if the directors are honest.

A CORRECTION.

In the tabular matter entitled "Transactions in Local Stocks and Bonds" unintentional injustice was done to two local companies, the Rutland Electric Light Company and the Portland G. E. Company, by a slight error in the types. By the misplacement of reference marks both these companies were made to appear as receivership properties. This was not correct, of course, and as everyone in the trade knows, the credit of these companies is very good indeed. We regret the error, but do not believe either concern could be injured by it.

THE DAY OF JUDGMENT POSTPONED.

John Randolph of Roanoke was the first, we believe, to enunciate the truism that a corporation has no body to be kicked, no soul to be damned.

It is evident that the G. E. Corporation has enough individual responsibility left to desire, like the rest of us, to postpone the day of judgment as long as possible.

The New York Stock Exchange having passed a resolution that all companies having listed stock should issue their annual report at least two weeks in advance of the annual meeting, the G. E. directors at once decided that the annual meeting of this company, which should be held early in April, be postponed to May 14, thus giving all the time possible for the manipulation of the shares on the market.

Go slow, Mr. Charles H. Coster and Messrs. Board of Directors—the day of judgment may be postponed, but it cannot be finally averted.

You will yet answer for your connection with the greatest swindle of this decade.

WISDOM FROM THE FOUNTAIN HEAD.

Pudd'nhead's View of the Situation.

(From the Electrical World, March 2.)

While the G. E. Company has been knocked out in several important instances, its position has been strengthened in other directions by favorable decisions equally as important. Among other things, the company won this week at Cleveland, Ohio, the suit of the Edison Electric Light Company against the Universal Electric Company to enjoin the manufacture of incandescent lamps. The decision is understood to cover very broad principles and to be of great value to the General Electric Company.

$$\text{G. E.} = \frac{100}{10}$$

Municipal Ownership of Niagara Power Distribution for Buffalo.

BY FRANK C. PERKINS, M. E.

A number of resolutions have been passed by the various business associations and societies of the city of Buffalo, and have been submitted to the Street Committee, who have the subject of the Niagara Electric Power Transmission franchise under consideration. Some of the associations recommend that the city of Buffalo contract for the power either at the city limits or on the lands of the Niagara Power Company, and transmit and distribute the electric power at cost to the consumers in the city of Buffalo. Other societies are strongly opposed to this plan, and recommend that a franchise be granted to the Niagara Falls Power Company with the necessary restrictions to guard the interests of the city.

Whether the decision is finally made in favor of municipal ownership or not will be dependent largely upon the final attitude of the power company: 1st, In reference to a time limit of franchise, the power company desiring a 35 to 40 year limit, while many members of the associations consider a short period to be best for the city's interests; 2d, The naming of a maximum price for electric horse-power per year delivered in Buffalo, the power company holding that it is impossible to name a maximum price, while the members of some of the societies state that a maximum price is absolutely necessary in order to insure cheap power for Buffalo.

In case the power company should concede the short time limit and name a maximum price, the indications are that the franchise would be granted with few other restrictions as those two points seem to be the subjects of discussion.

In case the power company holds strictly to the conditions as given in the statement below, absolutely refusing a short-time period and the naming of a maximum period, then the indications at present are that there is likely to be a more serious consideration on the part of the city of the desirability of taking the power at the city limits or at the Niagara plant and making the distribution independent of the power company.

The question of municipal ownership is one that should be looked into with great care. 1st, As to the success of such an enterprise. Can it be accomplished? The visiting of from 40 to 50 central stations in Italy, Switzerland, Germany, Austria, France and Great Britain, for both electric lighting and power distribution, convinced me that municipal ownership, if properly looked after, is a success, as many of these stations were giving excellent satisfaction, and were owned and controlled by the city.

Whether it is for the best interests of a city in this country is a question yet to be decided. There is no doubt, if the best management is secured—if it can be successfully divorced from politics and there are no pockets to be filled—municipal ownership can be made a success in this country. The people are beginning to wake up, and the methods practised in the past in New York City and some other large cities are being repudiated, and it is hoped will soon be abolished forever.

It is a question of vital importance whether municipal ownership is advisable at this time for the Niagara power transmission. In regard to the discussion a year ago, it might have been favorable for municipal ownership in regard to arc lighting, because in that case no experimenting was necessary. Hundreds of arc plants are in operation. The lighting of the city with arc lights was, therefore, no more of an experiment than the building of a schoolhouse. If such an arc plant had been built during the past year as was contemplated, it would now be furnishing 2,000 arc lights at a considerable reduction from the present price. In addition, after the Carnival had brought out what motors, etc., were best adapted for the Niagara power, the city could contract for 2,000 or 3,000 H. P., and belt the motors to the arc light machines according to the suggestions of Prof. Forbes, holding the the engines in reserve for an emergency, thus receiving their lighting for a very low figure. Such a steam plant would be necessary for a reserve, but would be adequate for a lighting plant three or four times its capacity.

It is, however, a serious question whether it is advisable now to take the distribution of power in the city of Buffalo off from the power company's hands, as there is still a great deal of experimental work to be done. Can the city do such experimental work as well or as economically as a corporation? Would it not tend to make the power company lose interest in the city distribution? Would it not tend to make the power company shirk responsibility? Would not the company naturally say: "Well, here is the power at the city limits, do with it as you please," and if mistakes occurred, which would be very liable to happen with the first apparatus installed, if a short-circuit was made which damaged the dynamos at the Falls, the city would be blamed and a lawsuit for damages might follow.

A discussion of this problem might be a matter of interest to the readers of ELECTRICITY, as the opinion of some engineers generally opposed to municipal ownership might be favorable in such a special case as this one, while other engineers, usually in favor of municipal ownership, might consider this an extra-hazardous undertaking on the part of a city. The opinions of Mr. Nelson W. Perry, of ELECTRICITY's editorial staff, would be very valuable, and would be appreciated by the many readers who are specially interested in this subject.

The three propositions of the power company for the sale of 10,000 H. P. to the city of Buffalo, delivered on the lands of the company at Niagara, are especially interesting, involving as they do the question which, if any, would be best for such an undertaking. The following is the statement by the Niagara Falls Power Company of its position in regard to its power for use in Buffalo in response to the request made at the Common Council meeting February 7, 1895:

THE PENDING APPLICATION.

This application has been made by the Niagara Falls Power Company as a necessary basis for its decision as to transmitting to and distributing in Buffalo 10,000 H. P. generated in its power-house at Niagara Falls. To be ready to do this will involve the extension of the present wheelpit by at least 140 feet, and the installation of three 5,000 H. P. turbines and three 5,000 H. P. dynamos in addition to those already ordered and partly installed (one being a reserve); also the building of transformers, transmission lines and a distributing system. We are advised that such extension of wheelpit and the necessary hydraulic and electrical installation can be made within eight months from the time the order is given for the work and plant. Before the order is given it is necessary, therefore, for the company to know, and at an early day, what action the city of Buffalo will take in regard to a franchise.

The Power Company has found that it cannot economically transmit to Buffalo less than 10,000 H. P., and it cannot consider the transmission of any less amount. If a proper franchise be granted, the company is prepared to institute the arrangements necessary to effect the proposed transmission and distribution of 10,000 electrical horse-power generated at Niagara.

While the company recognizes the propriety of provisions for the protection of property and the public safety, there have been suggested some restrictions which, if incorporated in the franchise, will absolutely prevent its acceptance by the company.

1. The company cannot accept a time limit less than the term of its bonds; such a restriction would deprive the company of any proper or usual basis for estimating the propriety, security or extent of its proposed investment; and

2. The company cannot consent to the fixing of a maximum or other price for power within the city.

The price must be left as a matter of negotiation in each instance between the company and the taker of the power, who will find adequate protection in the fact that unless the electrical power can be used at a cost below that of steam power it will not be used. The company will be prepared to sell, and can sell, power in Buffalo to those who wish to buy it only because they find it more economical than any other power.

MUNICIPAL CONTROL.

It has been suggested that the city purchase the power from the company at Niagara.

The company is now ready to execute a contract in either one of three forms for the sale to the city of Buffalo of 10,000 H. P., deliverable on the lands of the company at Niagara, upon the following terms and at the following prices:

10,000 H. P. undeveloped on lands of the company at Niagara, at $10 per horse-power per annum, twenty-four hour power; the city of Buffalo to make its own wheelpits and side tunnels and to put in its own wheels. The necessary water, the inlets and the necessary discharge space in the completed tunnel of the company are now ready to produce this power.

This form of contract is of public record at Lockport with the Niagara Falls Paper Company, by whom this form of power has been in satisfactory use for over one year, showing that interruptions from ice or other causes are not to be feared; or

10,000 H. P. developed on the shaft of turbines furnished by the company on the company's lands at Niagara, at $18 per horse-power per annum, twenty-four hour power, so to be delivered within six months from the execution of the contract; or

10,000 H. P. electrical alternating current, at a voltage of 2,000 as it comes from the company's generators at the power-house, twenty four hour power, at *$18 per horse-power* per annum, to be delivered within eight months from the execution of the contract.

In the event of the city making a contract for power in either of the above forms, the company will place at the disposal of the city all the data which it has gathered in a five years' study of the problems of transmission, and will arrange for a satisfactory use by the city rights of way between Niagara Falls and Buffalo which the company has acquired. These rights of way are three in number and are practically complete.

The company cannot name a price for electrical power transmitted to the Buffalo city line, as in the question of transmission are involved the uncertainties of the losses and cost of operation and maintenance.

PRICE OF ELECTRICAL POWER AT NIAGARA.

The company has made a contract with a large electrical power user for not less than $20,000 per annum for 1,000 electrical horse-power delivered on the company's land.

As this statement has been called in question, the company now offers to submit this contract to the inspection of the Mayor of the city of Buffalo.

COST OF STEAM-POWER IN BUFFALO.

Referring to the tabulated statement said to have been prepared by Mr. Richard Hammond, and recently published in the Buffalo *Courier*, showing the cost of 1,000 H. P. ten hours per day to be $21 per horse-power per annum, the company is prepared to prove that for the city of Buffalo and under the conditions assumed in that statement the annual cost of such ten-hour power is not less than $32 per horse-power per annum.

If there were any plants existing under the same conditions and of the other sizes mentioned in the publication, the discrepancy between the figures estimated for the larger units and the actual figures would be even greater.

With a determination to avoid all arbitrary estimates, consideration has been given to actual facts and actual conditions in the cities hereafter mentioned, and the following figures are submitted, which may be regarded as indisputable:

	Per H.P. per ann.
A recent test by a disinterested expert of the cost of steam power, ranging over a period of eighteen months, in a Buffalo plant using considerably over 1,000 H.P. under excellent conditions as to economy, shows the annual cost of such eleven-hour power to be	$32.70
At the Buffalo City Water Works with engine capacity of 3,600 H. P., the average cost of all the engines in use for the years 1893 and 1894, as stated by their engineer, for over 2,000 H. P. is	77.55
Mr. Knapp estimates that for 1895 the cost of 3,000 H. P. will be over	60.00
This is pump horse-power and the average efficiency of the engines having been found to be 80 per cent., the average cost of the steam horse-power of the pumping engines for the years 1893 and 1894 is	62.04
In Milwaukee, Wis., as the result of a year's work at the North Point plant of the city's water works, with steam pumping engines of 500 H. P. (a plant which Prof. R. H. Thurston, the recognized Ameri-	

can authority on the cost of steam power, pronounces one of the most economical steam plants in existence), a careful examination shows the cost of pump horse-power to be..	$75.83
And for steam-power to be	68.25
And this is exclusive of any allowance for insurance and taxes.	
In Urban & Company's flouring mill in Buffalo, a 400 H. P. plant operating twenty-four hour power, a recent expert test covering the year 1894 shows the cost of this twenty-four hour power to be not less than	45.00

Mr. Huntley, the General Manager of the General Electric Company of Buffalo, states that it is safe to say that in nearly every factory in the city the cost of steam power is not less than $45.00 to $60.00.

If the city does not desire to purchase power at Niagara as above suggested, then, within the limits and to the extent above stated, but not otherwise, the Niagara Falls Power Company respectfully renews its application for a franchise in the city of Buffalo.

It has generally been considered that the figures of Dr. Chas. Emery, as given in his paper before the American Institute of Electrical Engineers, were correct and fully within the safe limit for actual practice. Dr. Emery's figures were about $22 per H. P. per annum with coal at $2.00 per ton. In Buffalo the cost of coal is $1.80 per ton.

The Monocyclic System.

Discussion of Dr. Bell's Paper at the Cleveland Convention.

Mr. Kelly—I suppose I can honestly begin by paying a tribute to the ingenuity of the devisers of the system; but it is scarcely necessary, because we all know what they can do—how ingenious they have already proved themselves. I cannot help feeling, however, that in this case their ingenuity has been somewhat misapplied. The most serious fault with the system is that it did not come soon enough. If it had come before the polyphase systems had been worked out, perhaps we would not have needed any polyphase system, but coming when it does, it seems to me a step backward. In the first place, the generator, as Dr. Bell explained, is substantially a single-phase generator. Now in any given generator, it is not possible to get the same output and regulation when worked single phase as when worked two phase. Dr. Bell seemed to think that the two-phase was in trouble because of the difficulty of balancing the two circuits. I am more familiar with that system than any other, and my own reason for preferring it is because the regulation is better than if the work was thrown on one circuit. We have found that there is no more difficulty in balancing than in the common three-wire system. When it comes to the lines, I suppose it is in this point that the chief advantage of the monocyclic system is supposed to lie; but the system requires at least three wires and any polyphase system does not require more. Where lights only, and not power, are required, it only needs two; in practice that is all that any polyphase does. In any district where light only is required, you need only run a pair of wires, so that in this respect there does not seem to be any gain in the monocyclic system. The cost for copper is, at the least, according to Dr. Bell's diagram, higher than it is with the plain single phase, while the cost of copper in the two-phase three-wire system is very materially reduced. In the circular distributed I see it is stated that where power only is to be transmitted by means of the monocyclic system, the third wire is of the same section as the other two, making an addition of 50 per cent., but if the system is so working that this third wire is really a power wire, conveying energy, then there is not only this additional cost but the percentage of drop in the circuits is increased beyond that in the single-phase system.

Dr. Bell has raised the question as to the periodicity at which motors can be worked. Now there are undoubtedly great advantages in low periodicity in cases of long distance transmission; but one of them is not the possibility of operating motors. There is no difficulty in making polyphase motors of 16,000 alternations which will have high efficiency and start with large torque. As to the efficiency of the motor in the monocyclic system, there is nothing to be said against it, because the motor is substantially a polyphase motor, and whatever the polyphase motor will do of course the monocyclic will do.

Mr. Steinmetz—I am very much honored by being able to speak before such an Association as this, and may say that I have heard with very great interest Dr. Bell's interesting paper, and with much greater interest, Mr. Kelly's remarks. I can, however, not quite agree with his statement that the single-phase alternating-current system is antiquated and superseded by the polyphase system, and that therefore the monocyclic system is behind the times. The polyphase system has been before us now for nearly ten years. It made its appearance shortly after the single-phase system, and at a certain time after the Frankfort Exhibition, when our electricians came back from Europe and talked excitedly of what they had seen. Everybody seemed to think that the single phase system would soon disappear altogether. Nevertheless, we have now thousands of single-phase stations running, while the polyphase system is only just beginning to be used in special cases. Therefore I feel confident that the polyphase system will never be able to supersede the well-known single-phase system of old, but find that it possesses a limited application, although being very valuable at the proper place. The monocyclic system is entirely single-phase; that is to say, the total flow of energy issuing from the generator passes through zero and is fluctuating, while the polyphase systems share with the continuous system the common feature that the flow of energy is not zero, but more or less constant. E. M. F.'S of different phases, or currents of different phases, do not constitute the polyphase system; for in the ordinary single-phase system if a reduction coil is connected in series to incandescent lamps you get E. M. F.'s displaced from each other by 90 degrees; that is quarter-phase E. M. F.; and in a loaded transformer and in a transformer running light the currents are displaced in phase. In neither case, however, do we speak of a polyphase system. The polyphase system is indicated when both E. M. F.'s as well as currents differ in phase from each other.

Now with regard to the statement of Mr. Kelly that the output of a polyphase machine is larger than that of a single-phase machine, that is a common mistake, repeated now for years. It means that on the polyphase armature more wire can be put than on the single-phase armature. However, the output of an alternator is not limited by the amount of wire you can put on the armature, but by the armature reaction, or rather by that amount of armature reaction which you can take care of by the field; and in a single-phase machine you can by compounding take care of a very great armature reaction which you cannot take care of in the polyphase machine, where small armature reaction causes unbalancing of the circuit, in consequence of which the output of a polyphaser is less than that of a single phaser of the same size and speed, or at least not greater.

Professor Thomson—The paper of Dr. Bell was so full and so clear that it leaves very little for me to say, except that I can express my agreement with the statements of the paper, and that furthermore, after due consideration, I think Mr. Steinmetz has the right of it. He has given an enormous amount of time and attention and close study to the question of polyphase, single-phase and other systems, and has originated a number of remarkable combinations, one of which is the monocyclic system. I think the system undoubtedly accomplishes all that has been stated by Dr. Bell to be its advantages.

Mr. Scott—I have been, and I am sure all of you have been, very much interested in the presentation which has been made by Dr. Bell of the monocyclic system. We can take it, I think, as a carrying out of the remark that I made in an Association a year-and-a-half ago, that when we have an alternating polyphase system we have something that we can do something with. It is flexible—we can twist it about, we can make a two phase and three-phase system, and now a monocyclic system, variations of the polyphase system, and go from one to another and get the different advantages which any one of these may present for different kinds of work.

We have had the characteristics and advantages and merits of this system pointed out. It may be well, it seems to me, to bring forward some of the questions which arise with respect to the points which have been brought out so that they may be answered now, and that we may determine the relation of this system to the other systems. To those who are not immediately and technically familiar with the subject there is apt to be a sort of haziness about it. We hear first about the two-phase and then about the three-phase system, as if they were entirely new and different. As a matter of fact there is no fundamental difference between the two. Then we have a monocyclic system. What relation does it bear to the other systems? Is it radically and entirely new? Does this euphonious name mean something which is a departure from what has gone before, or is it a modification, and if so, of what is it a modification?

Starting with the source, the generator itself is just now somewhat in doubt. The single-phase generator is best, because it regulates better and has a better output. The polyphase generator, it is also stated, regulates well and has a good output, and without carrying that further, we can all be satisfied by taking our choice. We will consider a few points made with respect to the transmission circuit. There are one or two statements of Dr. Bell's which can either be called in question or certainly a little modification made to them. A two-phase four-wire system, which he has given as the third figure, he has considered as the correspondent of the alternating two-wire circuit only, and has not considered it applicable to use in a three-wire connection, in which the amount of copper is so much less. The reason of this was the added complication of running two three wire circuits. That might be true if the area to be covered were quite small, but as central stations usually run, the lines are carried out in different directions. In alternating stations there are anywhere from three or four to a dozen or several dozen feeding circuits running in different directions and supplying different territories. It is just as easy to divide these up into three-wire circuits for lighting, as the different parts of the city to be supplied or the districts are separated, as it would be if all of the circuits were of the same phase. If, therefore, the distribution can be carried on by the three-wire plan, the cost of copper here would be materially reduced and be made equal to that of the three-wire single-phase system. Considering the two phase three-wire system, the figure 145.5 was stated as the relative amount of copper used, and that a possible reduction to 72.5 if the extreme E. M. F. can be increased above that for the first figure upon the diagram, which is for the two-wire single-phase system. The assumption upon which all these figures have evidently been made is that there has to be a definite E. M. F. for the carrying of lamps. If that is to be carried through the various diagrams, then the 72.5 is a proper figure. If, on the other hand, a limited voltage is the consideration to be met, we have in the ordinary three-wire circuit twice the E. M. F. of the single-phase circuit. If the same be applied to the two-phase three-wire circuits then the amount of copper would not be 72.8, but one half, or about 36, so that the figure 145.5 in connection with that diagram is not in accordance with the assumption of the E. M. F. being controlled by the lamps in circuit; and if the highest E. M. F. allowed is that of the three-wire circuit, then the additional figure for the weight of copper for the two phase three-wire system should be 36 in comparison with the other figures.

Another point in connection with the lines is the unbalancing of circuits. It was stated that the two-phase three-wire circuit is one which is liable to unbalancing because of the reaction of one circuit upon another. While this is true in certain cases, in ordinary working it is one which would be met with but seldom. The next point in the system after going through our transmission circuits is the transformer. The transformers for transforming a given amount of energy for lighting or for power by the two-phase system, in which one transformer is placed on each of the two phases, is the same as that for the single-phase system. For the three-phase system, in which transformers are connected across each pair of mains, the converter capacity is the same; that is to say, if we have six transformers we may connect them in parallel across the single-phase circuit, or we may connect them in two sets of three each on a two-phase system, or we may divide them into three groups of two each on the three-phase circuits, and each transformer will have the same individual capacity in each position. When, however, these transformers are connected as in the diagram illustrating the monocyclic two-wire system, then these transformers, as has already been pointed out, do not operate in their ordinary way. Although the E. M. F. upon them may be normal, the currents flowing through the transformers differ from those in ordinary cases. They are not in phase with the E. M. F. upon the transformers, and the output of the transformers is reduced by a very appreciable amount—if I am correct in my present recollections, some 16 per cent. Thus transformers of about one-sixth greater capacity would be required for operating a motor under this system above that which would be required if the same motor were operated by two-phase or three-phase systems.

The transformers in the monocyclic three-wire system also seem to require an excess capacity. If the large transformer in that diagram is the one which supplies the lights and operates the motor when the motor is doing something, then the little auxiliary or teaser transformer is one which is useful only at the start and contributes nothing to the regular working of the motor according to the assumptions which have been made. This transformer, therefore, is an additional piece of apparatus which must be provided in the system.

With regard to the motor itself, I observe that the motor in the monocyclic two wire system is a three-phase motor and nothing else. I understand that the motors used are the standard three wire motors, and the motor itself does not know where it is getting its supply, whether from a regular three-phase system or a two wire monocyclic system. The transformers for this motor on the three-wire three-phase system would naturally be the three. We seem here to have cut off a part of this system by cutting out one of the transformers. We are not keeping the symmetrical arrangement now, but are supplying the motor by but two transformers, leading to the result to which I have just called attention, that is, a larger transformer capacity. The reversing of the secondary coil of one of the transformers, if I understand the connections and arrangement, would be obviated and the transformer would be connected directly without this crossing if the primaries of these transformers were directly connected to three-phase mains. Suppose we have a system, then, with three-phase mains with three transformers connected, feeding respectively the three circuits of the motor. Now we cut out one of these transformers, but our motor will still run, but without the same efficient performance of the transformers. If we change the relation of the middle wire at the dynamo, or change the voltage of this wire, we can do so in such a proportion that the phases of the two primary circuits will not have their former relation, will not be 120 degrees apart, but 60 degrees apart. In this case it becomes necessary to reverse one of the secondaries in order to obtain two currents 120 degrees apart for operating the motor. If, therefore, the teaser coil were wound with a different number of turns to give a higher E. M. F. we might have a three-phase generator supplying directly three-phase mains. What this seems to be, then, is really the elements of the three phase system distorted somewhat by changing the E. M. F. on the middle or teaser wire and reversing the secondary of one of the transformers and leaving out the third transformer. So much for the motor which operates from the two-wire monocyclic system.

The motor on the three-wire system seems to have somewhat different relations. This is not a three-phase motor, but, I take it, is a two-phase motor, and it is rather interesting.

Dr. Bell—It is a three-phase—the same motor as the other.

Mr. Scott—Very good; but on the diagrams I have seen of this monocyclic system I have taken it as a two-phase motor, the two windings being given in the diagram as two coils placed at right angles to one another. The very reason for bringing up this discussion and making it so full at this time is to get a correct understanding of these motors. The understanding which I got from the diagrams and explanations which I have seen of the system seems to me to represent a two-phase motor, one of the circuits being wound through directly similar to the monocyclic generator. This motor has been pointed out—I do not remember whether in the paper Dr. Bell has just read or not—as similar to the monocyclic generator, which is stated to be a single-phase machine wound with one winding straight through from one end to the other, with this little auxiliary or teaser coil connected between the middle of that coil and a third terminal. If this be the case, then it seems to me that this motor is either a single-phase motor or a two-phase motor. The explanation given of the operation of this motor has not been very complete to-day. If I make a mistake in drawing on other sources of information in regard to it I hope I will be corrected.

This motor I have taken to be a single-phase motor when running at speed, but essentially a two-phase motor which is supplied by the three wires that are operated by two transformers which have E. M. F.'s at right angles, or the 90 degree relation of the two-phase motor. We are supplying, then, to this motor the output of two converters which are operated at a difference of 90 degrees. All the circuits of the motor are active while the motor is coming up to speed. One of the windings on the motor is somewhat different from that of the windings on the transformer. It is not exactly proportioned in both of its circuits to the E. M. F. supplied, so that when run at speed one of the circuits does all the work. It is very much as if two transformers are connected in parallel, one giving 100 volts and the other 99 volts. If we put a load on the two transformers connected in multiple until the E. M. F. drops to 99 volts, then one of the transformers would be carrying all the load and the other nothing. The motor described here is the same motor, if I understand it correctly, as is described in the patents granted to Mr. Steinmetz. Then it seems to me that this motor is very similar to a sort of lopsided two-phase motor, stronger on one side than the other. The two circuits operate with fair effect to bring the machine up to speed, and then one of the circuits takes all the load and the other has but little to do. The motor in running at full speed and doing its regular work operates as a single-phase motor. A single-phase induction motor will not carry the same load that the two phase induction motor will. Anyone who has operated two phase induction motors knows that one circuit may be cut out and the machine will continue to run, but it will not carry the same load as before. If that be true, and the information upon which I understand the connection of this motor be true, then this monocyclic motor seems to be a rather decrepit two phase motor

There is one point to which attention was called by my able friend, Mr. Steinmetz, to which I take exception. That is his definition of a polyphase system or a polyphase motor. He was pleased to say that difference of phase in E. M. F. with no difference in current does not constitute a polyphase system, and he pointed out that if a coil and a lamp be placed in series, the E. M. F measured directly across the lamp and the E. M F. measured directly across the coil would not be in phase with one another, but would occur at different times. So also if a coil and a lamp be placed in multiple so that the same E. M. F. is on the terminals of both, then the currents are not of the same phase But he held that neither of these would constitute a polyphase system, because the flow of energy was not constant. A constant flow of energy may be taken as a definition of a polyphase system, so might difference of E. M. F. or difference of currents. As I understand a polyphase system, I do not mean that the E. M. F. at one part of the circuit may be one thing and at another part somewhere else another thing; either at a great distance or connected with a different piece of apparatus, that would not necessarily constitute a multiphase system; but if the two different elements with difference of phase cause the operation of that apparatus, then we have the essence of a polyphase system. If we have a motor and wind its circuits in such a way that the circuits shall differ in capacity or self-induction if the currents in the different circuits differ in phase, and owing to this the apparatus operates and the motor runs, then we have something which should be legitimately considered as polyphase apparatus. We have an apparatus which operates due to the difference of phases, or to too many phases, and in the polyphase motors that is the characteristic element. The element which causes rotation, the fundamental element, seems to be the shifting of the magnetic field in the apparatus. It is not fundamentally essential to the operation of such an apparatus that the currents give equal energy to the apparatus at all times, but that they be supplied in such a way as to give the shifting field which will cause the rotation and running of the apparatus. I would therefore call a multiphase machine one which has in it a shifting magnetic field of many phases or currents producing these magnetic fields, rather than one having a flow of energy to the apparatus.

The power wire operating in the monocyclic three-wire system is said to be a powerless wire. This wire is for the purpose of operating the motor while it is coming up to speed. The two great problems in an alternating current motor are the bringing of the motor up to speed and the keeping of it there. These are two different problems, and different methods are devised for effecting the two different results; very often the elements which contribute to one detract from the effectiveness of the other. The power wire, if I am right in understanding this motor, does not necessarily supply power to the motor at the time when the motor is running at full speed, but it contributes to the power which is required for bringing the motor up to speed, and would continue to deliver power to the motor instead of lying idle and resulting in so much idle copper in our system if the motor were a complete and symmetrical motor instead of one which has possibly been made defective to meet the requirements of this system

Dr. Bell—The first question raised may be granted, that the monocyclic system is a modification of something. Is it now to be considered as a single-phase or two-phase system, or a polyphase system of some sort? I think that question was clearly answered by Mr. Steinmetz when he pointed out that you must consider as a polyphase system one in which the energy remains constant—the common characteristic of all polyphase systems whether evenly balanced or unbalanced. In the monocyclic system we have three currents substantially in phase with each other, and the told energy passes through zero. I fail to see how the widest possible extension of the definition of a polyphase machine could be made fairly to include it. The most that could be said would be that there might be a limiting case in which the unbalancing of a polyphase system might go on until the total energy would actually pass through zero. If that is so, it might serve equally well as a limiting case for either the single-phase or the polyphase system. It is certain that the monocyclic in its operation suggests a polyphase system in the character of the currents which flow through it and in the distribution of the energy. It is peculiarly single-phase in its character. I was interested in Mr. Scott's remarks on the subject of the four-wire connection of the two-phase, and in the second place, the three-wire connection of the two-phase system. Now, with a four-wire connection, it is of course possible to use the Edison three-wire system on each branch if one so desires; but in order to do so, and to run motors at the same time, one must interlink the two three-wire systems—in other words, you must have two three-wire systems, each system being approximately balanced as to itself, and each three-wire system balanced as respects the other three-wire system occupying the same territory. They must be interlinked for motor service, and that is the reason which, I maintain, bars out the two-phase four-wire system from employing the Edison three-wire connection, just as it must bar out in the same way, and even more effectively, the three-phase system from operating on each of its three phases an Edison three-wire system. It makes a complication of circuits for general distribution which would be perfectly intolerable—two three-wire circuits in the same territory, and each balanced with respect to the other; it would be something better imagined than described. In certain cases for lights only it may be applied, because you are at liberty to scatter your circuits, but even then it would require more or less balancing of the two systems, else you get into trouble with one side of the machine having a greater load than the other, which causes a difference in drop which cannot be compensated by compounding. With the two-phase three-wire system Mr. Scott's point was well taken on the question of maximum voltage. However, if you are dealing with the maximum permissible on the transmission line, where the thing to be considered is not the maximum on the distributing system to translating devices but the maximum permissible on the whole system—if you confine yourself to that, you will find that combining the two-phase into three wires requires excessive copper. If you confine yourself to the secondary system alone it will be possible to permit the same maximum voltage as on the straight Edison three-wire, and I should say that the same rule would apply to the reduction of copper in the three-phase three-wire system or any other systems in varying degree according to their character.

As regards the question of unbalancing, I think I stated with a fair degree of distinctness that with any polyphase system, though unbalancing may occur, and occur in a serious degree, I do not believe it would be a common occurrence. I think I specifically included the polyphase systems in general.

With regard to the question of the reduced capacity of transformers operating on three-phase or monocyclic systems: As a matter of fact there are three plans of working, we will say, with a three-phase system as regards its transformers; in the first place we may have a composite transformer, including all three legs of the circuits, which has been used with very fair results. Next we may use three transformers, or finally only two transformers. Sometimes it is more convenient to use three, and sometimes two. We must remember that there are not to be had an infinite number of sizes of transformers, nor an infinite number of sizes of motors. The consequence is it is sometimes a difficult matter to find transformers which will exactly fit a given horse-power of motor, and the loss of capacity which is thus met in furnishing transformers too large for the motors (because we must be sure to have them large enough) may easily amount to 10 or 15 per cent. either with two or three phases, and unless special transformers are made to fit the motors we are liable thus to require an increased total capacity of transformers as well on two-phase as on three-phase systems. With the three-transformer connection for the three-phase circuit we have one very material advantage which perhaps makes it worth while to employ it in many cases, and that is if one of the transformers for any reason is crippled we can operate at least two-thirds of the output with the remaining two, whereas on the two phase system if one transformer gives out the motor is crippled, either by overloading and stopping absolutely or able to run at half output as a single-phase motor, but in no case starting until the transformer is fixed. If two transformers are used, the statement has been made that the loss in output in connecting three-phase transformers is about 16 per cent. I would like to see experimental evidence brought up in this case. We have been informed in many well written technical articles that the output of the polyphase machine was thus and so in connection with a single-phase machine, and we know that the facts do not fully bear out the theory. We are now given similar information in regard to the transformers. While I am not prepared to dispute the fact without having experimented on it, I would like to see some evidence that the difference in output rises to any practical magnitude.

As regards the teaser transformer, I think we may consider the secondary transformer on the monocyclic three-wire system as practically part of the power wire. It needs to be of small size and furnishes only a small amount of energy. With that connection the one transformer furnishes the power wire for the whole three-wire system. It is not a part of each motor, simply a part of a power wire, and as such it may be taken as a part of the installation belonging to the three-wire system. The single small transformer in the system furnishes the entire power wire for the whole system.

As regards the motor on the monocyclic two-wire system, it is correct in a sense to say that the motor does not know whether it is on a three-phase circuit or a monocyclic. As regards its operation, it does not know—that is, as regards the direction of the E. M. F.'s in it. It is a matter of perfect indifference which system it is on; but as regards the character of the currents and their direction, if the motor possessed an ammeter to put in its own coils it would find there was a very large difference in the distribution of currents. As regards its magnetic qualities it would not matter, although the actual distribution of the current is widely changed. We have in the monocyclic induction motor a motor which in its operative qualities is like a polyphase motor. Nevertheless, the distribution of currents in it, although resulting in a perfectly symmetrical production of motive power, is something that you cannot find in any polyphase motor. It depends on the particular action used in the monocyclic system. It has essentially a single-phase current, although its effect as regards magnetism is closely similar to that of the true polyphase motor.

As regards the motor on the monocyclic three-wire system, I was much pleased with the ingenuity with which Mr. Scott constructed a large, able-bodied and well-dressed man of straw for the purpose of knocking the gentleman down and jumping on him with both feet. The motor is not a two-phase motor of any kind. It is an ordinary induction motor, such as is used indifferently on three-phase or monocyclic systems. Doubtless, from the experience of the speaker, he deeply realized how bad a bad two-phase motor could be. The winding of the monocyclic motor is in every respect similar to that of the three-phase motor. There is a possibility, and sometimes a great convenience, in being able to work a monocyclic generator as a synchronous motor. Used in such a way it works during its operation like any other synchronous motor. It is a possibility which is sometimes very convenient. The motor starts itself, and the teaser coil, when the motor is up to speed, produces no effect on the rest of the system if the motor is properly designed with reference to suppressing the E. M. F. of the teaser circuit. In the monocyclic three-wire system we have in the first place a three-phase motor structure, but operating on a monocyclic three-wire and teaser circuit, with the properties and distribution of currents—or electrical character—of the single-phase system. The actual details of operation in a monocyclic motor are somewhat complicated. Substantially we have a structure which in all its characteristics is only proper to be operated on the monocyclic or three-phase circuits. The currents which flow through it, however, are not three-phase currents, the E. M. F.'s being 120 degrees apart. The currents are substantially in phase, but the magnetism produced is so distributed as to give a perfectly symmetrical torque on the motor just as though it were run upon a polyphase circuit—a point which, I think, justifies me in the remark I made at the beginning, that the monocyclic system is to be regarded not altogether as a modified and glorified single-phase, nor again as a decrepit and disreputable polyphase system, but rather as in a class by itself.

The discussion on Dr. Bell's paper, which was broken by other business and adjournment on Wednesday, was resumed at Thursday morning's session, as follows:

W. R. Gardener, of Pittsfield—I am very much interested in this question of multiphase apparatus, and after hearing the paper read yesterday, and the arguments which followed it, I am not quite certain about it. I do not pretend to know anything about polyphase or multiphase systems, or teasers, or anything of that kind, but I do know when I have something in my station that gives me perfect satisfaction. I know that I have got something in my station that satisfies my requirements as central station man. We are operating a two-phase machine, and have been for over a year and a half. The first work required of the two-phase machine was to furnish fifteen horse-power a mile and a half from our station over an existing circuit. We ran an extra wire, and from that circuit are furnishing incandescent lights to stores and dwellings and also this fifteen horse-power. Later on a fire occurred in a mill and their engine was destroyed. We put in two motors of twenty horse power each, and furnish power on this circuit, giving perfect satisfaction. Our business increased, and we were obliged to put in larger machines, and to-day we are furnishing power, incandescent and arc lights from this one machine. We are at the present time going to change our station. We have got five alternating-current machines from 750 to 1,500 lights capacity—machines as good to-day as when they were bought—but we cannot afford to run them as long as there is something better. But the items of repairs on ordinary apparatus is enormous, as you know. With these two-phase machines, including the transformers and motors, we have not spent one cent. We are going to take out the five machines referred to and put in one two-phase machine, and instead of our dynamo attendants bobbing from one end of the switchboard to the other and reading five ammeters and voltmeters they will read one. We have not experienced any difficulty on these lines.

Royal E. House.

Royal E. House, who died recently in Bridgeport, Conn., was born in Susquehanna, Pa., in September, 1814. His first patent was numbered 1,200, his latest No. 533,600. Prof. Morse had taken out his earlier patents, but had not built the first electro-magnetic line from Washington to Baltimore when Mr. House conceived the idea of the printing telegraph. He made his first machine for this purpose in 1844 and exhibited it in New York. The system printed its message in Roman letters, and the actual speed attained was fifty words a minute. In 1884 the Morse Company filed a petition for an injunction, claiming an infringement, and to stop House operating a line between New York and Boston. The court decided that there was no infringement. When it was found that by the Morse system the message could be taken by sound the expensive machine of Mr. House went out of use. Mr. House was the inventor of several other instruments used in telegraphy.

Have Opened New Office.

The firm of Metcalfe & Moeller, whose main office is at 348 Ninth avenue, have opened a down town office at 201 Electrical Exchange Building, where orders may be placed for the repair of incandescent lamps, and all business with the concern can be attended to.

THE AMERICAN INSTITUTE.

H. Ward Leonard's Views.

On Wednesday evening, Feb. 27, the American Institute of Electrical Engineers held its 94th meeting at New York and Chicago. The chief feature of this meeting was the reading by Mr. H. Ward Leonard of a paper giving his impressions of electrical engineering developments in France and England which were gained from a recent visit. The paper was one of exceeding interest and drew forth a most animated discussion which was participated in by Messrs. Wolcott, Lieb, Emery, Lloyd, Kennelly, Forney, Hutchinson, Sachs, Houston and others at the New York meeting, and doubtless by quite as many at Chicago, but of the latter meeting no reports are as yet at hand. The following is an abstract of Mr. Leonard's paper:

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND.

As a result of inspecting some of the most interesting of the developments in the field of electrical engineering during a recent trip to France and England, and as a result also of having met many of the engineers responsible for these recent developments, I find it difficult to reach a conclusion as to whether we or our contemporaries across the water are ahead in the electrical engineering race.

Although I have always felt that so-called fundamental patents and the resulting enormous aggregations of capital and engineering talent under one management were a millstone around the neck of our profession, I have never before had the opportunity of seeing positive and unmistakable evidence of it such as this visit abroad showed me.

In the beginning of electric lighting, both arc and incandescent, we led the world from an engineering standpoint, and were years ahead of any other country. But what has been done in this country in the way of a remarkable electrical engineering development since Edison started his first three-wire system at Sunbury, Pa., in July, 1883, and Westinghouse established his alternating system with 1,000-volt primary and 50-volt secondary a few years later, and Sprague started the Richmond electric road. A moment's thought will, I think, make you all realize that the practical development of electrical engineering improvements is almost impossible against the opposition of the gigantic corporations in that field, and that corporations having such a large portion of their capital represented by patents will not wish to see the practical trial of a promising improvement which they do not control, and which may depreciate the value of the methods they control or claim to control. It is just this way that we are losing ground when compared with England and France.

We undoubtedly have the best three-wire central station plants in the world, also the best alternating system converting from 1,000 to 50 volts. But what other kind of central stations have we to point to? Practically none.

We have 500-volt continuous current electric railways galore, and we operate such railways at distances for which 2,000 volts should be used instead of 500, and after investing more money in copper per car than the entire cost of the electrical equipment we still lose twice as much energy as is commercial in the line.

Is there a large electric railway system in this country which as an electrical transmission of power is a credit to our profession? Not one.

In France, and even more in England, one is forcibly impressed by the many kinds of central stations being tried. Many of them may seem almost sure to prove commercially unsuccessful, but who can say which one may not prove the "Sunbury" of an enormous electrical engineering development?

No capital or patents can prevent the slow development of evolution, but I fear that under the existing conditions we shall have to content ourselves with drawing pictures of what might be done, and watch the continued introduction of the three-wire system of 1883, the 1,000 to 50-volt alternating system of about 1887 and the continuous current 500-volt railway system of 1887, while our engineering friends abroad keep trying not only their own ideas, but the ideas of many of us from this side, because they have the necessary encouragement and opportunity to do so while we have not.

MANUFACTURING AND ENGINEERING.

In England there is a multitude of medium size concerns, manufacturing electrical apparatus, and the competition is mainly on ideas, and not the cost of dynamos per kilowatt. It is surprising to find that generators and motors are much cheaper in the United States than in either England or France, notwithstanding their advantages over us as to cheaper raw materials and labor.

STEAM ENGINES.

I believe we are ahead of England and France in the designing of dynamos and engines. Their workmanship leaves nothing to be desired, but giving consideration to amount of material used, efficiency and design, I think we are in advance of them.

One of the most surprising things to me was to see the almost universal use of engines which we would consider had practically no governor. That is, engines using slow acting throttling governors instead of the triumphs of engineering skill which are so common in this country. Not since 1883 have I seen such poor governors as I found generally used abroad in the finest and most recent stations and upon engines which are almost perfection itself as regards manufacture.

THE PARSONS STEAM TURBINE.

The Parsons steam turbine was one of the most interesting things I saw in England. These steam turbines are direct coupled to dynamos, and in sizes of 350 K. W. revolve at 3,000 revolutions per minute, and of course run at higher speed in smaller sizes. The space occupied by a 350 K. W. outfit is over all about 25 feet long, 5 feet wide and including governor about 7 feet high. These turbine plants when running at these high speeds are entirely free from vibration and are not even bolted down, but are supported by three pedestals, one near each end and one at the middle. There are some seven or eight bearings all in line, and a continuous stream of oil is forced through the bearings by a small pump driven by a worm on the main shaft.

Tests by Professors Ewing and Kennedy indicate that this turbine when in perfect condition has an efficiency of one K. W. hour in electrical energy produced by 28 pounds of feed water, the turbine being operated condensing. At Newcastle-on-Tyne I saw a central station of about 25,000 lights operated solely by these steam turbines, and which has been in operation since 1890 and has been earning and declaring dividends ever since it started. An interesting fact as to this Newcastle station is that all the conductors are laid underground and consist of vulcanized rubber cables drawn into cast-iron pipes which are gas and water tight, and through which chemically dried air is forced from the station by a blower.

THE LAVAL STEAM TURBINE.

Before leaving the subject of steam turbines, I will refer to the Laval steam turbine of which I saw a number in the works of the manufacturers, Breguet & Co. of Paris. The number of revolutions of the disk per minute varies from about 30,000 to 15,000 in sizes from 5 to 50 horse-power. The buckets are milled out of a solid disk of steel just inside the periphery, so as to leave a solid band on the circumference. The edges of the buckets are quite sharp. The disk in a case of a 50-horse-power turbine is about ½ inch thick. This disk is mounted on a small steel flexible shaft at a point about ⅓ from one end. At the high speeds in question, a body tends to revolve about an axis through the center of gravity, and since it is impracticable to make the center of gravity absolutely coincident with a straight line joining the bearings, Mr. Laval has used a flexible shaft so that the disk is free to assume such a position as to revolve practically around an axis through the center of gravity, and consequently the disk revolves with perfect smoothness and without any trouble at the bearings at these enormous speeds.

The Laval people claim as high efficiency as that of any steam engine of the same horse-power, and there seems no good reason to doubt their ability to secure such an efficiency which they guarantee fully and specifically.

A careful test made at Stockholm in 1893 showed an efficiency of 20 pounds of water per horse-power hour with steam at 113 pounds initial pressure and used condensing. The weight of this turbine is about 30 pounds per horse-power in a size of about 30-horse-power.

The simplicity of this steam engine, also its theory and practical design, in detail are most beautiful, and it seems likely to become an important factor in the electrical field. What is needed is a generator of electricity directly driven by, or preferably constituting a part of, the revolving disk, and here is food for considerable thought.

ENGLISH CENTRAL STATIONS.

In London I visited several stations of which I will mention two. The first is that of the Metropolitan Electrical Supply Company. This company has an enormous area allotted to it. I found four Parsons steam turbine units of 350 K. W. each, running at 3,000 revolutions per minute. I inquired as to the working of the steam turbines and was informed that they were not able to detect any difference in their coal consumption compared with the compound condensing reciprocating engines formerly in use.

The other London central station I shall refer to is that of the City of London Company. This company supplies the heart of London—that is, the old "City of London"—which is without doubt the best central station territory in the world, on account of the wealthy nature of the customers, the substantial character of the buildings, and especially because of the peculiarly dismal foggy weather in London. While I was there artificial light was required almost as much by day as by night. This central station is beautifully located on the south bank of the Thames, near the center of lighting, and is a fine example of the best that can be done to-day with the alternating system under such conditions. I do not believe it would be possible to find less excuse for the use of the alternating system than in this station, and yet I expect it will pay, for it can hardly fail to earn money under such extraordinarily favorable conditions for lighting.

But I need hardly say that they have no motors except toys, and but few of them; and when I remember that in Chicago 40 per cent. of the connecting load is motors, and that this percentage is rising all the time, it seems evident that the City of London Company is terribly handicapped by the use of the alternating current. However, they have a 2,000-volt primary three-wire secondary, and operate the dynamos all on multiple-arc, which is certainly using the alternating current to the best advantage. Aside from the use of the alternating current under these conditions, it is difficult to say anything in criticism of the central station.

The plant is arranged on the panel system, which Mr. Mordey says originated with him, and which is thoroughly carried out in this station, for each panel or section across the building comprises an independent unit including a boiler, engine, dynamo and switchboard for 500 K. W. The engines are vertical, and direct-coupled to the Mordey alternators. The switchboards are entirely novel in design, being cast-iron pyramids about ten feet high, standing clear from the wall and having all of the conductors inside, with the instruments, etc., mounted on the front face. While very finely finished and ornamental, I could not but think that the vital parts would be more difficult to inspect and repair in case of emergency than in our recent switchboard practice.

One detail of electrical construction in which the foreign practice seems very backward is the rheostats. In this magnificent station in the City of London, for instance, and in many other places, I saw rheostats made by winding german silver wire on a slab of slate, which was then mounted on insulators horizontally on a table, and a slider arranged to move over the surface of the resistance wire itself, which was thoroughly exposed.

Another detail in which we are certainly in advance of foreign practice is our instrument work, for which we must thank Mr. Weston solely. I saw many fine instruments while abroad, but they seemed to be more suited for a physical laboratory than a central station; the substantial, compact, permanent features of the Weston instrument, with its readable scale and dead-beat index, were conspicuous to me by their absence.

FRENCH CENTRAL STATIONS.

In France the most interesting central station I saw was in Paris, where I visited a sub-station designed for a capacity of 30,000 lights. The sub-station was supplied from a distant central station by means of a constant current of 250 amperes, all devices on this current being in series, and the total E. M. F. running as high as 6,000 volts at times.

In the sub-station were rotary transformers, the primary ends of which were series wound motors and all being in series. The secondaries of these rotary transformers as generators fed a five-wire system of conductors, and in multiple-arc with these generators across the five-wire system was a bank of storage batteries. The lamps used were 110 volts; some of the rotary transformers had 110 volt secondaries, four of such secondaries being in series so as to make the five-wire system complete independently of the batteries. Other of the rotary transformers had 440-volt secondaries and fed the outside conductors only. On each rotary transformer was a rheostat, which was in multiple with the series wound field, and which by a step-by-step movement similar to that of the old U. S. automatic regulator, controlled the strength of the series field so as to keep the E. M. F. in the secondary constant, the controlling magnet of the automatic being across the secondary of constant E. M. F.

The storage battery plant was well designed and seemed to be in good order. It was as clumsy and seemed as full of troublesome possibilities as those we have on this side of the water. It had capacity for 8,000 10 C. P. lamps for three hours and cost about $30,000, weighed about 400,000 pounds and occupied a space about 32 x 50 feet. This cost means about $107 per K. W. of output, which seems a pretty high price to pay for a plant to generate electrical energy to-day, especially when it probably has an efficiency at three hours discharge not above 60 per cent. Such a storage battery must be compared in cost with the cost of boilers, engines and dynamos, per kilowatt, which would cost perhaps $50 per K. W., and whose efficiency would be 100 per cent. as compared with the 60 per cent. efficiency of the storage battery, since the storage battery must derive its energy from a steam plant first. The craze for storage batteries as the universal panacea for electrical troubles, which we have all read so much about in connection with European practice, seems to be on the wane if I may judge from the statements of the engineers rather than the storage battery manufacturers, but when we remember that in France and England they do not know what a healthy motor load means, we need not be surprised at the claims of inefficiency for stations which do not use batteries, and hence run their boiler, engine and dynamo for most of the twenty-four hours practically without load.

(*To be continued.*)

To Branch Out and Grow.

A resolution has passed the lower house of the Connecticut Legislature by which the New Haven Electric Light Company is given power to extend into adjacent towns, and the right to establish electric light, heat and power properties, and to obtain control of railways in New Haven and neighborhood. The company, which has a present capital of $400,000, is allowed under the bill to increase to $2,000,000 and issue bonds to half that amount.

The Ansonia Company Revived.

It is said that the recent sale of the plant of the Ansonia Electric Company, at Ansonia, Conn., to Franklin Farrel has resulted in the formation of a new company to carry on the business. The capital stock has been fixed at $56,000, divided into 560 shares of $100 each. The stockholders in the new company are: Franklin Farrel, Thomas Wallace, Jr. (who is the principal and will manage the business), Franklin B. Platt, Louis F. Anschutz, Jonah C. Platt. Fifty shares are held by Thomas Wallace, Jr., as trustee.

SOCIETY NEWS.

New York Electrical Society.

A meeting of the New York Electrical Society will be held at Columbia College, 49th street and Madison avenue, on Thursday, March 7th, at 8 P. M. Mr. Charles S. Bradley will deliver a lecture on "Alternating Currents in their Relation to Power Distribution."

A. I. E. E.

At the regular monthly meeting of the Council, held Feb. 27, it was voted that the General Meeting of the Institute be held at Niagara Falls beginning on June 18.

It is proposed to devote this meeting principally to the question of Power Transmission.

The following associate members were elected: Franklin Robert Anson, Arthur B. Cumner, Joseph Nisbet LeConte, Hermann Loewenherz, Robert C. MacCulloch, Maxwell M. Mayer, J. T. Nyhan, B. C. Paddock, Jr., J. Lloyd Prince, Geo. A. Redman, Bernard Victor Swenson.

The following associate members were transferred to membership: James Wellington Crosby, Hix, Crosby & Co., New York City; E. Randolph Hix, Hix, Crosby & Co., New York City; C. O. C. Billberg, Philadelphia, Pa.; James Hally Craig, Cumner, Craig & Co., Boston, Mass.; Edwin C. Shaw, Akron General Electric Co., Akron, O.

F. R. Upton's Assignment.

Mr. Francis R. Upton has filed an assignment for the benefit of his creditors in the Register's office of Essex County, N. J. The schedule of liabilities foots up $19,315, with contingent liabilities of $58,550. The assets are stated roughly at $20,000, and consist of real estate, promissory notes and a large amount of stock in various manufacturing and electrical companies. The value is considered questionable.

Mr. Upton's endorsements of Electrical Construction and Supply Company's paper go to make up the "contingent" liabilities.

Fire in Chicago.

Early on the morning of March 4 the power-house of the North Shore Electric Railway, at Edgewater, was destroyed by fire. The generators and most of the motor cars were destroyed.

An Electrical Ball.

The first annual ball of the employees of Zimdars & Hunt, electrical contractors, took place at Lyric Hall on the evening of Washington's Birthday. The hall was handsomely decorated. The chief feature was the electrical display, which consisted of an entire electric illumination of the stage end of the hall, including some novel and surprising effects. Two columns supported an arch upon which was mounted about 75 incandescent lamps, the shafts of the columns being also entwined with smilax interspersed with roses, and round each column there were entwined about 50 electric lights.

On the caps of the columns were two American shields with flags draped each side, the colors in the shields being illuminated by numerous small electric lamps. Above the arch were numerous novel devices displayed, one reading "Employees of Zimdars & Hunt," also the formula "$C = E \div R$," which is well known to electricians, all being illuminated by numerous electric lights, making a pleasing and handsome effect. The decorations were designed by Mr. J. P. Smith and executed by the employees of Zimdars & Hunt and carried out under the superintendence of Mr. J. F. Vielberth assisted by Mr. Geo. Ruckle, Mr. J. I. C. King, Mr. George McGibney, foreman, and other employees. Mr. George T. Butler was president.

At 9 o'clock Prof. Douthwaite with full orchestra discoursed sweet music for the promenade concert, which lasted till 10 o'clock, after which the grand march took place, ending with a mazy waltz, and dancing continued until the small hours of the morning.

LEGAL NOTES.

Switch and Socket Litigation.

The U. S. Circuit Court of Appeals for the Second District has handed down a decision sustaining Judge Coxe in his decision of last summer that Perkins patent No. 247,103, owned by the G.E. Company, which they had always claimed was the great foundation patent on snap switches, is limited very closely to mechanical details.

In reference to the socket litigation a decision has also been handed down affirming Judge Coxe's decision that the fifth claim of the Johnson patent No. 251,596, covering all modern sockets in a metal case, was invalid. The fundamental Edison patent on a socket was decided by Judge Coxe to have expired December 14, 1891. So this lays aside what have been claimed to be the two primary patents on sockets.

The Court of Appeals has also affirmed Judge Coxe in sustaining the Bergmann patent No. 257,277.

The receiver of the Bergman Gas and Electrical Fixture Company, of New York, has been granted permission by Judge Lacombe, of the U. S. Court, to sell the assets, amounting to $10,000, at public auction and distribute the proceeds among the creditors.

In the case of the Cambria Iron Company vs. the Tiffin Electric Street Railway Company, at Tiffin, Ohio, Judge Schaufelberger has ordered the sale of the Tiffin Interurban Consolidated, the Tiffin Electric Railway and the Tiffin Street Railway. They are to be sold separately.

Boston Notes.

The Altham motor, about which so much has been written and said, is being exhibited in Boston and is regarded as a success. It is a new type of turbine wheel operated by a small jet of steam or a hydro-carbon fuel which is fed automatically into a generator, where its combustion produces a gas under heavy pressure, which in turn is fed to the turbine in the same way that steam is now injected. The motor now on exhibit is cylindrical in form, about 18 inches in length by about 12 inches in diameter. It is coupled directly to the shaft of the armature of an old type of dynamo, and with about 14 H. P. of steam energy it generated quite easily current for 100 lamps of 16 C. P. capacity.

Professor A. E. Dolbeare has delivered a singularly interesting and instructive lecture before the Boston Scientific Society on the "Nature of Electricity." Some beautiful experiments and illustrations of the lecturer's theory were shown, to the astonishment and delight of the interested audience.

Manchester, N. H., is becoming an important electric street railway center, and extension is the order of the day up there.

The electrical fraternity of Boston are enjoying quite a busy season for the time of year. The supply houses especially are doing well, and the amount of railway material that is being shipped to various points throughout New England is something enormous.

Keith's new theatre, which was quite recently built and finished at a cost of $600,000, is being made more and more attractive every week. The proprietor has decided to take out his entire electric lighting plant and install a new and larger one at a cost of some $50,000. It is intended to have the new plant and the room in which it will be installed the most beautiful place of its kind in the world and to be a regular show place underground. The Thompson-Brown Electric Company of Boston has got the order for the switchboard.

In the new office building which is about to be erected on the site of the old historic Tremont House, now in course of demolition, there are to be no less than 9,000 incandescent lights. It will be by far the largest building in New England. The entire cost will be about $2,700,000.

General News.

What is Going on in the Electrical World.

Phœnix, N. Y.—Orrin F. Gaylord, of Oswego, has purchased the Phœnix Electric Light Company's plant.

Dover, Del.—The House has passed the bill to incorporate the Dover and Milford Electric Railway Company.

Fremont, Neb.—The board of public works has been instructed to advertise for bids for an electric light plant.

Parsons, Pa.—At an election just held, the people of this village voted in favor of establishing an electric light plant.

Northwood, Iowa.—At the election here on the 4th inst. a vote was to be taken on the question of putting in an electric light plant.

Aitkin, Minn.—An election is to be held here in a few days to decide whether the village will bond itself in $10,000 for an electric light plant.

Quebec, Can.—An electric railway is to be built this spring in and around this city with an extension in the suburbs to the shrine of La Bonne St. Anne.

Lansing, Mich.—The car barn and nine cars of the Lansing Electric Street Railway were burned last week. The damage is estimated at $20,000.

Painesville, O.—It is rumored that Gen. J. S. Casement will take hold of the street railroad and extend it to Fairport, making an electric road of it.

Wilmington, Del.—Frank S. Garrett and Henry K. Miller have purchased the electric supply business of the Delaware Electric and Supply Company.

Knoxville, Tenn.—The council will shortly discuss the question of adopting electric lights for the city streets. Gas is used for that purpose at present.

Wichita Falls, Tex.—The Wichita Falls Construction Company are in the market for the necessary material to build eighteen miles of telegraph line, with two wires.

Yankton, S. D.—Commodore Kountz, of Pittsburg, a large property owner of Yankton, has made a proposition to the city to construct and operate an electric street railway here.

Farmersville, Tex.—At a mass-meeting here last week committees were appointed to investigate and report on the best means of securing for this city a system of water works and electric lights.

Jamaica, N. Y.—The village trustees have appointed a committee to ascertain and report what it will cost to put in an electric plant and waterworks system in Jamaica.

Sheboygan, Wis.—The Sheboygan City Railway Company have petitioned the council for permission to erect poles to put in a trolley system. The line will be extended to all parts of the city.

Brooklyn, N. Y.—Mayor Schieren has expressed himself emphatically opposed to the city doing its own electric lighting. He says municipal ownership and operation have in nearly every case proved a failure.

Reading, Pa.—A charter has been granted to a company to build an electric railway from Reading to Allentown. The capital stock is $100,000. Dr. J. S. Trexler, of Kingston, Pa., is president of the company.

Tacoma, Wash.—The Tacoma Traction Company, recently incorporated, with a capital stock of $500,000, will at once build a new power house and equip with electricity the Tacoma and Puyallup Railway, twelve miles long.

Winona, Minn.—Seward D. Livermore, of St. Paul, has been appointed receiver for the street railway and electric lighting plants of the Winona General Electric Company in this city. Mr. Livermore is a practical electrician.

Washington, D. C.—The Georgetown and Tennallytown Electric Railroad is to be operated henceforth under changed ownership. O. T. Crosby and Charles A. Lick, of New York, have, it is reported, bought a majority of the stock and will reform the directorate.

Grand Rapids, Mich.—Mayor Fisher has vetoed the action of the council ordering the issue of $150,000 bonds to build an electric lighting plant. His chief reason is that the city, with an overdrawn treasury of $90,000, cannot afford the luxury of an experiment of that kind.

Martinsburg, W. Va.—Stewart W. Walker, receiver of the Edison Electric Illuminating Company, of this city, has been authorized by the court to sell the plant of the company at Martinsburg on March 23.

Union City, Mich.—The electric light plant established here five years ago by Rhenbottom & Bond has been purchased by the city. The plant will be improved and run in connection with new waterworks.

Owosso, Mich.—Frank Lodge, president of the Owosso and Corunna street railway, now in the hands of a receiver and involved in litigation, says the road will be equipped with electricity within a year, steam being the present motor power.

New Haven, Conn.—Israel Kelsey, of Orange, who has asked the Legislature to grant him a charter for an electric road to run from Derby to New Haven, through Orange, it is said proposes to build the road just as soon as he gets the permission and the weather is favorable.

Jefferson City, Mo.—The Jefferson City Light, Heat and Power Company have decided to enlarge by adding to their present electrical equipment one 1,000-light machine to furnish current for power and light. After the additional equipment is put in they will furnish current day and night.

Burlington, N. J.—It is announced that the Pennsylvania Railroad Company is about to award the contract for equipping the Burlington branch of the Amboy Division with the trolley system. This branch connects Burlington and Mt. Holly, N. J., and is between seven and eight miles in length.

New Orleans.—A brake and controller for electric street cars has been invented by Marvin B. Monroe of this city and been tested on one of the Traction Company's cars. It worked successfully and was considered by those who witnessed the test to be an improvement on the apparatus now in use.

Salamanca, N. Y.—A company has been formed and a charter obtained for the purpose of constructing an electric road between Little Valley and this place and extending on to Great Valley. The company expects to purchase Rock City, a spot often visited by pleasure seekers, and build a hotel there.

North Adams, Mass.—S. P. Thayer, of this town, and Walter S. Kelly, of Boston, have been given a hearing before the legislative committee on mercantile affairs at Boston in behalf of the incorporation of the Hoosac Valley Electric Power Company. Their plan is to develop the water power in Readsboro, Vt., and transmit electric power by wire to North Adams and other adjoining towns.

Meridian, Miss.—J. P. Donovan, P. A. Brady, John F. McDermott and E. B. Tyler, all of St. Louis, have been granted a franchise for an electric railway to be run in this city, and also for electric lighting as soon as the present contract expires. The same parties have completed negotiations with the Meridian Street Railway Company for the purchase of all its street railway property.

Chicago, Ill.—The Cosmopolitan Electric Company has been granted by the city council a franchise for a period of fifty years. It grants the right to maintain and operate a plant or plants and to construct, maintain, and operate in, through, over and upon the streets, avenues and alleys, tunnels and viaducts, and under the Chicago river and its branches, a line or lines of wire or other electric conductors to be used for the production, transmission and distribution of electricity for the purpose of furnishing light, heat and power and the transmission of sound and signals or any and each of them.

Philadelphia, Pa.—The Atlantic Transport Line steamer British Princess, which sailed a few days ago from this port for London and Swansea, took out with her 196 iron trolley poles and fixtures made by Morris, Tasker & Co., for a line to be established in Bristol, England.—The Philadelphia Traction Company has its electric cars operating in 157.83 miles of streets, cable cars in 20.13 and horse cars in 19.76 miles. Besides these the company has under consideration extensions that will add ten miles to its system.—Bonds of $25,000 have been filed for the building of three trolley roads in West Philadelphia covering twenty seven miles of streets.

Pasadena, Cal.—The Pasadena and Los Angeles Electric Railway Co. have about completed their "loop" in this city. Power for the operation of the cars will be transmitted from the power-house at Los Angeles.—President J. S. Torrance, of the Pasadena Electric Light Company, says his company will raise the capital stock from $50,000 to $100,000 and make a large addition to the plant, a move made necessary by the growth of the city.

Albany, N. Y.—The cities committee of the Senate has reported favorably Senator Owens's bill fixing the price of electric light in cities of 800,000 population or over at one-half of a cent per hour per incandescent light and four cents per hour for arc lights.—Among the bills introduced in the Assembly last week was one providing for a five-cent fare for one continuous ride on all steam, cable or electric railroads in cities having a population of over 1,500,000.

Somerville, N. J.—Work has been started here on what will be when completed the longest trolley road in the world. The constructors now at work in constructing the road are under bonds to complete by April 10 the first five miles of the New York and Philadelphia Traction Company's proposed electric railway between the two great cities. The first rails will be laid at Raritan, after which the construction of the road will proceed at the rate of one mile per week until it connects the towns of Somerville and Bound Brook with the city of New Brunswick. The only direct means of travel between these places for more than one hundred years has been by stage coach.

New York.—The Fire Commissioners have appointed a board to examine every electrician holding a responsible position in the operation of electrical machinery in this city.—Proposals are advertised for in the *City Record* for putting in and maintaining an electrical time service, consisting of a master clock and a series of secondary clocks, with battery and necessary wirings and connections, in the courts and offices of the new Criminal Court House in this city. Bids will be received until March 15 at the office of the comptroller, Stewart Building.—A resolution offered in the board of aldermen and referred to the committee on railroads provides that hereafter all surface railway franchises consented to by the board be sold by the comptroller at public auction to the highest bidder.—All attempts to arbitrate between the striking electrical workers and the contractors have so far failed. The walking delegates threaten to extend the strike to all the building trades.

Telephone and Telegraph.

A telephone system is to be established at Linton, Ind., connecting Linton, Worthington, Bloomfield, Lyons and Switz City. An Indianapolis company is heading the project.

The net earnings of the New York and New Jersey Telephone Company for the year were reported at the annual meeting held on the 1st inst. to be $344,914 50.

The Citizens' Telephone Company of Sharon, Pa., has been granted a franchise by the council, and will enter into immediate competition with the Bell Company. The new company will use the Harrison system.

Henry W. Marshall has been elected president of the Indiana Harrison Telephone Construction Company, succeeding Hon. John R. Coffroth, whose stock in the Construction Company he purchased. The other officers of the the corporation are; Geo. P. Haywood, first vice-president; E. H. Andress, second vice-president and assistant secretary; Wm. Taylor, treasurer; E. G. Leszynsky, secretary and general manager.

The Central Telephone Company is arranging to rebuild its system at Quincy, Ill., Jacksonville and Springfield, also to run a long-distance wire down the Illinois and Michigan Canal from Chicago to Ottawa, Decatur, Springfield and St. Louis, with a branch to Jacksonville and Quincy.

A telephone company has been organized at Pensacola, Fla., and will apply for a charter at once. The officers of the company are: President, T. E. Wells; vice-president, H. T. Wright; secretary, L. Jacoby; treasurer, W. A. l'Alemberte; directors: T. E. Wells, John Cosgrove, H. T. Wright, T. C. Watson, Rix M. Robinson, A. C. Blount and Pat McHugh.

Augusta, Ga., and Aiken, S. C., have been recently telephonically connected.

The telephone line between Lincolnton and Washington, Ga., has been sold to P. J. Halliday for $5. The line had become inefficient and out of repair. Mr. Halliday will renew the wires and equipment and continue the service.

Spartanburg, S. C., talks of forming a joint-stock company to compete with the Bell Telephone Company, whose charges are not relished by the business men of the town.

The Phœnix Telephone Company is making inroads at a lively pace into the Bell company's business at Traverse City, Mich. The first-named company has already obtained about 150 subscribers. The Bell company will reduce its rates.

St. Louis is still without long-distance telephone service, and can't even talk direct with her great rival, Chicago.

The Terre Haute, Ind., council has granted a franchise to the Indiana Harrison Telephone Construction Company, to run twenty years.

If either of three bills now before the Massachusetts Legislature becomes law, telephone and telegraph companies will be subject to the supervision of a commission created for the purpose.

W. H. McCullough, auditor of the Great Southern Telegraph and Telephone Company, has been investigating the feasibility of constructing a telephone line between Natchez and St. Joseph, La. If the line is built it will give the entire front of the Fifth Louisiana Levee District telephone communication, which would be of inestimable advantage in flood seasons.

The Committee on Law of the Philadelphia city councils have decided to report in favor of repealing the ordinance granting the Mutual Automatic Telephonic Company a franchise, on the ground that its passage was obtained through corrupt influences. An investigation has been in progress for several weeks to find out whether there was any truth in the charge.

Evansville, Ind., expects to enjoy the advantage of the long-distance telephone service before the ensuing summer is over. The arrangements have been made by the Cumberland Telephone and Telegraph Company. The new service will connect the Evansville exchange with the local exchanges in the following States: Maine, New Hampshire, Vermont, New York, Massachusetts, New Jersey, Maryland, Pennsylvania, Ohio, Indiana, Illinois, Wisconsin and Minnesota.

Over two-thirds of the stock of the new telephone company at Petersburg, Va., has been subscribed for. It cannot be positively stated whether or not the new company will be organized in case the demands of the committee for cheaper rates are conceded by the local Bell company. Some of the parties who have subscribed for stock are said to be in favor of going ahead with the organization of the company in any event, as they believe it will prove a profitable investment.

The Metropolitan Telephone and Telegraph Company of New York announces that extra toll charges will not be made for messages from subscribers' stations to public pay stations.

The Mexican Telephone Company has added another exchange with about sixty subscribers to its service. The new exchange is at Campeche, was put in operation about January 1, and showed net profits of about $180 the first month. The rental of instruments is $10 per month.

The borough council of Kennett Square, Pa., has passed an ordinance taxing all telegraph, telephone and electric light poles standing in the borough one dollar per year.

The city council of Anderson, Ind., has granted franchises to both the Harrison and American Telephone Companies, and these and the Bell Telephone Company, already operating, are expected to go on cutting rates until they get down as low as 50 cents a month.

The Traders' League in Philadelphia have issued an appeal to business men to aid them in their opposition to Congressional measures tending to prolong the monopoly of the Bell Telephone Company. The joint committee of the league, in the report embodying the appeal referred to, say: "As Judge Carpenter, of the United States Circuit Court, has publicly criticised the work of the Patent Office in connection

with patents issued to the Bell Company or its assignors, it is very plain that the Patent Office ought to be overhauled. We therefore respectfully request you to ask your Representatives in Congress to ask for an investigation into the Patent Office and its methods."

A new telephone company has applied for a franchise to establish a complete telephone service in Atlanta, Ga. Among the men who have petitioned the city council for the franchise are Captain A. J. West, James R. Collins, T. B. Brady, F. Hardy, N. C. Boyster, A. P. Morgan, A. L. Glenn and J. W. McPherson.

The Harrison Telephone Company will begin erecting its plant at Fort Wayne, Ind., as soon as the condition of the ground permits.

A new telephone company has been organized in Pittsburg, Pa., and in view of this fact the vice president of the established Bell company, in an interview on the question of rates, says his company does not contemplate any reduction.

The plan devised by Prof. Lucien I. Blake, of the Kansas State University at Lawrence, for telephoning to a vessel anchored a long distance off the coast, has been successfully tested at Sandy Hook between the shore and Scotland lightship, several miles off. The difficulty presented by the vessel's continual change of position was the problem to be solved in getting the current from the cable at the bottom of the sea to the deck. Prof. Blake has solved this by attaching to the anchor another chain leading a sufficient distance toward the shore to avoid any disturbance by the movements of the vessel, and using the chains for transmission of the current to the deck from the connected cable.

H. L. Baldwin, of Watertown, N. Y., has petitioned the Watertown council for a telephone franchise in that city.

The Southwestern Illinois Telephone Company, just incorporated, with a capital stock of $100,000, proposes to open and operate a telephone exchange in East St. Louis. The incorporators are Anthony Isch, Daniel Sullivan and W. A. Rodenburg.

A telephone company has been organized for the purpose of constructing a line from Fargo to Grand Forks, N. D. The company is now on the road securing the right of way between Fargo and Hillsboro, and work will be commenced as early in the spring as possible.

A new company, to be known as the Bell Telephone Company, is being organized at Bedford City, Va. It offers cheaper telephone rates than those of the existing company.

The council of Argentine, Mo., has granted a franchise to the Silver City Telephone Company to do a telephone business in Argentine.

COMMERCIAL PARAGRAPHS.

The Metropolitan Electric Company of Chicago are introducing to the trade a new Carbon Battery of high efficiency test for open circuit work. The battery is guaranteed and offered to the trade seeking a high-class article of this description.

The F. E. Belden Mica Mining Company of Boston, Mass., miners and dealers in mica and manufacturers of ground mica, quartz, flint and silex, have established a branch at 182 Franklin street, New York (Union Adams, Jr., agent), where all their products may be found.

Storage Battery Plant for Light and Railway at Merrill, Wis.

Merrill, with a population of about 9,000, is situated 352 miles northwest of Chicago, in the lumber regions of Wisconsin, on the Wisconsin River. The city is divided into two parts, the Eastside and the Westside, by the Prairie River, which here flows into the Wisconsin. The Merrill Light and Railway Company furnishes all electric light in the city and operates the electric railway connecting the Eastside and Westside.

The electric lighting of the city is divided between two stations, that on the Eastside being run from a water-power plant and the Westside from a steam-power plant. The railway generator is operated by a water wheel at the Eastside station.

Some months ago the company was brought face to face with that problem, so frequently occurring in the electrical field, of the best plan for enlarging the power plant to meet the requirements of increasing demand.

After much discussion of the question, it was decided to install a storage battery plant in a sub-station at or near the distant light center, the power-house itself being at one center.

It was decided that the battery should not only be utilized for increasing the light capacity, but also for regulating the voltage on the railway circuit.

The storage battery plant, recently installed, is situated midway between the East and West sides, on line of trolley road. The plant contains 240 eleven "F" Chloride Accumulators, capacity 500 ampere hours at 50 ampere rate, manufactured by the Electric Storage Battery Company of Philadelphia. The batteries are divided into four series of 60 cells each, connected to a switchboard so arranged that cells may be connected to railway, 240 in series, or to lighting circuits, two parallel series of 60 cells each, on each side of three-wire system, capable of supplying, normally, four hundred 16-candle power lamps for ten hours, or, at maximum discharge, 600 lamps. An independent feeder connects battery with the Eastside power-house, three-quarters of a mile distant. A variable resistance is placed in circuit between battery and railway, so that when battery is fully charged, requiring a voltage of 600, the voltage on railway may be cut down if necessary.

On January 4, 1895, the battery was connected to railway circuit. The great improvement in running of cars was immediately noted by all, but it was at night that the contrast was most apparent. The two water wheels were connected together as usual, but the railway generator charged the battery at almost a steady rate, instead of running a car with its ever-varying demand of from 0 to 120 amperes. Instead of one dimly-lighted, slow-running car, two brilliantly-lighted cars were operating at the highest speed allowable on the streets. Instead of a succession of sharp peaks, the voltage curve of lighting circuit became practically a straight line; instead of nine volts variation on each side of three-wire system, as at first, there was practically no variation, demonstrating most clearly the capability of battery to respond to all demands of railway, no matter how severe.

On several occasions the two cars were operated by the battery alone for several hours at a stretch, thus in the daytime allowing of the entire shutting down of power plant and at night of the use of the two water wheels exclusively for lighting.

This installation most clearly demonstrates the great value of storage battery installation in connection with light and railway plants: First, as a reservoir in which to store up energy otherwise lost—the difference between the average demand and maximum demand on a generating plant; second, as a regulator of pressure on circuits subject to fluctuating demands. Many street railways could thus add materially to their income by establishing storage battery sub-stations along their lines, to be charged direct from the trolley or trolley feeders and furnishing current of almost any desired voltage for light and power purposes.

The Walker Manufacturing Company.

Among some of the larger orders taken already this year by the Walker Manufacturing Co., Cleveland, Ohio, may be mentioned the following:

The Complete Electric Construction Co., New York City, two 50 K. W. belted lighting generators.

The Rahway Electric Railway Co., Rahway, N. J., one 100 K. W. belted multipolar generator; three double car equipments, 25 H.P. spring mounted steel motors.

The Philadelphia Construction Co., Philadelphia, Pa., for the Schuylkill Electric Railway Co., Pottsville, Pa.; three 400 K. W. belted generators and switchboard apparatus; two double car equipments, 25 H. P. motors.

The Michigan Electric Co., Detroit, Mich., for Saginaw Consolidated Street Railway Co., Saginaw, Mich., one 200 K. W. belted generator; six complete car equipments, 25 H. P. motors.

Hartford and West Hartford Street Railroad Co., Hartford, Conn., two double car equipments, 50 H. P. steel motors; two double car equipments, 25 H. P. steel motors.

C. E. Loss & Co., Chicago, Ill., for Waukesha Street Railway Co., Waukesha, Wis., one 150 K. W. belted generator; three double car equipments, 50 H. P. steel motors.

The Detroit Railway, Detroit, Mich., two 400 K.W. direct coupled generators; one 750 K. W. direct coupled generator.

Gloucester, Essex and Beverly Street Railway Co., Gloucester, Mass.; three 225 K. W. direct coupled generators.

The Worcester Construction Co., Worcester, Mass., for the Gloucester, Essex and Beverly Street Railway Co., sixteen double car equipments, 25 H. P. steel motors.

Jaspar County Electric Railroad Co., Carthage, Mo., two 200 K. W. belted generators; five double car equipments, 30 H. P steel motors.

Besides the above, they have taken orders for their spring mounted steel motors for the Louisville Railway Co., Louisville, Ky.; Atlantic Avenue Railway Co., Brooklyn; Ottumwa Electric Railway Co., Ottumwa, Iowa; Aurora Street Railway Co., Aurora, Ill.; Bloomington City Railway Co., Bloomington, Ill.; Steinway Railway Co., Brooklyn; Kansas City Railway Co., Kansas City; Atlanta Electric Railway Co., Atlanta, and many others.

They have also taken large orders for their general work, among which may be mentioned contract for four 2,000 ton hydraulic cotton compresses for Mr. W. W. Bierce, Montgomery, Ala.

Siemens & Halske Generators in Philadelphia.

The People's Traction Company of Philadelphia have placed an order for three 870 kilowatt Railway Generators, running at 80 revolutions per minute, to be direct coupled to engines, with Messrs. Walker & Kepler, of Philadelphia, representatives of the Siemens & Halske Electric Company in Pennsylvania.

This order was placed with the Siemens & Halske Company after the experts of the People's Traction Company had made a careful examination of the Siemens & Halske machinery at their works in Chicago.

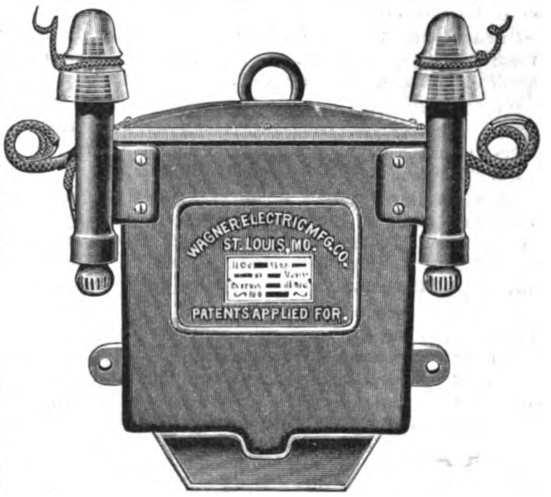
Bristol Recording Voltmeters.

Mr. J. Fred Galletly, electrician for Swift & Company, Chicago, in discussing recently his experience with incandescent lamps, said that he believed fully half the troubles usually credited to poor lamps were the result of lack of care on the part of the dynamo tender. His plant at the stock yards takes about 9,000 lamps. His breakages had been enormous until he was induced to add the Bristol Recording Voltmeter to his equipment, since which time his assistants realize that their care, or lack of it, in maintaining an even voltage is at once apparent, and the breakages are reduced to a minimum. Mr. Galletly says that the saving in this direction alone since putting in the recording voltmeter, is more than $50 per week.

Wagner Transformers.

The new transformers of the Wagner Electrical Manufacturing Company, first introduced to the public at the Cleveland Convention, bid fair to take their place at once in the popular estimation alongside of the best in the market. Their construction possesses so many points of merit that many central station men placed orders at the meeting.

The chief claims for consideration are that the transformer, primary cut-outs and insulator brackets are all in one, that trouble with primary fuses is entirely averted, and that by their use absolute protection both to lines and transformers is secured. They are made with either dry or oil insulation as desired, and with either attached or separate primary cut-outs.



WAGNER TYPE "D" TRANSFORMER.

Further information can be gained at the company's home office, St. Louis, or at either of its branch offices, Monadnock Building, Chicago, or Betz Building, Philadelphia.

Mather Company's Sales.

The Mather Electric Company of Manchester, Conn., report a continuation of the unprecedented amount of new business secured. The following sales have recently been made through their isolated lighting plant: The Berlin Iron Bridge Company, East Berlin, Conn. (second order); 250 light ring type dynamo; Perkins Electric Switch Manufacturing Company, Hartford, Conn., 350 light ring type dynamo; Haverhill Paper Company, Bradford, Mass., 150 light ring type dynamo; Inter-Mountain Electric Company, Pocatello, Idaho, 450 light ring type dynamo; Hub Gore Makers, Brockton, Mass., 450 light ring type dynamo; Coffee Exchange, New York City, 600 light ring type dynamo; Iroquois Furnace Company, 150 light ring type dynamo; Cranston Worsted Mills, Bristol, R. I., 250 light ring type dynamo; New Opera House, Holyoke, Mass., 250 light ring type dynamo; Hub Gore Makers, Camden, N. J., 150 light ring type dynamo; Waverly Woolen Company, Pittsfield, Maine (second order), 350 light ring type dynamo; Thatcher Bros., New Bedford, Mass., 100 light ring type dynamo; Jas. F. Grant, Youngstown, Ohio, 450 light ring type dynamo: Rockwell Manufacturing Company, Milwaukee, Wis. (second order), 100 light ring type dynamo; Burtis & Howard, Minneapolis, Minn. (third order), 100 light ring type dynamo; S. N. Blake Elmira, N. Y., two 250 light ring type dynamos; B. Lowenstein & Bros., Memphis, Tenn., 100 light ring type dynamo; Straight Line Engine Company, Straight Line, New York, 20 K. W. Manchester type generator;

Cook Locomotive Works, Paterson, N. J., 45 K. W. 220 volt multipolar generator; J. Holt Gates, Chicago, Ill., two 60 K. W. multipolar generators, 500 volts; Denison Light and Power Company, Denison, Tex., 45 K. W. multipolar generator, 220 volts.

RECENT COMPANY ELECTIONS.

Bell Telephone Company of Missouri, St. Louis. Directors: Henry B. Stone, Charles C. Maffitt, Arthur I. Fuller, James Campbell, John E. Hudson, Edwards Whitaker, W. H. Forbes, William Duncan, C. Jay French, George G Hall and Alonzo Burt.

Bangor, Orono and Old Town Railroad Company, Bangor, Me. Directors: J. C. Libby, C. A. Richardson, A. F. Gerald, J. Manchester Haynes, F. O. Beal, J. F. Gould, A. J. Durgin.

Washington, Alexandria and Mt. Vernon Electric Railway Company. President, G. E. Abbott: vice-president, Frank A. Reed; treasurer, D. C. Leach: assistant treasurer, D. W. Holden; secretary, F. K. Hipple; auditor, J. A. Swartz. The officers named, together with J. S. Swartz and James R. Caton, form the board of directors.

The Maryland Electric Company, Baltimore. President and treasurer, W. B. Putney, of New York; vice-president and secretary, A. A. Glasier, of Boston. Directors: W. B. Putney, A. A. Glasier, R. T. McDonald of Fort Wayne, Ind.; Joseph P. Smith and W. H. Garrison of Baltimore.

Marble City Electric Company, Rutland, Vt. President and treasurer, F. M. Butler; secretary, James Carruthers; auditor, H. O. Edson. Directors: F. M. Butler, Henry O. Edson, A. C. Bates, H. M. Bates, T. W. Moloney, S. W. Bassett, James Carruthers.

City and Suburban Railway Company, Savannah, Ga. President, James H. Johnston; vice-president, Henry Parsons; secretary, E. J. Thomas; treasurer, E. Schmitt. Directors: J. H. Johnston, Henry Parsons, E. J. Thomas, J. N. Harriman, Luke Carson, C. S. Hardee.

Orleans Street Railroad Company, New Orleans. Directors: Paul Capdavielle, U. Koen, A. Fitzpatrick, Peter Congot, C. M. Harrod, N. C. Cromwell, and F. L. Limongi.

Hamilton Electric Light and Power Company, Hamilton, Can. Directors: R. Thomson, president; John Knox, vice-president; J. V. Teetzel, secretary-treasurer, and Alex. Turner, S. F. McKinnon and H. M. Pellatt.

Beaver Valley Traction Company, Beaver Falls, Pa. President, John M. Buchanan; treasurer, R. P. Stone; secretary, A. D. Long. Directors: Dr. T. P. Simpson, A. R. Leyda, A. M. Jolly, J. C. Whitla, Robert S. Kennedy, Dr. H. S. McConnell.

Hingham Electric Railway Company, Hingham, Mass. President, Sidney Cushing; secretary and treasurer, W. C. Foster. Directors: Sidney Cushing, J. J. Moore, B. C. Wilder, E. H. Gowing, E. F. Wilder, C. H. Marble and W. B. Foster.

Lowell Electric Light Corporation, Lowell, Mass. President, George W. Fifield; vice-president, W. A. Ingham: treasurer, William H. Burt. Directors: George W. Fifield, W. A. Ingham, William H. Bent, P. P. Perham, L. T. Fletcher, James H. Tolles and Charles S. Collins.

Bell Telephone Company, Buffalo, N. Y. Directors: Henry Altman, Philo D. Beard, Benjamin E. Chase, Clarence O. Howard, Edward J. Hall, John E. Hudson, Porter Norton, David B. Parker, Thomas T. Ramsdell, Sherman S. Rogers, Samuel S. Spaulding, Henry M. Watson, William H. Watson, George Weldon and John L. Williams.

Holmes Electric Protection Company, Toronto, Can. President, T. G. Blackstock; vice-president J. B. Wood; secretary-treasurer, A. S. Wigmore. Directors: T. G. Blackstock, W. B. McMurrich, L. K Cameron, B. Jennings, F. A. Ritchie, A. S. Wigmore and J. B. Wood. In Montreal the same company re-elected the old board of directors.

INCORPORATIONS.

The Murphysboro Gas Light Company, Murphysboro, Ill.—to manufacture gas for light and power, maintain and operate waterworks and electric light plants. Capital stock, $80,000. Promoters: J. D. Peters, P. M. Post, W. C. Norman, Geo. E. Kirchner.

The Cambridge City Electric Light Company, Cambridge, Ind. Capital stock, $20,000. Promoters: Edward W. Boden, Chas. H. Kerlin, Thos. B. Stephens.

The Fuller Electric Engineering Company, East St. Louis, Ill.—to manufacture and deal in electric appliances of all kinds, build and operate electric plants and carry on a general electrical business. Capital stock, $30,000. Promoters: W. A. Fuller, Charles T. Dana, C. H. Dudley.

The Onondaga Dynamo Company, Syracuse, N. Y.—to manufacture and sell dynamos, electrical machinery, etc. Capital stock, $25,000. Promoters: Ella H. Eager, J. W. Eager, David Cronin, all of Syracuse, N. Y.

The Oxley, Giddings and Enos Company, New York City, N. Y.—to deal in gas and electric light fixtures, etc. Capital stock, $200,000. Promoters: W. F. Moody, Bayonne, N. J.; Frederick Wilcox, Brooklyn, N. Y.; W. N. Robertson, Jersey City, N. J.

The Harrisburg and Cumberland Electric Railway Company, Harrisburg, Pa.—to construct and operate an electric railway. Capital stock, $36,000. Promoters: Wm. L. Corgas, Frank R. Leib, S. W. Fleming, Harrisburg.

The Citizens' Electric Light and Power Company, Hughesville, Pa.—to supply light, heat and power by means of electricity. Capital stock, $6,000. Promoters: William Frontz, Peter Rooden, Hughesville; James K. Boak.

The Pennsylvania Heat, Light and Power Company, Philadelphia, Pa.—to manufacture and supply light, heat and power by means of electricity. Capital stock, $10,000. Promoters: Robt. Reaves, C. W. McKinney, John Taylor, Scranton, Pa.

The Hillsborough Electric Light and Power Company, Hillsborough Bridge, N. H.—to manufacture and supply electricity for light, heat and power. Capital stock, $25,000. Promoters: James F. Grimes, Harvey Jones, Geo W. Lincoln, Wilson D. Forsaith, Hillsborough Bridge.

The Jaeger Electric Lamp Company, Newark, N. J.—to manufacture, sell and deal in electrical lamps, etc. Capital stock, $10,000. Promoters: Herman J. Yaeger, Norman D. Webster, Brooklyn, N. Y.; Louis J. Auerbacher, Newark, N. J.

The Harrison Electric Company, Chicago, Ill.—to manufacture all kinds of electrical machinery, appliances and devices. Capital stock, $500,000. Promoters: Edward M. Harrison, Lewis H. Painter, Lewis Rinaker.

The Scoville Island Street Railway Company—to build and operate an electric road from Wyoming, Pa., to Old Forge, six miles. Capital stock, $36,000. The officers of the company are: President, Wm. S. Tonkins. Directors: E. B. Long, E. A. Corry, Jr., of Pittston: C. D. Simpkins and H. M. Straeter, of Scranton, Pa.

The Manhattan Electric Storage Battery Company of New York City—to manufacture and sell electric storage batteries or accumulators and any appliances connected therewith. Capital stock, $600,000. Directors: August Belmont, James H. Hoffman, Louis Stein, Lewis May and Ignatz Boskowicz, of New York City.

The Montgomery Electric Company of Ambler, Pa. Capital stock, $1,000. Incorporators: E. A. Murphy, R. L. Parkinson, A. M. Slocum and Henry Parker, of Philadelphia, and others.

The Vermillion Water, Light and Power Company, Vermillion, S. D.—to furnish water and light to the city of Vermillion, S. D. Capital stock, $25,000. Promoters; G. T. Salmer, S. E. Brookman, E. Brookman, all of Vermillion.

The Commercial Heat and Power Company, Chicago, Ill.—to construct, maintain and operate a plant for heat and power; construct and maintain mains, pipes, etc. Capital stock, $2,000,000. Promoters: Dan'l V. Harkin, Harry C. Colson, M. W. Cagney.

The Los Angeles Traction Company, Jacksonville, Ill.—to construct, lease, purchase and operate street railways in the State of California. Capital stock, $100,000. Promoters: Thos. J. Hook, Francis Hook, Marcus Hook.

The Cosmopolitan Electric Company, Chicago, Ill.—to manufacture and generate electricity, construct plants, etc. Capital stock, $2,000,000. Promoters: Albert H. Tyrrell, Wm. H. Pope, Walter H. Marble.

The Third Street and Suburban Railway Company, Seattle, Wash.—to build, own and operate street railway, electric light and power plants, saw mills, etc. Capital stock, $100,000. Promoters: August Mackintosh, A. N. Brookes, Frederick Bausman, W. C. Crambs, Thos. Boyd, David T. Denny, D. Thomas Denny.

The Hickley Launch and Electrical Engineering Company, Asbury Park, N. J.—to supply power for electric light and heat and other electrical appliances, etc. Capital stock, $100,000. Promoters: Arthur S. Hickley, Myron S. Gould, Cook Howland, Asbury Park, N. J.; Claude V. Guerin, Ocean Grove, N. J.

The Dexter and Brownsville Street Railway Company, Watertown, N. Y.—to build and operate a street surface electric railway in Jefferson County, N. Y., to connect the villages of Dexter, Brownsville and Sacketts Harbor. Capital stock, $40,000. Directors: Byron B. Taggart, Hiram F. Inglehart, Joseph Mullin, George H. Walker, B. B. Taggart, Jr., Chester C. Inglehart and N. P. Wardwell, of Watertown; J. A. Lebkeucher, and J. Krementz, of Newark, N. J.

The Franklin Electric Illuminating Company, Oyster Bay, L. I., N. Y.—to manufacture and use electricity for producing light, heat and power in the villages of Sea Cliff, Glen Cove, etc., in Queens County, N. Y. Capital stock, $25,000. Directors: Samuel Stenson, John Graham, W. A. Porter, D. W. Pardee, of Sea Cliff; Louis T. Duryea, James Norton, of Glen Cove; Frank D. White and Henry F. Noyes, of Brooklyn, and James Tychborne, of Mount Vernon.

The Queens County Telephone and Telegraph and Supply Company—to connect the village of Oyster Bay, Queens County, with the village of Huntington, Suffolk County, by way of Cold Spring Harbor from Oyster Bay to Hicksville, by way of Syossett and intermediate points from Oyster Bay to Flushing, by way of Glen Cove, Roslyn and intermediate points. Capital stock, $20,000. Directors: W. L. Swan, G. W. Foller, Samuel Y. Bayles, of Oyster Bay; U. S. Croft, of Brooklyn; R. Downing, W. F. Johnson and E. Morgan Griffin, of East Norwich, Conn.

Batavia Street Railroad Company—to operate an electric street surface railroad from Batavia to Horse Shoe Lake, a distance of seven and a half miles. Capital stock, $75,000. Directors: Amos H. Stephens, A. B. Wilgus, J. H. Wilgus, J. S. Lindsay, C. C. Marsh, of New York City; H. B. Burdick, of Malden, Mass.; F. P. Wilgus and Mark Sugarman, of Brooklyn; F. J. Fadner, of Chicago.

The Howard H. Bowen Company, San Francisco, Cal.—to manufacture and deal in gas, electric and combination fixtures, electroplating and art metal work, etc. Capital stock, $50,000 Promoters: Howard H. Bowen, Sam Soloman, Carl Rector, J. L. Franklin, Chas. A. Partridge, all of San Francisco.

The McLean Armature Company, Chicago, Ill.—to do general electrical repair and manufacture electrical apparatus. Capital stock, $15,000. Promoters: James McLean, John S. Parmele, Martin R. Nelson.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED FEBRUARY 26, 1895

ELECTRIC RAILROADS AND APPLIANCES.

534,642. Railway Supply System. Harding F. Gray, Passaic, N. J., assignor to the Gray Electrical Transit Company, of New Jersey. Filed Aug. 8, 1893.

534,662. Electric Railway System. Herluf A. F. Petersen, Milwaukee, Wis. Filed Nov. 8, 1893.

534,663. Underground Conduit for Electric Railways. Herluf A. F. Petersen, Milwaukee, Wis. Filed Mar. 26, 1894.

534,834. Battery System for Electric Railways. Edmond Julien, Brussels, Belgium, assignor to the Electric Storage Battery Company, Gloucester, N. J. Filed Dec. 9, 1886.

534,956. Electric Trolley Railway. Joshua M. Hammill, Aldan, assignor of one-fourth to John S. Latta and James J. Mulconroy, Philadelphia, Pa. Filed Jan 23, 1894.

534,986. Conduit Electric Railway. Michael F. Flynn, Stamford, Conn. Filed May 24, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

534,677. Electric-Arc Lamp. Hans O. Swoboda, New York, N. Y., assignor to the General Incandescent Arc Light Company, same place. Filed Apr. 6, 1894.

534,852. Electric-Arc Lamp. James Brockie, Forest Hill, England. Filed Nov. 13, 1894.

534,886. Electrical Lighting Device for Gas-Engines. Calvin L. Ives, Grand Rapids, Mich. Filed Mar. 30, 1894.

534,971. Incandescent Light. Henry F. Rooney, Randolph, Mass. Filed Nov. 17, 1894.

DYNAMO ELECTRIC MACHINERY.

534,678. Electric-Current Transformer. Joseph A. G. Trudeau, Ottawa, Canada. Filed Apr. 6, 1894.

534,729. Commutator. David P. Thomson, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Dec. 17, 1894.

534,851. Driving Mechanism for Dynamos Located on Railway-Cars. William L. Bliss, Brooklyn, N. Y. Filed Aug. 17, 1894.

534,953. Dynamo-Electric Machine. Rudolf Eickemeyer, Yonkers, N. Y. Filed June 7, 1888.

TELEPHONE AND TELEGRAPH APPARATUS.

534,639. Printing-Telegraph. Samuel V. Essick, Brooklyn, N. Y. Filed Sept. 18, 1890.

534,670. Telegraph and Telephone System. Charles A. Rolfe, Chicago, Ill. Filed Sept. 16, 1893.

534,671. Fire-Alarm-Telegraph System. Charles A. Rolfe, Chicago, Ill. Filed Apr. 10, 1894.

534,970. Telegraph and Telephone System. Charles A. Rolfe, Chicago, Ill., assignor to the Police Telephone and Signal Company, same place. Filed Feb. 15, 1893.

SIGNALS AND SIGNALING APPARATUS.

534,779. Signaling System. Clarence B. Brace, Union City, Mich. Filed Nov. 27, 1894.

534,815. Electric Slot for Signals. John P. Coleman, Swissvale, Pa., assignor to the Union Switch and Signal Company, same place. Filed Sept. 27, 1893.

534,908. Electric Signaling Apparatus. Bernice J. Noyes, Boston, Mass., assignor to George W. Gregory, same place. Filed July 5, 1892.

MISCELLANEOUS.

534,640. Recording Watt-Meter. Walter C. Fish, Lynn, assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Dec. 22, 1894.

534,650. Electrically-Actuated Combination-Lock. Samuel L. G. Knox, Camden, N. J. Filed Apr. 13, 1894.

534,699. Electric Resistance-Card. Alton J. Shaw, Muskegon, Mich. Filed Dec. 1, 1894.

534,732. Connector for Electric Conductors. Robert D. Titcomb, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Dec. 21, 1894.

534,785. Method of and Apparatus for Insulating Electrical Conductors. Louis W. Downes, Providence, R. I. Filed Aug. 22, 1894.

534,786. Apparatus for Manufacture of Insulated Electrical Conductors. Louis W. Downes, Providence, R. I. Filed Dec. 11, 1894.

534,802. Electric Metal-Working Apparatus. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Dec. 3, 1892.

534,942. Manufacture of Articles by Electrodeposit. Henry S. Anderson, Springfield, Mass. Filed Dec. 18, 1889.

534,961. Electrically-Operated Keg-Register. Josef Kuff, New York, N. Y., assignor, by mesne assignments, of one-half to Mary A. Richter, same place. Filed Apr. 4, 1894.

534,974. Electric Brake. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company, of Ohio. Filed Jan. 30, 1894.

534,975. Apparatus for Arresting Motion of Electrically-Propelled Mechanism. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company, of Ohio. Filed Feb. 5, 1894.

534,977. Electric Brake. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company, of Ohio. Filed June 8, 1894.

ELECTRICITY.

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EDITORIAL NOTES.

THE LAMP SITUATION.

The recent decision of the United States Supreme Court in the Bate case, throwing open forever the field of incandescent lamp manufacture, and the changed conditions resulting therefrom, are matters of far more importance to the independent lamp companies and to the public than to the General Electric Company itself, and presents strong reasons for a careful consideration of the situation. That the G. E. Company is affected to a smaller degree than the independent companies will not be apparent, perhaps, to the casual looker-on, but it is a fact. A favorable decision in this case would have given the G. E. Company only a negative victory, and one which they did not expect. It would not have given them control of the lamp situation, and they would have been compelled to meet the competition of at least two companies—the Columbia and Buckeye lamp companies—which could not have been closed up—if at all—much before the limit of the patent which it was hoped to establish.

After the long battle, in which the Edison lamp has been at no time an undisputed winner, the situation is revolutionized. Litigation is ended—barring the possible victory of the Westinghouse interests in the McKeesport case, which case, we think we are safe in saying, interests only the two large companies, General Electric and Westinghouse.

The question now arises, what is the lamp business worth to those engaged in it? Prices have been, as we all know, reduced one-half from the basis of 1892. There is, however, at present prices a fair margin of profit left; as large, probably, as that in most lines of manufacture.

Competition will be fierce. Those who have stood together in opposition to the Edison interests have already separated, actuated by the motives which have controlled human action since the world began--self-interest.

Of those who are already in the business, and those who will enter it soon, not all will remain on January 1, 1896. Who will survive? First, of course, those companies which have a respectable working capital, but the sure winners will be the ones who make the *best product possible*, and who refuse to sell *one lamp* unless a fair profit can be made. If there is any revolutionary cutting of prices to be done it should be left to those who are conducting their business as stockjobbing enterprises and not as legitimate business concerns.

At the present writing the new prices of the G. E. Company are not published, but ELECTRICITY is in possession of the facts.

Edison licensees can buy their 16 C. P. lamps at 17 to 18 cents. This is as it should be. They have paid for something which they never got, and the least which the parent company can do now is to give them lamps at cost. The price to ordinary users will be 24 cents, and other sizes in proportion.

We hear plenty of talk from lamp makers as to the remarkable results they have achieved in reducing the cost of lamps. Most of it can be brushed aside as trade buncombe—all right in its place, but not to be relied on by stockholders and investors.

ELECTRICITY has investigated the question thoroughly, and we stand as authority for the statement that no lamp maker in this country can make lamps for less than 17 cents. We therefore make the prophecy, advisedly and with knowledge that it will prove correct, that any company endeavoring to sell lamps much below present prices is not a safe concern to trust with the money of stockholders or with commercial credit.

The competitive fight is on; there will be vigorous competition, and the victors will be those who are guided by common sense and by the established laws of business.

It is not often that the duty of the purchaser, sentimentally considered, coincides so nearly with his duty to himself as in the present incandescent lamp situation.

That duty is to purchase lamps of the independent companies.

Notwithstanding the protracted litigation over the validity of the Edison lamp patent, the extended discussion in the trade press of its various features, comparatively few of those engaged in the business to-day have a clear conception of the actual facts. The situation has been so muddled up by complicated arguments and by points of law that the average layman, including the judges of our highest courts, has not been able to untangle the true from the false, or to characterize properly the position of the independent lamp companies and of the Edison Company.

We have heard it said within a week, by those who ought to know better, that these independent companies have no claims upon the public; that they had placed themselves in the position of infringers of a patent duly sustained, and had refused to bow to the decrees of the courts; that if they had been governed by honorable motives they would have retired from the field immediately after Judge Wallace's decision in 1891.

Nothing could be further from the truth.

The Edison lamp patent has now passed into history. Even the most bitter partisans in the nine years' warfare conducted by the Hessianic attorneys should now be able to view the record without prejudice and with perfect fairness.

Electricity has been from the beginning upon the side of the independent companies in their efforts to maintain their businesses. We have not, however, up to this time, ever offered one word of criticism as to the validity of the Edison patent, because we did not deem it politic to do so.

But now the smoke of battle has cleared away and unbiased history can and will be written. We record it as our fixed opinion that the **Edison lamp patent was a fraud from the date when application was made therefor to the time of its judicial limitation by the United States Supreme Court.**

The fraud was first upon the investors who purchased stock in the Edison Electric Light Company, and afterwards upon the public, upon the courts, and upon the competing lamp makers.

We place this opinion on file, of course, with all due respect to the various judges who have decided various points in the litigation and without questioning their honesty. But no electrical man, familiar with the art and with the quality of the electrical knowledge displayed by these judges in their opinions, can allow their conclusions to weigh for anything whatever against the plain records of the progress of the art.

Every worker in the field previous to and contemporaneous with Edison has devout partisan upholders, each of whom puts forth strong arguments for precedence in support of his favorite. All, however, who are familiar with the development of the incandescent lamp (save those who from motives of pecuniary benefit, direct or indirect, were induced to smother their honest convictions) AGREE that the commercial lamp *was* a development, a growth, to which several workers contributed, and that the full measure of credit for the so-called "invention" could not be claimed by any one man; that no man's claim was strong enough to entitle him morally to go down in history as the inventor of the incandescent lamp.

To offer severe criticism of a man who has done so much good work as has Mr. Edison may seem like heresy; but truth will prevail, is now indeed gaining in the struggle against falsehood, and the Edison which our children read of will not be the Edison portrayed in the New York *Herald* in the early eighties and written about by brainless space-writers ever since.

If we search for the one controlling reason why so many judges were found to sustain the unjust claims to priority for Edison, we find it in the continued newspaper twaddle of the period from 1879 to 1885, by which the average reader was convinced beyond any further argument that Edison was the first man in the world who knew anything of the practical application of the electric current. Men who had never heard the name of Faraday, or Siemens, or Starr, or Swan, were made familiar with Edison, "the wizard," through countless articles which the latter's agents either wrote or inspired. So much for the power of the press when exerted in the wrong direction.

If, then, we ask why so many men of education, and of at least ordinary commercial honor, were found ready to engage in the lamp business in the face of the Edisonian claims to exclusive right, we find the answer in the fact that a vast majority of those who were well informed did not believe in the justice of those claims.

Electricity does not assume in this brief article to give credit to every individual who contributed something to the development of the incandescent lamp of to-day. We merely mention four conspicuous workers in the field whose work was as well known in 1879 as it is to-day to the men who were leaders in the art at that period.

Fully entitled to stand at the head as the father of the incandescent lamp was J. W. Starr, an American, whose work in 1845 shows that he had at least discovered all the requisites for a successful lamp.

Passing by the patient workers of the intervening period, many of whom made important steps in advance, and considering the period from 1876 to 1879, history will eventually show that Edison, Swan, Lane-Fox and Weston were all entitled to a fair measure of credit for the working out of the problem, and that no one of the group was entitled to a monopoly of that branch of the art. It will further be shown, we are confident, that the cause of the Edison-Swan compromise in England was the knowledge of both parties that if they fought to a finish it would result in throwing the manufacture of incandescent lamps open to the public at that time.

Judge Wallace came very near to expressing the honest expert opinion when he spoke in his decision of 1891 of the "shadowy demarkation of the line between the essential and non-essential features of the invention."

We hold, therefore, that the independent lamp makers have at no time been infringers in the popular acceptance of the word. They have at no time broken the law of business honesty. They have engaged in a business in which they believed they had a right to engage, backed in that belief by a majority of the men in the electrical line.

The duty of the public, both to themselves and to those to whose courage and persistence is due the reduction of the price of incandescent lamps from $1 to 25 cents, is clear. Other things equal, no man should buy lamps except of one of the many reputable independent lamp companies. This is a debt which the public owes to independence and the true American spirit, and which can be paid with profit to both parties.

The Edison lamp interests have no claims upon the public. For years they charged an extortionate price for their product, retarding as far as they were able the progress of the industry. At the same time they offered a lamp of inferior quality, a lamp which was beyond question the poorest lamp ever offered to the public by a concern of any standing. They never improved the quality of their lamps until forced to do so by the competition of the independent concerns. Again we cite the words of Judge Wallace:

> "Undoubtedly the improvements that have been made in the art, such for instance as the method of electrical carbonization of the filament, since Mr. Edison's invention, have been of great value, and the perfected commercial lamp of to day is far superior to the one which could be made by applying to the description of the patent all the knowledge and skill then possessed by those to whom it was more particularly addressed."

Pages could be written showing just why the Edison lamp patent was unworthy of the respect ordinarily due to the claims of a reputable inventor, and many pages will yet be so written. The history of the litigation is one not pleasant to discuss, but which justice demands must be discussed. It was blackened by the perjury of men like Walter K. Freeman, who testified first on one side and then on the other, and by the concealment of the truth on the part of many an expert who now regrets his connection with it and who hopes the Searchlight of Electricity will never turn in his direction.

The independent lamp makers have not been morally infringers; they have not sought to break down an honest patent, or to rob any worthy inventor of the fruits of his labors. They are as worthy of respect as any class of men in any line of business. They are offering the best incandescent lamps to be bought anywhere in the world to-day, and they are worthy of the confidence and patronage of the public.

* * *

The decision in the Bate Refrigerator case has encouraged the organization of a new cheap telephone company in Washington with metallic circuit free from induction. The Government has constructed a telephone system in the Interior Department for which the entire cost is less than one year's rent of the old plant.

* * *

The decision of the U. S. Supreme Court in the McKeesport case will not be handed down before March 25.

Coal Consumption in Central Stations. There is probably no line of work in which the National Electric Light Association can engage that will be more prolific of good results to the lighting industry as a whole than that which has been delegated to the Committee on Data. The difficulties with which a committee having the collection of such information in hand must contend can only be appreciated by those who have had experience in this same work. Members of the present committee have complained of an apathy on the part of Central Station men and an unwillingness on their part to co operate, but while there may have been some apathy, it has doubtless been true that inability rather than an unwillingness has prevented the majority of those who have remained silent from assisting in this most praiseworthy work. This became evident at the Cleveland Convention by the demand for information from Central Station men as to how to prepare or collate the information desired, and we are glad that instructions that will assist those who need them are to be prepared and distributed with future requests for information.

The value of these reports of the Committee on Data, incomplete as they are, is becoming more and more appreciated, and with this better understanding of their value will also come a greater readiness to co-operate as well as a better ability to do so.

We remember distinctly the shock with which the Washington report of this committee was received. Everyone was surprised at the unfavorable showing made, and the committee itself in comparing the results obtained in the Chelsea Jute Mills, of Brooklyn, N. Y., which, during a period of six days, averaged 653.3 indicated H. P. on a coal consumption of 1.482 lbs. per I. H. P., with results obtained in electric light stations in which the best was only half as good, and in which the average reporting was between one-fourth and one-fifth as good, seemed reluctant to believe that its figures were accurate.

A comparison with foreign practice showed, however, that bad as was the showing made by the report, we were in no sense behind. This was a poor satisfaction, however, and has stimulated Central Station managers to do better. In the last report, published in this issue, the best statement far surpasses anything previously given and if the figures are correct probably makes a a record for Central Station economy which has not been previously obtained. This record was an electrical H. P. hour on a consumption of 2.84 lbs. of coal. The second best was 4 lbs., or about the same as the second best in the Washington report. The average of the ten reports from stations generating over 5,000,000 watts per day is stated as 4 lbs. This is evidently a typographical error since we figure it out as 5 lbs. In the Washington report there were but two stations reporting over 5,000,000 watt hours, and these average 4.2 lbs. The average of thirteen stations having an output of 1,000,000 watt hours or more was 5.6 lbs. as against 5.7 lbs. in the last report as an average of sixteen stations.

On the whole, therefore, the Cleveland report does not show quite as good an economy as did the Washington report, and this becomes emphasized when we understand that the stations from which data were obtained for the Cleveland report averaged a very much larger output than did those considered in the Washington report.

When we compare the economy of the Chelsea Jute Mills of producing an indicated H. P. hour on a consumption of 1.482 lbs. or an equivalent of an electrical H. P. hour on a consumption of 1.83 lbs. with an average from our large Central Stations of 5.7 lbs. we see how wide a chance there is for improvement, and it is to be hoped that these reports will be the means of effecting a marked change for the better in Central Station practice.

* * *

The Best System Will Win. The N. Y., New Haven and Hartford Railroad Company, which has had the passenger and freight business of a large part of New England in its grasp for several years, is now making a stupid but bitter fight against the electric systems connecting the towns along its various lines. The corporation has taken the matter before the Legislature with a view to ending the increasing inroads of the trolley systems upon its local traffic. The main contention is that public necessity does not demand these trolley roads, and that the State guaranteed in the steam road's charter against parallel lines.

Public necessity demands the best and cheapest means of traffic available, and we don't believe that even the Connecticut Legislature, a large percentage of whose members have shown in times past that they are the servants of the New Haven road, will dare to block the wheels of progress.

If the people want the trolley roads, they will get them. If they don't want them, capitalists will not build them.

Under the Searchlight.

Views and Opinions on Timely Topics.

POLITICS IN CHICAGO.

Are Hornsby and His Pupils to be Provided For?

An ordinance has been introduced in the Chicago City Council providing for the creation of a Board of Electrical Examiners, three in number, who shall be entitled to receive a salary of $500 a year and an allowance of $1,500 for a secretary. It shall be their duty to examine all applicants for the licenses which shall hereafter be necessary to enable any person to engage in electrical construction work or to serve as dynamo tender.

So far, good.

There shall be for the first class an examination fee of $10 and an annual fee of $50; for the second class an examination fee of $5 and an annual license fee of $5.

This Board shall be subsidiary to the Superintendent of City Telegraph, who shall handle the money and issue the licenses.

There is no provision that members of the Board may not hold a dozen other positions at the same time—such as organizers for the National School of Electricity.

It is also provided that—

The Board of Electrical Examiners may in lieu of examination of applicants as to electrical knowledge, for both forms of license as provided in this ordinance, *accept a certificate of graduation or scholarship from such technical schools or colleges as they may regard as expressive of proper qualification for the holders of same.*

Thus the guarantees or promises of Hornsby that pupils of the National School may be able to secure good paying positions as electricians upon completion of a six months' course may perhaps be fulfilled.

Ruinous fines are proposed for those who break the rules laid down by the Superintendent of City Telegraph, and construction companies must file a bond of $300 to indemnify the city of Chicago against defective work.

With Barrett at the head of the inspection department and Hornsby appointed to a place on the Board of Examiners, the electrical interests of the great city of Chicago would certainly be well watched, and the name of Hornsby alone should be sufficient guarantee that all work will be done in accordance with the most advanced ideas. Indeed the Board of Underwriters might then dispense altogether with their inspection machinery!

Who says Professor Barrett and Doctor Hornsby of Heidelberg College, Tiffin, O., are not up to snuff?

* * *

ELECTRICITY acknowledges with proper gratefulness the gift of a package of lead pencils from the *Electrical Review*.

* * *

IT is announced that the final loss of the Edison lamp patent will not itself be included in the reductions in the patent assets in the next annual statement of the G. E. Company, as the decision of the U. S. Supreme Court was not rendered during the fiscal year ended January 31.

* * *

THERE is on foot a scheme for a consolidation in the electrical manufacturing line so comprehensive in its nature as to throw into the shade the rosiest plans of the G. E. promoters even in their few weeks of glory. No intelligent opinion can yet be expressed as to the effects of the proposed plan upon the trade as a whole. It may be for the best. If it should, however, be carried to completion and develop into a second campaign of extermination, ELECTRICITY will be found expressing the same views as heretofore, not intimidated by the wealth or prestige of any body of men in America—not even the Standard Oil coterie.

* * *

FISH vs. THE U. S. SUPREME COURT.

The Bate Case Decision.

F. P. Fish says: "The decision construes the statute contrary to the intention of Congress, and was forced upon the Court by the bungling language of the law."

The U. S. Supreme Court said, without a dissenting opinion: "In our judgment the language is so plain and unambiguous that a refusal to recognize its natural meaning would be justly regarded as indicating a purpose to change the law by judicial action based upon the supposed policy of Congress."

New York Electrical Society.

On Thursday evening, March 7, the New York Electrical Society held its regular monthly meeting at the School of Mines. The feature of the evening was a paper by Mr. Charles S. Bradley, of the Fort Wayne Electric Corporation, on "Alternating Currents in their Relation to Distribution of Energy." Mr. Bradley is one of the acknowledged authorities on the subject with which he dealt, and anything which he has to say is listened to with the closest attention and respect. He began by reviewing the history of alternating current development from the single-phase up to the two and three-phased methods, including the so-called monocyclic. As regards the rotary field or drehstrom method, he placed the credit for the invention several steps in advance of Tesla. In fact, he placed Tesla's discovery in point of time the last of several, Marcel Desprez being credited with the original discovery. He also read a translation from the French of a letter describing Desprez's invention, and exhibited a working model of the motor which was actuated by two distinct coils in which the phases differed by 90 degrees and which were themselves at right angles.

As to the relative merits of the various methods of transmission by alternating currents, he classed them in the following order:

For transmission purposes purely—1, tri-phase; 2, two-phase; 3, single-phase.

For lighting purposes he reversed the order thus—1, single-phase; 2, two-phase; 3, tri-phase.

In regard to the so-called monocyclic system he claimed that it was weak in the very point for which its friends had claimed that it was strongest, viz., in its adaptation to motor work. Its weakness in this consisted in the fact that in the motor the phases were not in the best relation. This view evidently coincided with Mr. Scott's, which was that it was "lopsided."

He then showed a three-phased motor of his own invention which had an armature of the squirrel-cage type. This was in duplicate—one half of it consisting of bars of high resisting german-silver short circuited upon themselves, and the other half consisting of similar bars of copper. There was but a single set of field magnets, which, in the motor exhibited, were placed over the german-silver end of the armature in starting and then shifted to the copper end when full speed was attained. He explained that the extra resistance required for starting might be placed externally to the armature and thrown in and out when desired, thus doing away with the double armature and the shifting of the field frames. He also showed by means of a spring balance the difference in starting torque when the fields were placed first over the german-silver winding and second over the copper winding. In the first case the pull at the end of a two foot radius was 2½ lbs. and in the second case 1 lb.

A large number of curves were exhibited showing the performance of the motor and its various peculiarities. One of the most noteworthy of these latter was a series of curves showing the efficiencies of two motors otherwise similar but in one of which the armature was of solid and the other of the usual laminated iron. These curves showed that the efficiencies were almost exactly the same.

The paper proved of great interest to all those present and was charming from its unconventionality. Usually when one sits down to hear a paper on alternating current distribution it is with the expectation of hearing a technical dissertation which it would require weeks to digest. Mr. Bradley, however, used no language which could not be assimilated at once by the merest tyro. In fact his methods of reasoning are exceedingly simple, and this was admirably illustrated by his reply to a question from Dr. Emery. Mr. Bradley had stated that the three-phased motor which he exhibited was a four-pole machine. Dr. Emery asked him how he got a four-pole field with three wires, and requested him to give a diagram of the windings. Mr. Bradley with a loud laugh, and holding his hands up in holy horror, replied that he never made drawings of his windings—that when he wanted to make a machine he "just went to work and *made* it."

Storage of Energy Essential to Economy of Working in Central Stations*—II.

BY N. W. PERRY, E. M.

GAS STORAGE AND GAS ENGINES.

On purely theoretical grounds at least the gas engine deserves our consideration at this point for the following reasons: In the first place, we may replace the wasteful standby losses of steam boilers under the variable central station load by the ideally simple and economical system of gas storage. The use of the gas engine, therefore, comes legitimately within the province of this paper, since it permits of employing a substitute for the boilers, which may be operated continuously at the most economical load, and yet supply with equal efficiency the most variable load that can possibly be thrown upon it.

Comparing the relative theoretical advantages of the gas engine and the steam engine, Prof. Kennedy states that the maximum theoretical efficiency of the steam engine is thirty per cent. Its obtained efficiency is about ten per cent. The theoretical maximum efficiency of the gas engine is eighty per cent. Its efficiency obtained in practice is twenty-five per cent. These facts have led Mr. Thwaite to say that the practical efficiency of the gas engine is equal to the theoretical efficiency of the steam engine. As a matter of general experience, however, under usual working conditions with large engines, very little if any advantage in efficiency is shown by the gas engine over that driven by steam, but if this statement is disputed, as I am not at all sure that it cannot be successfully, the burden of proof lies with the gas engine.

The gas engine has the practical advantage that it may be started and stopped when required, thereby avoiding the standby losses so fatal to economy where boilers are used. These standby losses for boilers are given by Dowson† as ten per cent.; that is to say that boilers that are standing idle and furnishing no steam will require ten per cent. of the fuel they will take when working at their rated capacity. The gas plant, however, where gas storage is employed, has no standby losses of this kind, but in many cases where fuel gas is manufactured to be used on the premises adequate storage is not provided and in times of light load part of the plant is banked. Under these conditions, Dowson states that the standby losses will not exceed 2.8 per cent. The advantages in favor of the gas engine in this respect, even under the most unfavorable circumstances, are therefore as 10 to 2.8 or 3.

As to fuel consumption in gas engines, foreign practice furnishes considerable data. Messrs. Crossly guarantee one brake horse-power hour on a consumption of one pound of anthracite coal, using Dowson gas. Under test conditions‡ the gas engine plant at Chateau Say, supplying 650 lamps, consumed 1.2 pounds per indicated horse-power hour. At Leven Tweed Mills, four gas engines, aggregating 200 horse-power, used in six days' trial one and one-quarter pounds anthracite per brake horse-power hour, or one and three-quarters pounds gas coke per brake horse-power hour. At the Godalming mills gas engines, aggregating 400 indicated horse-power, averaged one pound of fuel (character not stated) per indicated horse-power. At the Chelsea flour mill a sixty nominal horse-power twin cylinder gas engine with Dowson gas, under full load test, used 0.87 pounds coal per indicated horse-power. But, as we are all aware, the fuel consumption under test conditions is no criterion to judge by, and especially misleading when we have under consideration an electric lighting plant. Furthermore, as I think has been conclusively shown, the fuel is by no means the only expense attending the production of power. Mr. Dowson places the cost of a Dowson gas plant of eighty horse-power at $20.31 per horse-power, and for a plant large enough to supply 530 horse-power at $10.87 per horse-power. The wages of firemen for a gas plant are no more than for a steam plant and a much cheaper fuel may be used. But let us assume that the fuel in both cases costs the same per ton, that the gas plant costs $20 instead of $10, so as to cover the cost of extra land required. Then our account would stand something like this:

Cost of engines, 6.17 at $50	$308.50	
Cost of gas plant, 1.547 at $20	30.94	
Cost of buildings	120.00	
Cost of dynamos	120.00	
Total fixed investment	$579.44	
Interest on $579.44 at 4 per cent.	$23.18	
Maintenance and depreciation—		
Machinery,$459.44	34.06	
Buildings, $120 at 2 per cent.	2.40	
Total fixed annual cost		$59.64
Cost of coal, 2 pounds, 8,760 hours, at $1.75	$15.33	
Cost of petty stores	1.64	
Cost of driving, stoking and cleaning	11.67	28.64
Total annual cost per electric horse-power		$88.28
With coal at $3.50 the total cost.		$103.61

Saving over present methods, with coal at $1.75 = $117.78 — $88.28 = $29.50; with coal at $3.50 = $148.40 — $103.61 = $44.79.

THERMAL STORAGE.

Mr. Druitt Halpin, of England, has devised a method of thermal storage which has attracted wide attention abroad and is likely to attract great attention in this country as soon as its efficiency becomes better understood. We all know that a boiler when supplying an intermittent demand is capable of supplying for a short time energy at a much more rapid rate than its steaming capacity would warrant; that during the period of light load it has stored up a certain amount of energy which it can give out again when called upon to do so. It will have been observed that during the period of comparative rest the pressure in the boiler will have increased as also the temperature of the water and steam. It is this increase of temperature that constitutes the storage of energy, and with the same increase of temperature above the normal working temperature the amount of energy stored will be proportional to the quantity of water heated. Since the quantity of water usually employed in our boilers is comparatively small, the storage of energy in them within the limits of safe pressure is, therefore, limited. Mr. Halpin, however, has conceived the plan of connecting the boilers to large iron storage tanks filled with water which is brought to the same temperature and pressure as the boiler. It is a condition any system of heat storage for central stations that the energy stored should be recoverable whenever and at any rate of supply required. Superheated water fulfils this condition, for if the pressure is reduced steam is generated instantly and in controllable amount. This has given rise to three methods of procedure, which he has designated respectively "steam storage," "feed storage" and "combined feed and steam storage."

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*Read before the National Electric Light Association at its Eighteenth Convention, held at Cleveland, O., February 19, 20 and 21, 1895.

† "Gas Power," a paper by Emerson Dowson in the *Engineering Review*, November 30 and December 20, 1894.

‡ Bryan Donkin, before Incorporated Institute of Gas Engineers.

The first of these was very fully described by Prof. George Forbes at the St. Louis Convention. The other two are later developments.

In the steam storage system Mr. Halpin employs only sufficient boilers to supply the mean demand and storage tanks sufficient to supply the maximum demand. These latter not being subjected to the fire will suffer but little deterioration, and being simple iron reservoirs of sufficient strength to withstand the pressures required are comparatively inexpensive to install. The boilers working continuously at their most economical rate have their excess of energy during light load stored up in the water of the tank, from which it may be drawn at will during heavy load. He proposes that the boilers and tanks shall work under a pressure of 265 pounds per square inch when fully charged, which corresponds to a temperature of 406 degrees Fahrenheit. He proposes that the engines be worked at 130 pounds per square inch, which corresponds to 347 degrees Fahrenheit. The total available heat stored when the reservoirs are fully charged is the difference of the total heat of the water at 406 degrees and at 347 degrees Fahrenheit, or that due to a range of temperature of fifty-nine degrees. Every pound of water falling in temperature through that range will yield sixty-one thermal units of heat. The total heat required to generate a pound of steam at 130 pounds per square inch from water at 347 degrees is 868.8 thermal units. Consequently fourteen and one-quarter pounds of water falling in temperature from 407 degrees to 347 degrees will yield one pound of steam. To allow for radiation loss and imperfect working, this may be taken at sixteen pounds of water per pound of steam. The steam consumption per effective horse-power may be taken at eighteen pounds per hour in condensing and twenty-five pounds per hour in non-condensing engines. The storage room per effective horse-power by this method would, therefore, be $\frac{16 \times 18}{62.5} = 4.06$ cubic feet for condensing and $\frac{16 \times 25}{62.5} = 6.4$ cubic feet for non-condensing engines.

Gas storage, assuming that illuminating gas is used, would require about 20 cubic feet of storage room per effective horse-power stored, and if ordinary fuel gas were stored it would require about four times this capacity.

In water storage 317 cubic feet would be required at an elevation of 100 feet to store one horse-power hour, so that we see that of the three methods of storing energy the thermal method is by far the most economical of space.

In the steam storage method the boiler is completely filled with water and the storage tank nearly so. The two are in free communication by means of pipes, and a constant circulation of water is maintained between the two, but the steam for the engines is taken only from the top of the storage tank through a reducing valve.

In the feed storage system the excess of energy during light load is stored in the tanks as before, but the boilers are not completely filled. In this system the steam is taken exclusively from the boilers, the superheated water of the storage tanks being used during heavy load as feed water to the boilers.

The third method, as the name would imply, is a combination of these two. In the "combined" feed and steam storage system the pressure in boiler and storage tank is equalized by connecting the steam spaces in both by pipe, and the steam for the engines is, therefore, taken from both. In other words, they work in parallel.

An incidental advantage of thermal storage is the purity of water supplied to the boilers. Since the latter derive their feed water from the hot reservoirs, it will have deposited its impurities where they can do no harm. The only unavoidable losses that need be considered in connection with thermal storage are those due to radiation from the reservoirs. This can be provided against by proper lagging so as to be insignificant, and be still further reduced if there be a number of reservoirs. If, for instance, there are four, each will radiate from three-quarters of its surface towards the other three, and only from one-quarter of its surface into space.

STEAM STORAGE SYSTEM.

As illustrating the *modus operandi* and cost of the system of "steam storage," as it is called, I quote from a report by Mr. Wm. Schonheyder, who, taking the load line of the Berlin electric lighting station as a basis, has figured out the relative costs of operation with and without a steam storage system. Fig. 1 is the load line of this station for December, 1891. The scale of the diagram is 1,250 kilowatts per ½ inch, and the water consumption is taken at twenty-two pounds per kilowatt hour. Using storage tanks 8 feet in diameter this would give a scale for water consumption of one inch to 27,500 pounds per hour. The maximum load is 7,500 kilowatts, requiring, say, 10,000 electrical horse-power. The minimum load, according to the curve, is 320 kilowatts, and the proportion of the maximum to minimum work required from the boilers will be as 7,500 to 320 or as 23.4 to 1. The mean load was 2,030. Excess of maximum above mean, 5,080, or a load factor of about 27 per cent. Duration of maximum above mean, 7.5 hours.

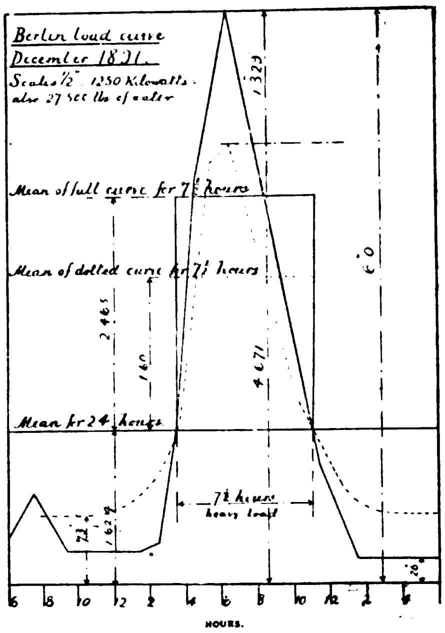

Fig. 1.

In estimating for the steam storage system the extra quantity of steam wanted during seven and one-half hours, and which has to be produced from the water in the tanks, is represented by the area inside the full line curve, Fig. 1, and the straight mean line for twenty-four hours. The boilers and tanks will, under this system, have to work at 250 pounds gauge pressure, equal to 265 pounds absolute, for a large portion of the twenty-four hours. This extra steam, then, is 2.465 × 27,500 pounds × 7½ hours = 508,200 pounds at 130 pounds absolute pressure as required by the engines, and this is equal to an expenditure of 508,200 pounds × (1.219° — 376°) = 428,413,000 heat units,—376° being the mean temperature of the water from which the steam is produced, viz., 406° at beginning of heavy load and 347° at the finish; 1.219° is the total heat of 130 pounds steam. Since the water in the tanks, in producing this steam, cools from 406° to 347° it gives up, say, 59 heat units per pound, and we shall therefore require $\frac{428,413,000}{59} = 7,261,000$ pounds water in the tanks. Taking the tanks, as before, as holding an available (steam room required at top) 75,000 lbs. each, we want $\frac{7,261,000}{75,000} = 97$ tanks.

The necessary boiler power, compared to that of the present installation, will be in proportion of 1.624 to 6, and allowing, say, 5 per cent. extra cost for the increase in pressure, we get the cost of boiler plant with steam storage tanks equal to

Boilers, $\frac{1.624}{6} \times$ £30,000 × 1.05 = £8,526
Tanks, 97 × £500 × 1.05 = 50,925
Total.............................. £59,451

This is nearly double the cost of the existing plant, but, as we will see later, the saving in fuel and in other ways makes the increased investment pay when fuel is dear.

(*To be continued.*)

Thawing by Electricity.*

Mr. Edmunds states that he has been making some experiments lately with most complete success, in what we think is a new and important application of electricity to domestic use. He, like many others, has suffered the inconvenience of having his gas and water service frozen during the late severe weather. It occurred to him that a resistance, suitably protected, might be introduced into those pipes which were most exposed and least easy of access with flame or hot water or other ordinary method of thawing. He had a special wire made, in which the current was conducted through a highly resistant metal, insulated with a fireproof medium that was also a non-conductor of electricity. The whole was enclosed in a metal tube, which could be drawn down to make a compact wire or tube that was externally a conductor of heat, but not of electricity, thus preventing loss of current and electrolysis. The results were most satisfactory This "thermic" wire was introduced into the waste pipe from a bath room at the north side of his house, which entered a fall pipe some 20 feet from the ground, and which was easily frozen. On Saturday last the thermic wire was introduced from the outside. At night a small stream of water trickling down, froze, forming an icicle some 12 inch. long and 1½ inch. thick, completely blocking the waste pipe. The thermic wire having been previously connected with Mr. Edmunds's electric light circuit, at 50 volts pressure, when current was turned on four amperes flowed through it; and in four minutes a complete thawing was effected, and the waste service was cleared. This is a method of thawing which might be worth the consideration of gas and water companies; certainly it is one that highly merits the attention of prudent householders.

An electric trolley tricycle is being built at San José, Cal., to be used to pace bicycle record breakers. It is the invention of Wilbur J. Edwards, the well known racing man, who was the Pacific Coast champion of two years ago. The object of the invention is to provide a mechanism which is especially adapted as a pacemaker to be used in trials of speed for bicycles in connection with that of wind-break or shield which will protect the rider from the resistance caused either by the direct wind blowing against him or the current formed by his own rapid speed.

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* *Electrical Review*, London.

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND*—II.

IMPORTANCE OF THE LOAD FACTOR IN CENTRAL STATIONS.

All central station people have known for years that the most profitable consumers were those who used their lamps for the greatest number of hours.

In other words, that the net profit due to a consumer was largely dependent upon the relation between his average load and his maximum load, which Mr. Crompton in England has aptly called the "load factor." Yet, while appreciating this fact, central station companies make their rates dependent upon the kilowatt hours used, and independent of the maximum kilowatts used.

Mr. Arthur Wright, at Brighton in England, deserves the credit, as far as I know, for having first given commercial recognition to this load factor of the consumer. Mr. Wright supplies each consumer not only with a meter which registers the kilowatt hours used, but also a second meter of simple construction which registers the maximum kilowatts used at any time during the month, and the discount which the consumer gets is very largely due to the relation between his average and his maximum kilowatts.

Suppose that there are two customers connected to a central station and that the monthly readings show that each has used 900 kilowatt hours. By the usual practice in this country the bill would be the same, yet one bill may be due to the use of one and one quarter kilowatts for twenty four hours per day and for thirty days per month, and the second bill may be due to the use of 30 kilowatts an average of one hour per day for thirty days per month. That is, the first bill may be due to a steady load, such as a few lamps in a basement of a hotel or a ventilating fan, while the second bill may be due to a larger load of lamps used only occasionally, as in an office building or an electric elevator requiring 30 K. W. for a few seconds to start it up, and after starting requiring only 15 K. W.

With the same 900 K. W. hours per month for the two cases, the central station company should charge at least five times as much for the case having the elevator and small load factor as in the other case.

It is a fact not generally appreciated that in any central station the cost of producing a kilowatt hour can be divided into two portions, one of which, such as interest on cost, depreciation, salaries, a small part of the labor and coal, vary with the kilowatt capacity of the plant, that is proportionally to the maximum load, and are independent of the number of kilowatt hours produced, and the other portion of the cost of producing 1 K. W. hour represented by the larger portion of the coal, labor, water, etc., is dependent upon the number of kilowatt hours produced, and is independent of the maximum load.

The fact about this matter which is least appreciated is, that the portion of the total cost of 1 K. W hour produced, which depends upon the maximum load, is about two-thirds of the total cost, and the part dependent upon the output is only about one-third.

In a modern central station 1 K. W. of its capacity represents about $800 invested. Consider the two consumers cited above. Both loads are in use at the time of maximum daily load. For the elevator, the central station has to provide an investment of $9,000, for the ventilating fan $875. Assuming interest, depreciation and similar charges at 10 per cent., we have $900 to deduct from our gross earnings in the elevator case before we reach net profits, and $87.50 in the other case.

Suppose we get 10 cents per kilowatt hour in each case, and that the cost of production independent of general expenses, interest, depreciation, etc., is 50 per cent. of the gross receipts, etc. This would mean that if we get 10 cents for each kilowatt hour in both cases our gross revenue would be $90 per month in each case, and gross profit $45 per month, or $540 per year, in each case. But in the elevator case we have interest and depreciation charges of $900 a year, and hence have actually lost considerable money in supplying this customer, while in the other case we have made a net profit of over $500 per annum.

We would have to charge more than ten times the rate per kilowatt hour to the elevator that we charge to the ventilating fan to make the same net profit on $1 of capital invested.

This load factor is a most vital question, and it is the difference in load factors in English and American central stations which makes storage batteries commercially possible there and impossible here.

The average load factor of an English central station is less than 15 per cent., and even in London in December it is only 33 per cent., while in most American cities the load factor which averages 40 per cent. will in December in many cases be above 50 per cent.

This difference is due almost wholly to our motor load, which is an almost unknown quantity abroad. With a 15 per cent. load factor a storage battery may pay, but not with a load factor of 40 per cent., especially when the load factor in our central stations is rising each year.

If central station companies would offer such a discount due to load factor as to warrant an individual customer's installing at his own expense a storage plant which he would charge at the minimum rate per kilowatt hour by a steady current for twenty-four hours per day, and then used this stored energy to supply his occasional demands for an occasionally very large rate of energy, I believe it is possible that the central station companies, the storage battery companies and the consumers might all derive a profit from the arrangement. I have no doubt that a central station company could afford to make a rate of 4 cents per kilowatt hour for a continuous service night and day, and make a satisfactory profit, while it would surely lose money in supplying an elevator, such as described above, even at 15 cents per kilowatt hour.

I believe that the following schedule of rates fairly represents the charges per kilowatt hour that should be made to customers of various load factors:

Load Factor.	Rate per K. W. hour in cents.	Resultant gross income per annum per K.W. of plant.
5	30	$131.40
10	20	175.20
15	16	210.24
20	13	227.76
25	11.2	245.28
30	10	262 80
35	9.2	281.07
40	8.5	297.84
50	7	306.60
60	6	315.36
70	5.3	325.00
80	4 8	336.38
90	4.4	346.89
100	4	350.40

THE HEILMANN LOCOMOTIVE.

In France I examined what I considered the most important electrical engineering development of all that I saw. It was the Heilmann electric locomotive.

The locomotive I saw was the first one built, and was not in service when I was there. It had run 2,200 miles commercially, however, and as a result of the performance of this first locomotive which was 600 H. P., there are now building two locomotives of 1,500 H. P. each, which it is expected will go into commercial service about June next.

The entire weight of the locomotive is 114 long tons; that is, about 15,500 pounds per driving wheel, which is about the same as our standard practice in this country. With a tractive coefficient of .2 this means a draw-bar pull of 50,000 pounds, and assuming friction at six pounds per ton, we find that 50,000 draw-bar pull would enable us to pull 1,900 tons on a one per cent. grade at a low speed, say 15 miles per hour, and would give us ample draw-bar pull for handling a 200 ton train at any speed thus far seriously discussed.

The steam engine is compound, well-balanced and directly coupled on its shaft is the electric generator. A four-pole single reduction motor of the iron-clad type is geared to each of the eight axles, and the motors, which are series wound, are in multiple with each other across the brushes of the generator armature. As the motor field must have a fair degree of saturation to prevent sparking when the locomotive is running light and pulling no train, it will be evident that under all operating conditions the motor fields are constant and fully saturated, which makes them entirely sparkless. The field of the generator is separately excited by means of a small auxiliary engine and constant potential dynamo, which also supplies the electric lights needed. The main engine has a fixed cut-off at the most economical point, say one-quarter stroke, and its speed is adjusted by the throttle.

The engine in practice is varied in speed from perhaps 50 to 500 revolutions, and the strength of the generator field from zero to its maximum strength. It will be noticed that all steam used is used expansively at a fixed cut-off, and Mr. Heilmann lays great stress on this, although I myself would prefer an automatic engine running at a constant speed, and I believe that he would if he could get as good ones abroad as we can in this country. For starting, an almost unlimited torque is secured by gradually increasing the generator field strength and speed, which sends a current through the motors, rising smoothly from zero to that current sufficient to start the motor armature. If we leave the field controller and throttle in this initial position, our train will start smoothly, and will continue to move slowly, using the full current, but producing the current with about 50 volts or one-tenth of the full voltage, and we will be producing this power, about one-tenth of that required at full speed, by a steam engine using steam expansively instead of, as in the steam locomotive, full stroke. But of course we desire to accelerate the train rapidly, so we keep on manipulating the field controller and throttle, until we finally have the engine driving the generator at full speed in a field of full strength, which will of course represent the full power of the locomotive. When we reach a grade requiring three times the torque required on the level, we weaken the field to one-third of its full strength. We will then move up the grade at about one-third of the speed on the level while using the same power as was required on the level.

It will be noticed that under the electrical arrangement on this locomotive the electric energy is used in such a manner that its voltage is varied in proportion to the speed desired, and the amperes are in proportion to the torque required, so that the electrical energy produced is utilized in the most efficient manner possible.

An electric locomotive of this kind would probably cost for the first few about $80,000, each being equipped with a 1,500-horse-power boiler of our best marine type and one of our best automatic cut-off compound engines directly coupled to a modern multipolar generator. I believe that a locomotive of this type could be built which would be able to pull 50 per cent. more weight than any of the present steam locomotives, and that it could pull the same weight at 50 per cent. higher speed. I think this type of electric locomotive is the stepping-stone between the steam locomotive and the electric locomotive operated from a distant central station.

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*Abstract of H. Ward Leonard's paper read at a meeting of the A. I. E. E., February 27.

A Method of Determining the Eddy Current and Hysteresis Losses in Direct Current Armatures.

BY A. W. K. PEIRCE.

By running a direct current machine as a motor, unloaded, at its proper speed and degree of magnetization, the input to the motor armature gives a measure of the above losses plus the friction of the bearings, brushes, etc. To eliminate this friction loss, the hysteresis and eddy current loss may be separately determined; the method usually employed is to run the armature at a constant speed in a frame whose magnetizing coils are adapted for separate excitation by means of another machine run as a motor. On measuring the input to the motor at various stages of the magnetization of the driven armature from zero to the maximum desired, the above losses plus the various losses in the motor are found. Assuming that these losses are constant (except the C^2R, which may be calculated and allowed for), the difference between a reading taken at any particular stage of magnetization and that taken at zero magnetization will represent the losses due to eddy currents and hysteresis in the driven armature for that particular magnetization. This magnetization is calculated from the E. M. F. generated in the driven armature as measured by a voltmeter connected to the brushes.

The assumption that these various losses in the driving motor are constant is hardly allowable. It may, if a large motor be used, be such that the difference between the various readings is small; but in this case the liability of error in determining the comparatively small difference between comparatively large readings is great. If a small driving motor be used, the liability of such error is much reduced; but new sources of error appear; the total tension of the driving belt, consequently the pressure on the bearings of both machines, and the amount of the "belt creep" are much increased, and the increased armature reaction of the driving motor causes its field to vary both in distribution and amount, thus varying its internal armature losses.

It is true that these variations may not amount to more than five or six per cent., and an error of this amount in determining a loss which only affects the efficiency of the machine by four or five per cent. is not serious; but the writer has devised a method of making these same measurements in which the sources of error above outlined do not exist, and as it requires as little or less manipulation, presents it as being superior to the method just described. In this method the arrangement of the driving and driven machines is the same as described, except that it is more convenient to use a series motor as the driving machine, although any will do.

The procedure is as follows:

The E. M. F. applied to the driving motor should be varied (by a rheostat connected in series with it) until the speed of the driven armature holds steady at the desired amount, the magnetization of the driven machine being zero. The current and E. M. F. at the terminals of the driving motor are carefully noted; a current is then sent through the magnetizing coils of the driven machine, and the resulting field, by putting extra load on the driving machine, slows it down.

An E. M. F. is now applied to the armature terminals of the *driven* machine slightly greater than and opposite to the E. M. F. generated therein. The obvious result is that a current will flow through the winding of this armature which will tend to drive it as a motor, and the applied E. M. F. may be varied until the current flowing will exert just torque enough to balance the load due to the hysteresis and eddy current losses, leaving the driving motor to furnish the balance of the power required. This will evidently be just exactly the amount it was called upon to furnish when there was no current in the magnetizing coils of the driven machine, and the point at which this condition is reached will be indicated by the return of the speed and the current and E. M. F. of the driving machine to their original values as previously noted.

Under these conditions the input into the driven armature, which should be noted, is equal to the loss in that armature due to the eddy currents and hysteresis at that speed and degree of magnetization plus the C^2R of the armature windings. In a well designed machine this C^2R will prove to be so small that it may be neglected, but it may readily be calculated and subtracted if desired.

The magnetization of the armature may be calculated from its counter E. M. F.; the applied E. M. F. as read is so very nearly the same that its values may be taken.

For any other magnetization the above process would be repeated until a sufficient number of observations are made to allow the core loss curves to be platted.

The advantages of this method over that first given are, that the load on the driving motor and its speed being the same at all readings, its losses of all descriptions are constant. The instruments used to indicate its condition of load need not be accurate, or even calibrated at all, as their readings are necessarily the same; the only accurate instruments required are two, a voltmeter and an ammeter, and the product of their readings gives the desired results directly, or at most only a very slight subtraction (C^2R) is made.

A few hints regarding the making of tests of this general character may be in order.

Never depend for the readings of the speed (revolutions per minute) or any form of speed-counter or similar device which requires a lapse of time for its operation. Always use some form of direct-reading tachometer or other centrifugal indicator, which will give at any instant the *rate* of revolution, as that is what is required, not the number of revolutions which may occur in a given time.

Always wait before reading the other instruments until the revolution-meter indicates not only that the speed is that desired, but that the machine is steadily running at that speed; for if the speed be increasing, the driving machine is furnishing not only the power required to overcome the losses, but in addition is providing the power represented by the *acceleration* of the moving parts; conversely, if the speed is falling, a part of the power required to drive the machines is furnished by the reduction in the velocity of the moving parts, and any readings of the power supplied to the motor will give results too great or too small respectively. This is obvious enough, but is a point very frequently neglected.

When a motor is run with its armature terminals connected directly to the supply mains, the *effective* E. M. F. which is driving the current through the motor armature is only the difference between the E. M. F. of the mains and the counter E. M. F. of the motor armature. Now as this effective E. M. F. is small compared with the total (applied), slight variations, even if not more than 1 per cent. or so of the applied E. M. F., will vary this effective E. M. F., consequently the armature current in a very much greater proportion, especially if the moving parts of the machine have considerable inertia so that their speed does not respond readily to the variation in the motor torque due to the variable current.

On account of the above condition it is often difficult to make accurate readings of the current taken by such a motor.

If this is the case, it is only necessary to increase the E. M. F. of the supply and insert a resistance in the motor armature circuit, so that the drop in the resistance is about the same as the drop through the water; in other words, if the motor is wound for 115 volts, run it on a 230 volt circuit and cut down the E. M. F. on the motor to 115 volts (or whatever is required) by inserting sufficient resistance.

Under these circumstances, the difference between the applied and the counter E. M. F.'s is considerable, and slight variations in the applied E. M. F. have a correspondingly slight effect on the current.

The employment of this plan of steadying the current will often save much time in making tests, and will contribute largely to the accuracy of the results.

It is hoped that the above rather desultory remarks will prove of interest to those who have had occasion to make "core loss" tests, or have attempted to reconcile and use the results of such tests.

Scranton, Pa.

THE WELSBACH LIGHT.

Discussion of This Topic at the Cleveland Convention.

Mr. Gardener—In the city of Pittsfield there are at the present time about 250 of these burners in use. I understand that more have been ordered, but the agent has not been able to supply them. A dentist in North Adams was operating upon a patient under the light of a Welsbach burner, when the lamp exploded and imbedded pieces of glass in his cranium. I immediately investigated the subject, and found that he was no longer using it. We had a customer who was using our lights in his store and workshop, and he substituted the burner in his store but not in the workshop, the reason being that the hammering of his workmen on the benches caused a vibration which would gradually shake the mantel to pieces.

Mr. Edgar—We have had as much experience as any other city, but to sum up a long story I will say that the burner is gradually disappearing. I put one in my house two years ago. At first it saved considerable gas and gave a beautiful light, and the first outfit of mantels lasted over two years. Since that time the mantels have gone to pieces very fast, and my gas bills are larger than they ever were with the old burner and I do not think we are using any more light. We have just completed a contract with a large store which is going to take out the Welsbach and put in our lights. We have a letter from a drug store, stating in emphatic terms what the proprietor thinks of the Welsbach—often when his store door opens the mantel breaks from the draught of cold air. We are naturally prejudiced against the burner and want to see the thing disappear; but, leaving that out of consideration, I should say the burner is losing ground in Boston within the last six months.

Mr. Cairnes—In Memphis we became very much alarmed. They displaced probably 1,500 to 2,000 lights in from 30 to 60 days, and no amount of argument could stop the stream of popular favor in the direction of the Welsbach, and we sat down and mused over the possibilities of an assignment in the near future. That was about a year ago. I presume we have back from 50 to 60 per cent. of the patrons we lost by the burner, and I have assurances that we will get back as much as 25 or 30 per cent. more within the next two months. They have lost ground in Memphis as rapidly as they came in favor.

Mr. Burleigh—For what reason have they lost favor?

Mr. Cairnes—The fact that the longer they are used, the more objectionable the light produced becomes; and in like proportion the greater amount of gas is consumed as the burner begins to be used.

Mr. Seely—I do not think it is a very serious menace to the electric light business where people are at all discriminating as to the character of light they get. In smaller towns people are not as discriminating as they are in larger cities. It seems to me that one of the things the local companies want to do is to maintain better service themselves. One of the reasons that encourage the use of the Welsbach burner is that in some places the service of the electric light companies is irregular.

Mr. Peck—Our station in Brooklyn is almost entirely given to arc lighting. I noticed some four months ago that about 25 large stores used the Welsbach burner. I noticed the same stores a week or two since and discovered that 10 out of the 25 have gone back either to simple gas or the incandescent light.

Mr. Armstrong—This is very encouraging to us. The fact of the matter is that the electric light is a luxurious light, and it will compete, perhaps, with gas in larger quantities, but it will not with the small consumer. That is the thing we must face. The practical difficulty is that it does not pay us to supply very small consumers; it does not pay for the installation, the meter and all that. I am pleased to hear from Memphis and Boston as to what has been the history of this thing; but so far as our incandescent business is concerned it has been and is now a very serious problem. We lost during the last quarter 75 customers, and we do not see any cessation to it. I hope to report by next year that the number has been diminished in accordance with the statements made from other cities.

Mr. Stetson—I know a town a little north of Boston where I heard the manager say if he could have seen the Welsbach burner before he bought his electric light plant—he manages both wings of the service—he never would have troubled himself about the electric light plant, and is only hoping that the municipal lighting scheme would come along and buy his plant. You cannot compete with gas in small towns under 25,000 inhabitants. In the larger cities the electric can hold its own. I find the greatest annoyance in our community to come from the multiplication of the oil wagons. The Standard Oil Company has put up a very large tank holding thousands of barrels of oil, and they run out wagons just as the milk peddler does; and as our cities in the East are largely composed of people working in factories, there is no hope of our trying to get anything out of them with the electric light. If we could only increase our product we could decrease the cost; but there is no hope of this in those communities.

Mr. Corriveau—I do not think there ought to be much alarm felt about this Welsbach burner, or what we call in Montreal the oil light. I do not think there is a city in America which is provided with so many of these burners as Montreal at the present time. They have had them about a year and a half, and several thousand of them are in use; but I am pleased to state that to my personal knowledge eight or ten large stores have gone back to the electric light, and the reason is that they are completely displeased with the burner on account of the breakages of the mantel and the bad color of the light, and I believe it will only be a short time before this will be general.

Mr. Francisco—We had a customer who put in the Welsbacn, and after using it a month returned to the electric light. I asked the reason, and he said I had about 200 of those burners and I wanted to sell them; but I do not propose to lose on my own light the profit made on those burners.

That Allegheny Plant.

New bids have been opened for the lighting plant at Allegheny, Pa. The contract was supposed to be safely awarded to the Western Electric Company, but it seems their bid was defective, not covering the foundations as required by the specifications.

The latest Westinghouse bid is nearly $6,000 below their original bid of $16,385, and the new bid includes foundations, which the original did not. It is also $4,250 below the Western Electric's only bid (of Ball engines) with foundations, $14,500, and $2,750 below the Western's bid, which received the first award, $13,000.

THE NEW YORK BOARD OF FIRE UNDERWRITERS.

On Wednesday, March 6, the Committee on Electricity of the New York Board of Fire Underwriters met at their rooms to discuss the subject of "Attix" wire. The question at issue as to whether the Attix wire should be regarded by the inspectors as a conduit within the intent of the rules of the National Electric Light Association and the Underwriters' Association for Electrical Construction or not. It seems that Prof. Henry Morton had passed upon this wire in the following terms :

STEVENS INSTITUTE OF TECHNOLOGY,
Hoboken, N. J., May 21, 1894.

WM. A. ANDERSON, ESQ.,
Sup't New York Board of Fire Underwriters.

Dear Sir : In reference to the sample of Attix Insulated Wire sent by you April 21, I would report that portions of it have been under test ever since they were received in water, in air saturated with water, and imbedded in plaster.

In no case do they show any deterioration or loss of insulation, the latter being at this time over twenty megohms per mile, which is more than sufficient in practical use.

This insulated wire in my opinion can, therefore, be safely used imbedded in plaster or inclosed in moulding.

Very truly yours, HENRY MORTON.

P. S.—I regard this Attix wire as equally safe with a wire inclosed in the waterproof paper tubes heretofore approved. H. M.

Installations had been made of this wire which according to the letter of the rules did not conform to the requirements and had been rejected by the inspectors of the Bureau of Electrical Inspection, to which organization a number of very prominent insurance companies belong, and they consequently declined to assume the risks. The meeting was called to determine whether or not, within the meaning and intent of the rules, the Attix wire was a conduit. The New York Board of Fire Underwriters, or rather their committee having this subject in charge, held through the endorsement of Prof. Morton that the Attix wire did come within this meaning. The Bureau of Electrical Inspection, through Mr. Geo. W. Hoyt, Deputy Manager of the Liverpool and London and Globe Insurance Company, dissented from this view.

In addition to the Committee on Electricity, there were present by invitation a number of experts, among whom were Prof. Henry Morton, Prof. W. A. Anthony, Edw. H. Johnson and Messrs. Attix, Habirshaw, Stieringer, Godfrey and Perry.

Prof. Morton was first called to the witness chair, and in reply to questions from the president, stated that the Attix tube was a Habirshaw wire covered with a protective covering of braided material which was non-inflammable and afforded a good protection against mechanical abrasion. It would repel moisture, withstand the chemical action of plaster and cement, offered a high insulation resistance, and while it would not repel nails, etc., to the same extent as an armored conduit, was, in his opinion, the equivalent of a conduit, and better in some respects than an armored conduit, in that it did not have a conducting coating. The president of the committee in speaking of the Attix wire had called it a tube and Prof. Morton held that it was a tube—thus endeavoring to bring it within the rules covering the installation of interior conduits. Mr. Hoyt maintained that it was not a tube and hence could not come under this head, and that even if it were regarded as a tube the installations in question did not come within the requirements for conduits, which state that the conduit should be installed first and the wires drawn in afterwards, or come within the meaning of the section which states that "the object of a tube or conduit is to facilitate the insertion or extraction of the conductors."

A member asked Prof. Morton to define the meaning and province of a conduit as provided, but the chair ruled that the committee was better competent to decide this question. Mr. Hoyt, in reply to this ruling, stated that if the committee intended to amend the rules so as to give them an entirely different meaning from that which they now had, he had nothing further to say.

Mr. E. H. Johnson being called upon for some remarks, paid a high tribute to the quality of Attix wire, but claimed that it did not and could not meet the requirements of a conduit. He had been endeavoring for years to improve the quality of interior wiring, and had found that the best he could do was none too good. He differed with Prof. Morton that the metallic armor was in any case a disadvantage. It was in fact a great safeguard, since if a nail penetrated the insulation to the wire it constituted a short circuit which made itself manifest at once instead of remaining a menace to the building forever after until the latter burned down.

Prof. Anthony took very much the same ground, maintaining that the Attix wire was not a conduit—it was not a tube, and did not in any way meet the requirements of a conduit.

Mr. Perry asked Prof. Morton how the Attix wire differed generically from any other wire having more than one insulating layer. The reply was that the outside covering was sufficiently strong to offer great resistance to mechanical abrasion. Mr. Perry then said, "You would then consider any wire that was taped or braided so as to resist mechanical abrasion as a conduit ?" "Yes," said Prof. Morton, "it would in my opinion be equally good."

This question, which is as yet by no means settled, is likely to assume very important proportions before the matter is ended, and both wire manufacturers and underwriters are awaiting the outcome with intense interest.

London Notes.

(From our London Correspondent.)

Propagation of Magnetization Iron.

A brief abstract of the paper by Dr. J. Hopkinson, F. R. S., and E. Wilson, read before the Institution of Electrical Engineers on Feb. 21, is here given :

The paper deals with the same subject as was dealt with by the same authors at a meeting of the Royal Society on May 31, 1894, but the experimental work was carried out with larger apparatus. It has, of course, been long known that in electro-magnets with solid cores currents are induced in the solid iron when the magnetizing current is reversed, and that these currents for a certain time retard the development of changes in induction. The length of time that these currents exist will be surprising to many. In the experiments shown, a magnet of 12 inches diameter was used, and exploring coils were buried in its substance. These showed how the change in induction occurs extremely rapidly near the surface of the magnet, less rapidly at some depths, and slowly at its center. With certain magnetizing forces it takes as much as four minutes before the change at the center of the core attains a maximum. The application of the results to magnets with cores of other sizes was pointed out, and conclusions were drawn as to the appropriateness of general practice in regard to the sizes of wires or plates used in transformers. The experiments were made in part with the reversals of current in the magnetizing coils, and in part with the currents of a slow alternating character. The slow alternating currents were produced by means of a liquid reverser substantially similar to one which was described by Professor Ewing.

N. E. L. A.

Report of the Committee on Data.*

Mr. President:

The information contained in the tabulated report submitted herewith while recording data from fewer places than usual is believed to contain correct information and more than usual detail. Certain classes of equipment are not reported in sufficient numbers to warrant correct averages, but every central station manager will find in the table a style of equipment sufficiently like his own to enable him to compare results with at least a few others who are similarly equipped. The table contains reports from twenty-four stations using coal as fuel. The highest economy is shown in report No. 22, where 262 watts are generated from one pound of coal, the plant furnishing nearly 23,000,000 watts during 24 hours, the equipment being triple expansion engines with dynamo on the engine shaft, and horizontal water tube boilers with heaters, without economizers, the firing being done by hand. This result is secured from one-half each soft coal and hard screenings. An examination of this report proves it to be a high average for 24 hours, as with an evaporation of 9.37 lbs. of water per lb. of combustible, and a water consumption of 17 lbs. per horse-power, allowing 10% non-combustible in the coal, and taking the efficiency of the generators as stated at 85%, we have $\frac{9.37 \times .90}{17} \times 746 \times .85 = 314$ watts produced from one pound of coal. This average is much nearer the theoretical efficiency of a modern steam plant than any report previously received by this committee.

TABULATED REPORT OF DATA RECEIVED FOR THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

	EQUIPMENT.										PRODUCTION.										FUEL.		
	ENGINES		BOILERS		DYNAMCS.		ARC CIRCUIT				INCANDESCENT.				POWER.								
NO OF REPORT	CLASS.	WATER CONSUMPTION PER H. P.	CLASS	EVAPORATION PER POUND OF COMBUSTIBLE		EFFICIENCY	AVERAGE AMPERES.	AVERAGE VOLTAGE.	HOURS RUN	TOTAL WATTS	AVERAGE AMPERES	AVERAGE VOLTAGE.	HOURS RUN.	TOTAL WATTS.	AVERAGE AMPERES	AVERAGE VOLTAGE	HOURS RUN	TOTAL WATTS.	READINGS EVERY MIN.	TOTAL WATTS FROM ALL CIRCUITS	WHOLE AMOUNT OF COAL USED IN ONE DAY.	WATTS PRODUCED PER LB. OF COAL.	KIND AND GRADE OF FUEL.
22	A	17	A	9 37	Multipolar	85					7670	124.9	24	22,967,952					30	22,967.952	87,358	262	½ Soft Coal, ½ Hard Screenings
1	B& F		C & D		Con. & Bipol.		10	8145	24	1.954.800	224	1140	24	6,128,640	50	500	13	325,000	60	8,408,440	46,700	180	Hocking Screenings.
9	B		C		Multi.,Alt.,&c.		10	2387	13	5,896,081			24	2.434.500		500		2.322.750		10,653.331	59,884	177	Run of Mines, Alabama.
15	F		C		Arc, Alt.		6.8	47	4	1.278	66.4	1010	15	67.064						997.238	5.460	182	George's Creek, Cumberland.
8	E	27¼	C		Alt. & Con.		10	1000	12	120,000	37	1100	13	529,100					15	649.100	3,700	175	Cumberland.
18	B X F X	32.7	C	11 3	Alt. & Con.		6.7	7000	8	355,144	7 05	1172	24	1,983,024	42.4 80.3 65.2	1142 325 548.2	23¼ 10 16½	1,125,765 260,170 589.743	15	4,313,846	24 750	174	Pennsylvania Soft Coal.
12	B		B	8.4	Arc.		9.5	48	14	10,552,752										10,552,752	62,000	170	Soft Coal.
2	B E Z	15.5	A		Various.		9¼	4800	12	6,600,000	150	2200	24	7.920,000		250 525	24 18	908,200 400,000	10	15,878,250	50 tons.	158	Slack and Nut.
16	E		C		Arc, Alt.		by	Meter		246,000				580,000				948,000		1,774,000		150	Pocahontas, Soft.
13	C X	24	C	10.5	Various.		6.8	2275	14	7,042.426										7,042,426	50,238	140	Babylon Pea.
10	B F	23.6	B	11.34	Alt., Bipolar.		9.8	50	12	1,817.256	137	1130	24	3 715.200	36	535	24	465,000	30	5,997,456	45,000	133	Illinois Washed Pea.
21	C X		A C		Alt., Bipolar.		6 8			1,779,051	37		16½	837,930			10½	190,000	30	2,806,981	21,203	132	George's Creek, Cumberland.
17	B E		C		Alt., Bipolar.		6.8		7	357,000	40	1200	14	672,000					60	1,029,000	8,000	128.6	Coaldale, Bituminous.
19	F		C		Alt.		6.8	1100	5¾	43,010	27	1100	7½	Meter. 224,400					60	267,410	2,200	121	Pocahontas, Cumberland.
3	A Y	18	C	8.8	Alt., Bipolar.		10	Meter	24	1,990,000		Meter	24	90,900			24	950,000		3,849,000	35,322	108	Michigan Run of Mines, Poor.
20	F		C	9.02	Various.		6.8	6500	8⅓	367.333	100	240	16	384,000						845.333	8,131	104	Cumberland and Hard Scr'ngs.
14	A				Various.						6000	116	24						15	16,704,000	164,000	100	Buckwheat, No. 1 and 2.
4			A		Various.		10	3472	24	833,250	339	117.5	24	3.823.600	23	1060	24	584,640	15	5,241,500	60,283	86	Illinois Lump and Nut.
7	F		C	7.68	Alt.		6.8	1150	7¼	56,840	24	1040	7¼	105.560					30	162,400	1,963	83	Second Youg'y, Nut.
6	F		C		Alt.		6.8	656¼	8	35.700	16.75	2000	8	268,000	5	3916	6.5	127,269	30	530,996	6,583	80	Indiana Slack.
5	G X		A		Con. & Mult.						180	116.6	24	2,016,000						2,016,000	25,600	78	Illinois Nut.
11							10	50		1,500,000	104 140	120 1100	24 24	3.700,000 299,000	32	550	14	509,850		6,008,850	86,750	69	Soft Slack.
23	B E X		A								160	1000	16	1.640,000					30	1,640,000	42.000	44	Indiana Block.
24	F		C	6.3	Various.		10	50 ea.	12	1,104,250	112	1120	12	1.505,280	45	223.5	18	181,035	30	2,790,565	79,800 11,900	30	Bituminous Pea. Bituminous Slack.

EQUIPMENT.

CLASS A. Boiler Room Horizontal Water-tube boilers feed through heaters by steam or power pump; hand firing. Engine Room Triple Expansion Condensing Engines. Dynamo on Engine Shaft.

CLASS B. Boilers Vertical Water-tube, economizers, feed as A Hand firing. Engines. Corliss Compound Condensing, belted to jack shaft.

CLASS C. Boilers. Horizontal Tubular, feed as A. Engines, Simple Corliss or slow speed, condensing, belted to jack.

CLASS D. Boilers, Upright Tubular, feed as A: Engines, Simple Corliss, Non condensing.

CLASS E. Engine, High Speed Compound Condensing, belted direct.

CLASS F. Engines High Speed Simple Non-condensing, belted direct.

CLASS G. Engines, High speed Compound Non-condensing.

REF. X. Any of the above non condensing.

REF. Y. Belted to dynamo.

REF. Z. Dynamo on the Engine shaft.

Taking an average of the ten reports from stations generating over 5,000,000 watts in 24 hours we have 147.5 watts per lb. of coal, or a production of one electrical horse-power for four lbs. of coal on a basis of the efficiency of the generating machinery as stated in the last report by this committee.

Previous reports by this committee have been criticised as inaccurate and incomplete, and an attempt has been made in the work here submitted to improve it in both these particulars. From the first the results of this work have been handicapped by reports from the central stations incorrect, incomplete and based upon a variety of testing instruments constructed without any absolutely uniform standard. And again many central station managers do not wish to have their work made public, and in order to get at the results secured by these people, the information has previously been furnished to the committee, through your secretary, in such a manner that the committee were relieved of the responsibility of the exact source of the information furnished. This, in a measure, defeats the main object of the work.

. . . A careful review of this work for the past three years reassures this committee that the present method of securing data from central stations by individual effort on the part of the committeemen, with the understanding that the information is to be held confidential, meets all the requirements, as any manager can communicate with the author of any report either through the committee or the secretary of this Association, and reports can be had in this way from many who are not willing to have their work made public. . . . Several members of the present committee were unable to give the matter attention, and the table is therefore made from a limited number of reports. If the succeeding committee could pledge its membership to secure at least twenty-five reports each from the central station managers in their locality a much more valuable report can be made. . . .

H. M. SWETLAND, Chairman.

DISCUSSION.

Mr. W. R. Gardener—I consider a paper of this kind of very great importance to central station managers. In this paper the committee have gotten down to facts—there is no theory or fancy. It is made up of reports received from central stations and is worthy of careful study. The principal items of information given us by the reports are the equipment of the stations represented and the number of watts produced per pound of coal. I think it would be well that the valuable work of this committee be extended so as to give us other items that enter into the cost of developing energy aside from that of coal. To give you an idea of what I mean I will, with your permission, read to you the results of a test that has been made under my direction:

Method of Operation.

The entire coal used during period of test was weighed, including that used for banking. The water was also weighed.

The number of watt hours produced was found by ammeter and voltmeter readings taken as follows:

Single phase alternating current, readings every 30 minutes—watt hours produced	1,983,024
Two phase alternating current, readings every 15 minutes—watt hours produced	1,125,765
Street railroad, readings every 10 minutes—watt hours produced	589,743
Arc lights, readings every 15 minutes—watt hours produced	355,144
300 volt direct current power, readings every 15 minutes—watt hours produced	260.170
Total watt hours produced	4,313,846

Number of hours each class of service was rendered.

Single phase alternating current from 8 A. M. Dec. 27 to 8 A. M. Dec. 28—total run	24 hours
Two phase alternating current from 8 A.M. Dec. 27 to 12:15 m., and from 1 P. M. Dec. 27 to 8 A.M. Dec. 28—total run	23¼ hours

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*Read at the Cleveland Meeting, February 21, 1895.

Street railroad from 8 A. M. Dec. 27 to 10:30 P. M.,
and from 6 A. M. to 8 A. M. Dec. 28—total run.. 16½ hours
Arc lights were run from 3:45 P. M. Dec. 27 to 6:30
A. M. Dec. 28—total run.............................. 14¾ hours
300 volt direct current power from 8 A. M. Dec.
27 to 6 P. M., and from 7 A. M. to 8 A. M. Dec. 28
—total run.. 10 hours

My object was to find out the ratio of the different items of expense to the whole. The different items entering into the cost of developing energy I will class as follows:

First, which I will call Cost of Steam (coal and water only).

Second, which I will call Cost of Throttle of Engine: The above and wages of firemen, repairs of boilers, interest on boiler room investment, fire and boiler insurance on same, depreciation on boilers, which I have allowed at 5 per cent.

Third, which I will call Cost at the Switchboard: The above and wages of engineers, dynamo tender, mechanic and wiper, repairs electric plant, oil and waste, interest on steam plant, interest on electric plant, interest on real estate, insurance on entire building and contents.

Fourth, which I will call Cost at the Lamp or Motor Without Depreciation: The above and general salaries, office expenses, cost of carbons, globes, insurance, interest, incidental expenses, incandescent lamps, law expenses, oil and waste, re, airs steam, repairs electric, repairs lines, taxes, wages, wiring and wiring supplies.

Fifth, which I will call Cost at the Lamp or Motor Including Depreciation on Total Investment (which I have placed at 5 per cent. This does not include drop in the lines from station to lamp or motor.)

Taking the fifth, Cost at the Lamp or Motor Including Depreciation, as the total cost, I find that the cost of steam is 33.8 per cent. of the whole;

That the Cost at Throttle of Engine is 6.8 per cent. more or 40.6 per cent. of the whole;

That the Cost at the Switchboard is 26.4 per cent. more or 67 per cent. of the whole;

That the Cost at Lamp or Motor Without Depreciation is 15.7 per cent more or 82.7 per cent. of the whole;

That the Cost at the Lamp or Motor Including Depreciation on Investment, but not including any drop in line, is 17.3 per cent. more, or 100 per cent., the original total cost.

PERSONAL.

Robert Burns Corey.

The announcement that Mr. R. B. Corey is again actively engaged in the arc lamp business will be received with pleasure by his many friends who are scattered over the whole country.

The widespread use of arc lamps on incandescent circuits really dates from Mr. Corey's entrance into the electrical field. and to his energy, perhaps, more than to any other single cause is due the conversion of so many central station managers and the general adoption of this method of street lighting in connection with the commercial service of our low-tension stations.

Mr. Corey has had an extended commercial experience, and in his six years' connection with the electrical business has probably built up as wide a circle of acquaintances as any other man in the field.

The new enterprise is a purely individual one and will be conducted under the name of R. B. Corey. With Mr. Corey will be associated Mr. John C. Knight, an arc lamp expert of high attainments, whose latest production in the shape of an arc lamp for incandescent circuits was adopted by the Brooklyn Edison Company, who now have about 1,000 of them in use.

The concern will carry a full line of arc lamps for all services, including plain and ornamental series, direct and alternating current lamps, twin lamps, focussing lamps of every type, photo-engraving lamps, searchlights and complete theatrical outfits.

The popularity of their lamps and the high regard in which the gentlemen are held in the trade are evidenced by the number of orders received before their offices in the Havemeyer Building were really opened for business.

ELECTRICITY voices the sentiments of all good men in wishing them a full measure of success.

AT the April term of the Essex County (N. J.) Court damage suits aggregating $250,000 will be begun against the Consolidated Traction Company. This amount would pay for 5,000 fenders at $50 apiece.

Another Perkins Lamp.

C. G. Perkins, the inventor of the original Perkins lamp, has purchased the factory property at 83 Woodbine street, Hartford, and will shortly begin the manufacture of the Perkins incandescent lamp. Mr. Perkins will employ about 175 hands and will turn out at first 1,500 lamps per day. The factory has 25,000 square feet of floor space.

LECTURES ON ELECTRICITY.

Columbia College.

A course of six lectures on "How Electricity is Now Being Utilized," by Francis B. Crocker, E. M., Ph. D., Professor of Electrical Engineering, Columbia College, will be given in Room 11, Library Building, on successive Thursday evenings at 8:15 o'clock. These lectures will be very fully illustrated by experiments, and are specially intended for professional and business men who desire to obtain an intelligent idea of the present uses of electricity. The dates and subjects are:

March 21—How Electricity is Generated and Stored. March 28—Alternating Currents. April 4—How Electricity is Used for Lighting and Heating. April 11—The Electric Motor and Its Use in Transmission of Power. April 18—Electric Railways. April 25—The Telegraph and Telephone.

Tickets for the course, at $5, may be obtained of the secretary of the President, Columbia College. Tickets will not be sold for single lectures.

[Prof. Crocker has very kindly tendered his services for this course free of charge, and the nominal admission fee will be applied to meeting the necessary expenses of the course.—ED.]

VIEWS OF MR. WESTINGHOUSE.

(From an Interview in the Pittsburg Commercial-Gazette.)

Ever since the formation of the Edison Electric Light Company in 1878, its various managements seem to have acted under the assumption that, through the Edison inventions and certain patents therefor, they would be able to secure a monopoly of the electric light and power industry of the United States on their own terms, ignoring the fact that there were other electric light and power inventions and patents, some of earlier and others of even date, controlled and relied upon by others for the conduct of a competing business. As a consequence, all users of apparatus manufactured by others have been frequently threatened or sued and otherwise put to great expense, so that many electric light and electric railway enterprises have been constantly harassed and retarded, and the public interests correspondingly injured.

Nothing short of the complete control of the electric light industry of the country would satisfy the managers of the General Electric Company. The chief opponent to the carrying out of this policy was the Westinghouse Electric Company, which had become the owner of the Sawyer and Man patents, the Weston, Maxim and others owned or controlled by the United States Electric Light Company, and a very large number of other and recent patents.

The control of one side of the Bate case, just decided by the Supreme Court, was secured by the General Electric Company with the view of having the lower courts reversed as to the interpretation of the law determining the life of American patents. The Westinghouse Electric Company, in self-defence, naturally took the opposite side, and it seems that in such defence it has been successful. The electric lighting patents affected by the Bate decision are the earlier ones relating to the use of continuous currents, and the decision thus affects, besides the General Electric Company, all kinds of lighting, isolated or central station, by means of continuous currents.

The later patents relating to alternate current apparatus, details and systems, are not affected by the decision; and as the Westinghouse Company was the promoter of this system of electric lighting in the United States, and has secured a very large number of early and important patents, it is left in a position of great strength as compared with its competitors, more especially with reference to the distribution of power by means of alternating currents and multiphase or Tesla motors.

Biblier, White & Co. is the title of a new firm having offices in the Hathaway Building in Boston and handling several high grade specialties, including the well known Cerfeld insulated wires, the Cutter switches, etc., etc.

General News.

What is Going on in the Electrical World.

Knoxville, Tenn.—This city proposes to make its own electric lights and will advertise for bids for a plant.

Savannah, Ga.—The rival street railroad companies have had enough of the one cent fare business and have resumed the nickel.

Palestine, Tex.—The electric light plant owned by John R. Hearne has been purchased by the newly organized Palestine Electric Light Company.

Rochester, N. Y.—The Grand View Beach Railroad has been sold at foreclosure sale for $21,000. A new company will be at once organized to operate the road.

Elgin, Ill.—There is a rumor afloat here that the Mason air brake factory has been sold to an electrical supply concern that gives employment to several hundred hands.

Norwalk, O.—The Norwalk electric light plant was sold at public auction by the assignees on the 1st inst. It was knocked off to B. P. Foster, of Toledo, for $13,000.

Sharon, Pa.—The Shenango Valley Railway, running between Sharon and Sharpsville, has been sold at sheriff's sale to J. H. White, Daniel Stone and J. F. Barker of Beaver Falls.

Allegheny, Pa.—The Westinghouse Company's bid for the engines for the new Allegheny electric plant, being the lowest, its acceptance has been recommended by the committee.

Wytheville, Va.—The town council has leased the electric light plant for ten years to J. A. Mebane, Frank Owens, J. S. Ward and E. C. Burton. Arc lights are to be put in operation within sixty days.

Kingston, N. Y.—Surveys have been made for a proposed electric road between this city and Lake Katrine. The Dwyer brothers, owners of the Lake Katrine property, are the principal promoters of the enterprise.

Watertown, N. Y.—Ex-Mayor Hiram F. Inglehart has purchased a majority of the stock of the electric street railway system of this city, thus securing control of the entire road. The company will be reorganized.

London, O.—The council has passed the ordinance authorizing the issuing of $25,000 worth of bonds for the putting in of an electric light plant to be operated by the town. The matter will be voted on at the spring election.

Flushing, Mich.—Plans have been prepared for a complete electric lighting and waterworks system for this place to cost $20,000. A special election to vote on the question of bonds will probably be called for the last of March.

Pawnee City, Neb.—The council will probably purchase the electric light plant from the creditors of the Homestead Bank. The present dynamo will then be used for an incandescent system and a new one purchased for arc lights.

Atlanta, Ga.—The reports obtained by H. M. Atkinson, chairman of the electrical committee of the Exposition, indicate that the Electricity Building will be filled with exhibits and the display of electrical machinery one of the finest ever made.

Meridian, Miss.—The contract made a few weeks ago between the city of Meridian and some parties from St. Louis for the erection here of an electric plant for a railway and lights has been set aside, as the city refused to subscribe $25,000 towards the project.

Mankato, Minn.—Petitions signed by nearly all the heaviest taxpayers of the city were to be presented to the council at its last meeting asking that a proposition to vote $15,000 in bonds for a city lighting plant be submitted to the citizens at the city election in April

East Liverpool, O.—The Merchants' Electric Light Company, recently organized here with a capital of $20,000, will contest the field with the Cerenamic City Light Company. It is thought that one of the companies will eventually be compelled to succumb, the field being too limited for two.

Los Angeles, Cal.—The board of public works has recommended that the franchise for a double-track electric railway from Bonnie Brae street to the west city limits be advertised for sale. O. A. Ivers, John S. Maltman, John Kenealy, Richard Dillon and Henry T. Hazard had asked for the franchise.

Brookfield, Mass.—A new company will at once apply for a charter for an electric road extending from Spencer through East Brookfield and Brookfield to the town hall at Warren; there will also be a branch from West Brookfield to North Brookfield. The capital stock of the company is $150,000.

New Orleans, La—E. M. Hudson, an attorney representing Eastern capitalists, has submitted an ordinance to the mayor and council for their action, which provides for the purchase of franchises for an extensive system of electric street railroads in this city and suburbs, the franchises to extend fifty years.

Atlantic City, N. J.—The Industrial Improvement and Electrical Company has asked the council for permission to operate an electric light plant in this city. The company, which is largely composed of local capitalists, expect to have its plant in operation by June 1, and will make a big bid for a city contract for five years.

Toledo, O.—A mortgage has been filed in the recorder's office by the Toledo, Maumee and Perrysburg Electric Railroad Company covering the entire road in the sum of $300,000. The mortgage is given to the Metropolitan Trust Company of New York and is secured by 300 5-per cent. bonds of $1,000 due each March 1, 1920.

St. James, Minn.—The electric light plant installed for the village of St. James by the Fort Wayne Electric Corporation having been found entirely satisfactory, the city council has given the Northwestern agent of the company an acceptance of the plant. St. James now boasts of one of the best plants in the Northwest, costing about $7,500.

Denver, Col.—The Pandora Mill near Ophir, in which ores from the Smuggler-Union mines are treated, is being equipped with electrical motors and will be supplied with current from the San Miguel Consolidated plant, eight miles away. Steam has been the motive power heretofore employed in the mill, and the change is desirable for many reasons.

Norristown, Pa.—It has been suggested that a good route for a trolley road would be from Dublin to Norristown by way of Blooming Glen, Lawndale, Souderton, Franconia Square, Harleysville, Lederachville, Skippackville and then by the best route to Norristown. C. D. Hunsberger, of Souderton, is making an effort to interest local capitalists in the line.

Summit, N. J.—It is said that a number of Summit capitalists have plans under way for establishing a big electric plant in this township near East Summit. The plant is not only to supply light, but will also furnish power for a proposed trolley road to run through Summit and connect with the trolley lines that will run from South Orange to Millburn.

Little Rock, Ark.—The Federal Court has ordered a postponement of the sale of the city electric street railway property until April 18. The decree for foreclosure was given in favor of the St. Louis and Atlantic Trust Companies several weeks ago. The hearing of the case of the First National Bank against the receivers of the street railroad company was set for March 25.

Tokio, Japan.—The Tokio Electric Light Company was started in 1887, and since that date the Department of Communications has given sanction for the organization of thirty-one similar companies throughout the country. It is reported that there are eleven applications besides these, which, should they also be authorized, would bring the total to forty-three.

Attleboro, Mass.—The North Attleboro board of selectmen have granted the syndicate headed by E. R. Price an electric franchise to operate cars in the Attleboros. The syndicate will operate over the tracks of the old Attleboro, North Attleboro and Wrentham road, and will acquire possession of the Inter State as soon as possible and run the two roads under one system.

Valparaiso, Ind.—It is understood here that a stock company has been formed, composed of Chicago, Valparaiso and Hobart capitalists, to build an electric road from this point to Chicago. The cars will be constructed so that light freight can be shipped. The principal backers interested are milk shippers, whose daily business through these two counties amounts to hundreds of dollars.

Cleveland, O.—A meeting of men interested in the proposed Cleveland and Lorain electric road was held here a few days ago to arrange for the incorporation of the company. Two routes for the road are under consideration. One parallels the Nickel Plate Railroad, and the other is near the lake and twenty miles long, two miles longer than the former route. It is intended to carry freight as well as passengers.

Buffalo, N. Y.—The White-Crosby Company has signed the contract for the construction of the Buffalo and Niagara Falls Electric Railway. The road will be built under the personal supervision of O. T. Crosby. All the stock has been subscribed.—The Buffalo, North Main Street and Tonawanda Electric Railroad has passed into the control of the General Electric Company, which had a mortgage on it. This company will operate the road in future.

Youngstown, O.—The township officials have decided to submit to a vote by the electors in April the question of issuing $20,000 township bonds to construct an electric railroad from this city to Canfield, ten miles south of the city.—New York capitalists have purchased a controlling interest in the Park and Falls Electric Railroad and will push it to completion at once. The road will extend to a summer resort five miles south of Youngstown.

San Francisco.—The Market Street Railway Company intends to have two electric roads in operation from First avenue to the ocean in a few months. In California street the tracks of the steam road will be taken up and a new standard-gauge electric roadbed put down. The road will run on the route of the Cliff House steam line and will be in operation within a few months. Both of the new roads will parallel the road now being built by the Sutro Railway on Clement street.

Appleton, Wis.—A rate war in electric lighting has begun here between the Edison Electric Company and the Citizens' Electric Light and Power Company. The former has reduced its rates, and the latter will meet the cut. The Citizens' Company have built an excellent plant and began business about a fortnight ago with 1,500 lights on their circuit. They use the alternating current system. Their light has been favorably received and they have already ordered machinery to double the capacity of their plant.

New York.—A series of experiments will shortly be made on the Lenox avenue branch of the Metropolitan Traction Company's lines to test an underground electric railway system similar to that in operation at Budapest. If the tests are successful a revolution may be expected in the operation of the surface railroads in this city.—The electrical workers' strike still continues and is helped along by the occasional accession of other bodies of men in the building trades, who hope thus to assist in bringing the contractors to terms.

Lima, Ohio.—A scheme headed by Chicago capitalists is to build an electric road from this city to Bellefontaine, a distance of about 100 miles. The road could follow the right of way secured several years ago for the Columbus, Lima and Milwaukee Railroad. All the grading and building of culverts has been done and it would require but little repairing to make the bed ready. The road passes the Lewiston reservoir, the best hunting and fishing spot in this part of the country, which is many miles from a railroad.

Springfield, Mass.—The Palmer and Monson Street Railway Company, organized here last week, will apply for a charter at once. The company starts with a capital stock of $60,000 and proposes to build an electric railroad from Monson to Palmer, Wilbraham and Ludlow, connecting with the electric line for this city. Work on the road will be begun as soon as a charter can be secured. These directors were chosen for the new company: George M. Atkins, George E. Buck, E. L. Bodrish, Rufus Flynt, of Palmer, and George C. Flynt, E. D. Cushman and R. M. Reynolds, of Monson.

Albany, N. Y.—A bill has passed the Senate authorizing trustees of the village of Batavia to provide for expenses of electric lighting and other purposes.—A bill introduced in the Senate provides for the appointment by the Governor in each judicial district of bi-partisan boards of four electrical examiners for two years, to pass on qualifications of all persons installing electrical apparatus. No member shall be interested in the manufacture or sale of any such apparatus. The board may charge from $3 to $10 for an examination, but are not to retain over $5 a day for services, and must file a statement monthly with the Comptroller. Persons operating plants of twenty-five kilowatts or less are exempt from examination. Persons not holding certificates from examiners are liable to punishment for misdemeanor, and those employing such persons to a fine of from $25 to $250 for each offence.—Assemblyman Rockwell's bill providing for examinations of applicants for positions on street surface roads as motormen or gripmen has been favorably reported in the Assembly. The applicant must be thoroughly familiar with the machinery he is to control before he can be placed in charge of a car.—The State Railroad Commissioners have granted the Ballston Electric Railroad Company permission to operate a trolley line.

Telephone and Telegraph.

A bill introduced last week in the Illinois Senate provides that no more than 25 cents shall be charged for any telegraph message of twenty words or less.

The Southern Massachusetts Telephone Company intends, if permission is granted, to put its wires underground in New Bedford.

The Fulton Chain Telephone and Telegraph Company of Boonville, N. Y., just incorporated, was formed for the purpose of constructing and maintaining a line of telephone and telegraph wires, the general route of which will be as follows: Beginning at Boonville, the home office, and following the highway to Moose river, to McKeever, to Fulton Chain and to Old Forge; to Beaver river station, with a branch from Big Moose station to Big Moose Lake, a second branch running from Old Forge to the head of Fourth Lake, thence to Racquette Lake. The capital stock is $4,000.

There will be another hearing of the telephone rate bill before the Senate Cities Committee at Albany on the 19th inst. The bill has been amended so as to raise the rate in New York City from $78 to $125 per year, in Brooklyn from $66 to $85, and in cities from 100,000 to 500,000 population it was left at $48.

At a meeting of the board of directors of the Commercial Cable Company on the 4th inst. the old officers were all re-elected. The board declared the usual quarterly dividend of 1¾ per cent. out of net earnings, payable on April 1.

A new telephone company is at work in Salem, Mass., securing subscribers with a view to establishing an exchange there, and they promise to give the citizens a better service at a less price than the present company.

The Bell Telephone Company will have three or four competitors in Philadelphia if the companies now seeking franchises in that city obtain them. The companies already in the field are the Mutual Automatic Telephone Company, the Drawbaugh and the Central.

It is reported that the Central New York Telephone Company, a Bell corporation, is buying up the stock of the Interstate Telephone Company, organized to do business at Little Falls, St. Johnsville, Fort Plain and other villages in that section.

Citizens of Beloit, Wis., are forming a telephone company and will establish an exchange at that place. Already 100 of the leading firms and individuals have signed the subscription paper. When the list reaches 125 the work of construction will begin.

The subscribers to the stock of the new telephone company at Petersburg, Va., are very earnest in the matter and apparently determined to go ahead with their enterprise whether the Bell Company lowers its rates or not.

At Albany on the 5th inst., forty-two commercial bodies were represented at the last joint hearing on the Gerst-Parsons Telephone bill before the Senate Committee on Cities and the Assembly Committee on Gas, Water and Electricity. The New York Board of Trade and the Telephone Subscribers' Association were represented by Frank S. Gardner, secretary; Simon Sterne, Silas M. Giddings, C. C. Shayne, William McCarroll, ex-Judge H. D. Cary, W. D. Stewart and E. S. A. De Lima. Gen. B. F. Tracy, counsel, and Charles F. Ontler, president, represented the Telephone Company.

United States Consular Clerk Martin, at Southampton, England, in a report to the State Department at Washington, gives some particulars of interest relative to the telegraph in England. He shows that all of the companies' lines were acquired by the Government in 1870 for $55,000,-

000 and that in the year succeeding the Government built 15,000 miles of wire to connect the various systems. As an illustration of the results of this policy the report shows that while in 1870 the total number of telegrams handled weekly by all offices was estimated at from 128,000 to 215,000, in 1893 the total exceeded 1,100,000 and the number sent annually exceeded 70,000,000. In 1869 the English press service was 22,000,000 words. It now amounts to 600,000,000 words; thirty-six times more than formerly. The rate is twelve cents for twelve words, paid in stamps. It is not possible to calculate the cost to the Treasury of the telegraph service because of its combination with the postal service; but the English Government does not consider it as a means of revenue, but rather as a means of helping trade and informing the public.

Boston Notes.

As was the case all over the United States, when the decision of the Supreme Court in the Bate Refrigerator case was received in Boston and neighboring cities there was quite a flurry all through electrical circles. The lamp manufacturing firms were especially jubilant, as the entire field was at last opened to them without restriction or limitation. There being no longer either let or hindrance, several of the more enterprising ones entered the field instanter and began cultivating it in good shape. Already there is promise of an abundant harvest.

To meet the certain increased demand for filament silk, now that the incandescent lamp field is open to all, the Boston Braid Company, which hitherto have manufactured and supplied nearly the entire demand for braided silk for filaments, have recently largely increased their manufacturing facilities to enable them to handle orders with promptness.

The annual report of the Massachusetts Gas and Electric Commissioners shows that during 1894 there were no less than nine towns that availed themselves of the Municipal Lighting Act of 1891, and have either purchased existing or established new lighting plants or are preparing to do so. Some of those now in operation are showing substantial results in the way of economic lighting of streets, stores and houses. Other towns are looking into the matter very seriously.

Packard Lamps.

The New York and Ohio Company of Warren, Ohio, state that they have since the Bate decision given up all experimental and non-infringing foolishness and are now making the straight old Packard lamp with platinum leading-in wires. They have introduced a neat little device in the shape of a "date label." This is a small label pasted on each lamp on which is printed, besides the usual candle power and voltage markings, three spaces headed respectively Fin. ——, Up ——, B. O. ——. In the first of these spaces is marked the date on which the lamp was finished at the factory, and the others are designed for the consumer to mark the date on the lamp when it is put up an the date when it is burned out. The company cla that with their new lamp there is no smashing poin as the lamps give a good light up to the moment they rn out, not falling off in candle power and efficiency as ha heretofore been the case with all incandescent lamps. The use of the date label is certainly an evidence of good faith on the part of the maker and will doubtless prove a convenience to the user.

The Mather Electric Company.

The Mather Electric Company of Manchester Conn., report the sale through their well-known Western contractor, Mr. J. Holt Gates, of Chicago, of two 55 K. W. new type direct connected generators for Fort Dearborn Building, Chicago, these generators to be used in connection with Ball & Wood engines; also the sale of two 50 K. W. direct connected generators to be used with McIntosh & Seymour engines for the Lauderdale Building, Providence, R. I.; also, one 85 K. W. 220 volt generator to the Walter Ferris Coal Company, Salem, Ohio, and two 80 K. W. new type multipolar generators in the station of the Catasauqua Electric Light and Power Company, Catasauqua, Penn. These two generators are of the Mather Company's latest type, their speed not exceeding 300 revolutions per minute.

The Partridge Carbon Company.

The Partridge Carbon Company of Sandusky continues to bask in the sunshine of success undisturbed by the fierce competition in the sale of Arc Lighting Carbons. The reason is that they devote their attention to the manufacture of high grade Motor Brushes and Specialties, and that a customer once gained for them is rarely lost. They send out a pithy folder which is worth sending for.

Notice of Removal.

It is announced that on and after March 15, 1895, the general offices of the Interior Conduit and Insulation Company will be located at the works, 527-531 West 34th street, New York City.

Wm. B. Vansize.

The offices of Mr. W B. Vansize have been removed to the Postal Building, 253 Broadway, New York, where he will be pleased to see his customers and friends.

The Hornberger Electric Company.

Mr. John C. Boss, who has been connected with the above company for about two years, has purchased the entire capital stock of the company.

INCORPORATIONS.

The Milan, Birmingham and Elyria Electric Railway Company, Birmingham, Ohio—to construct and operate an electric railway; furnishing light, heat and power. Capital stock, $100,000. Promoters: Geo. W. Clary, C. P. Baker, H. P. Starr, H. D. Olds, W. L. Fay, F. Burk, E. H. Andress.

The Ontario Electric Company, Ontario, Cal.—to produce and deal in general electric heat and power; operate water, and deal in water rights and lands. Capital stock, $100,000. Promoters: John Jenkins, Chicago, Ill.: David Elcoat, Godfrey Stamm, of Ontario, Cal.

The Galesburg Telephone Company at Galesburg. Ill.—to operate a telephone plant. Capital stock, $50,000. Incorporators: O. F. Price, Robert Chappell and H. S. Gunnell.

The Dirigo Telegraph and Telephone Company, Augusta, Me.—to operate in Kennebec and Somerset Counties. Capital stock, $50,000. President, Hon. P. O. Vickery; treasurer, J. R. Gould; general manager, C. H. O'Brien. Directors: P. O. Vickery, G E. Macomber, J. F. Hill, J. M. Haynes, G. N. Lawrence, L. C. Cornish and M. S. Campbell.

The Phœnix Telephone and Manufacturing Company, Chicago, Ill.—to manufacture and sell telephone and other electrical goods and appliances, etc. Capital stock, $100,000. Promoters: Le R. Brown, E.E. Yaxley, J. H. Riley.

The Palestine Electric Light Company of Palestine, Tex.—to furnish electric light and power to the city of Palestine. Capital stock, $20,000. Promoters: John R. Hearns, A. S. Fox, W. C. Gorman, Palestine.

The Cleveland Gas and Electric Fixture Company (incorporated in W. Va.), Cleveland, Ohio—to manufacture, buy and sell gas and electric fixtures, copper and brass goods, etc. Capital stock, $100,000. Promoters: Burton C. Tremaine, Bernard Schatzinger, Louis Paplousky, Cleveland.

The Citizens' Electric Light and Power Company, Newark, Ohio—to manufacture and furnish light and power. Capital stock, $80,000. Promoters: Wm. C. Taafel, Wm. D. Fulton, Frank C. Warden, Frank Owens, Wm. E. Miller.

The Ansonia Electrical Company, Ansonia, Conn.—to manufacture, buy, sell and deal in any and all kinds of articles, machines and supplies used in whole or part for electrical purposes, etc. Capital stock, $56,000. Promoters: Franklin Farrell, Franklin B. Platt, Thos. Wallace. Jr., Ansonia.

The American Coal Company, Seattle, Wash.—to mine and deal in minerals and fuel; operate steamboats, vessels, waterworks, railway, telegraph, telephone and electric plants. Capital stock, $300,000. Promoters: Fred'k Nolte, P. O. Skoyan, Alfred Meyers, W. A. Burleigh, Jr., Geo. E. Wright.

The Allentown and Reading Electric Street Railway Company, Philadelphia, Pa.—to build an electric street railway. Capital stock, $108,000. Promoters: Victor D. Barner, Allentown, Pa.; W. H. Kennedy, Philadelphia; P. J. Moore, Philadelphia.

The People's Telephone Manufacturing Company, at Chicago—to manufacture telephones. Capital stock, $100,000. Incorporators: John E. Dalrymple, Joseph E. Michard and B. Schottler.

The Fulton Chain Telephone and Telegraph Company, Boonville, N. Y. Capital stock, $4,000. Directors: Dwight B. Sperry, of Old Forge; James Higby and Francenna A. Higby, of Big Moose; Dennis Cannon of Chase's Lake; Daisy L. Glenn, of Pettles Corners, and Clarence R. Sperry, of Boonville.

The Cushman United Telephone Company, Chicago—to build telephone and telegraph apparatus. Capital stock, $20,000,000. Incorporators; I. M. Cushman, O. O. Leabhart and Joseph Barton. Directors: S. D. Cushman, W. C. Dean, James Falley, L. H. Chatterton, Lewis H. Falley, William Falley and John E. Crawford. The company will confine its business for the present to small cities and country towns.

The charter of the Knoxville Water and Electric Power Company has been filed in the office of the Secretary of State. The incorporators are John Bane, S. A. Bailey, John Smithson, John J. Pogue and Noble Smithson, of Knoxville, Tenn.

The Oxley & Enos Manufacturing Company of New York City—to manufacture, import and sell lamps and gas and electric light fixtures, etc. Capital stock, $1,500. Directors: Edward A. Stevenson, of Brooklyn; Franklyn Paddock and Albert E. Seibert, of New York City.

The Galesburg Telephone Company, Galesburg, Ill.—to operate a telephone plant. Capital stock, $50,000. Incorporators: G. F. Price, Robert Chappell and E. S. Gunnell.

The New York and Brooklyn Tunnel Company, New York City—to build an underground railroad to be operated by electricity or other motive power, from a convenient point in New York between East Sixteenth and Whitehall street under the bed of the East River to a point in Brooklyn between North Eighth street and Atlantic avenue, a distance of two miles. Capital stock, $1,000,000. Directors: Thomas A. Patterson, Jr., Charles J. Schlegel, Walter J. Alms, John C. Bucken, Charles Kuehnmundt: John V. Bouvier, Jr., Frederick P. Delafield, Frank H. Knight and Samuel S. Slater, of New York City.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MARCH 5, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

535,214. Contact Device for Conduit Electric Railways. Frank E. Lodetti, Rondout, N. Y. Filed May 4, 1894.

535,294. Closed Conduit for Electric Railways. Patrick Murphy, Chicago, Ill. Filed Jan. 9, 1894.

535,297. Sectional-Conductor System for Electric Railways. Alfred Rosenholz, San Francisco, Cal., assignor of one-half to Samuel J. Clarke and Harvey S. Brown, same place. Filed Oct. 11, 1894.

535,308. Motor-Truck. Elmer A. Sperry, Cleveland, Ohio. Filed June 5, 1893.

535,324. Electric-Railway Conduit. William T. Dulany, Jr., New York, assignor of one half to Oscar F. Shaw, Brooklyn, N. Y. Filed Dec. 14, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

535,051. Electric-Arc Lamp. Harry P. Davis, Pittsburg, Pa. Filed Oct. 23, 1893.

535,052. Electric-Arc Lamp. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed May 3, 1894.

535,069. Light-Fixture or Analogus Article. William McElroy and George W. Bayley, Brooklyn, assignors of one-third to Fred White, New York, N. Y. Filed May 9, 1891.

535,199. Incandescent Electric Lamp. Frank L. Fowler, Philadelphia, Pa. Filed July 30, 1894.

535,336. Electric-Lamp Support and Cut-Out. Lafayette Johnson, New Albany, Ind., assignor of one-half to John H. Stotsenburg, same place. Filed April 5, 1894.

DYNAMO ELECTRIC MACHINERY.

535,010. Transformer. Fred S. Hunting, Fort Wayne, Ind. Filed Feb. 25, 1892.

535,104. Armature-Winding Machine. Harry E. Heath, Windsor, Conn., assignor to the Eddy Electric Manufacturing Company, same place. Filed May 15, 1894.

535,105. Apparatus for Winding Armature-Coils. Harry E. Heath, Windsor, Conn., assignor to the Eddy Electric Manufacturing Company, same place. Filed May 15, 1894.

535,106. Method of Forming Armature-Coils. Harry E. Heath, Windsor, Conn., assignor to the Eddy Electric Manufacturing Company, same place. Filed May 15, 1894.

535,158. Method of and Apparatus for Regulating Electric Circuits. Julien M. Bradford, Portland, Me. Filed Jan. 9, 1894.

535,304. Mounting for Electric Motors. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company of Ohio. Filed April 13, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

535,042. Telephone Apparatus. Otto L. Wullweber, Chicago, Ill. Filed Jan. 7, 1893.

535,247. Battery Telephone-Transmitter. William W. Jacques, Newton, assignor to the American Bell Telephone Company, Boston, Mass. Filed June 22, 1894.

535,284. Telephone-Transmitter. John Goodman and Henry M. Goodman, Louisville, Ky. Filed Sept. 19, 1894.

535,289. Telephony. William W. Jacques, Newton, assignor to the American Bell Telephone Company, Boston, Mass. Filed May 26, 1892.

535,299. Combined Telegraph and Telephone System. Christopher A. Shea, Boston, Mass. Filed Jan 3, 1893.

BATTERIES.

535,090. Electric Battery. Horatio J. Brewer, New York, N. Y. Filed May 2, 1892.

MISCELLANEOUS

535,027. Rheostat. Alton J. Shaw, Muskegon, Mich., assignor to Mary H. Shaw, same place. Filed Dec. 1, 1894.

535,060. Demagnetizing Apparatus. Charles Houlgrave, Buffalo, N. Y. Filed Jan. 22, 1894.

535,077. Circuit-Interrupter for Alternating Electric Currents. Henry N. Potter, Allegheny, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed Feb. 28, 1894.

535,084. Insulating-Conduit for Electric Conductors. Lewis B. Stillwell and Charles F. Scott, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, same place. Filed Oct. 25, 1894.

535,080. Lightning-Arrester. Alexander Wurts, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 28 1894.

535,100. Burglar-Alarm for Glass-Doors. James B. Gill, San Francisco, Cal. Filed Feb. 27, 1893.

535,173. Drying Electric Cables. Charles H. Rudd, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 18, 1892.

535,267. Electrolytic Conduit for Beer or Other Liquids. Louis Wagner and John Marr, Baltimore, Md. Filed Nov. 12, 1894.

535,321. Electric Heater or Rheostat. James H Delany, New York, assignor to Ezra T. Gilliland, trustee, Pelham Manor, N. Y. Filed Nov. 23, 1894.

ELECTRICITY.

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EDITORIAL NOTES.

General Electric's "Profits"? The fiscal year of the G. E. Company ended January 31. Every fact and figure needed for the annual report was in hand before March 1.

If the company's management is honorable, and the condition of the property has improved, why are the main results not published to reassure the stockholder who has seen every dollar of his investment shrink to 30 cents?

If there is anything in the actual condition of affairs to encourage any one, why is it not made known?

In regard to the claims of large business being made for the General Electric Company, either with or without official sanction, investors and others will do well to bear in mind the changed conditions as to prices and possible *profits* between 1892 and 1895. Even if it were true, as stated, that the company is doing $12,000,000 gross per year, would there be any profit?

The following comparative statement of prices will, we think, answer this question more conclusively than columns of arguments. The table is made up from authoritative sources and is correct:

COMPARATIVE STATEMENT OF G. E. PRICES ON APPARATUS, 1892-1895.

	1892.	1895.
Railway motors (two 25 H. P.), per car equipment	$2,500	$650—$850
Series arc machines, with lamps, per light	$65—$75	$30—$35
Series arc lamps, S. C.	$40—$45	$15
Double carbon lamps	$50—$60	$20—$25
Incandescent arc lamps	$25	$10—$15
Incandescent lamps (16 C. P.)	44 cents.	20c.—25c.
Bipolar belted machines (lighting or railway), per K. W.	$33	$10—$15
Multipolar direct connected lighting machines	not made.	$30—$35
Large railway generators, direct connected, per K. W.	not made.	$20 to $30
Alternating apparatus, per light.		$3—$1.50
Transformers		$2—$1.00

Railway equipment work is over one-half of the company's business, and on this class of work the prices average less than *one-third* of those of 1892.

On minor articles of manufacture, switches, sockets, cut-outs, etc., the present prices are about 40 per cent. of what they were three years ago.

Will the annual report include this information?

We have no hesitation in stating our opinion that the present position of the G. E. managers is that of stockjobbers, as it has mainly been from the first.

It is on record that Mr. C. A. Coffin was one of the largest operators on the short side of the market while G. E. was tumbling from 100 to 50 and before the public knew that dividends must be stopped.

Our view at present is that insiders, knowing the disastrous effects of the publication of the annual report upon the speculative market, are operating with a view to making as many turns in the stock market as possible before the final slump which must carry G. E. somewhere near the price where it will slumber and cease to be a factor in the market—about $10 per share.

* * *

No Consolidation, and Why? The consolidation scheme which was mentioned in ELECTRICITY last week has ended, according to our best information, in giving no comfort to investors in G. E. stock.

For more than two years the manipulators of this company's finances have endeavored to bring about a deal of some kind whereby G. E. and Westinghouse interests might work in harmony.

The ultimatum of the Westinghouse interests has been from the first, when the situation was carefully studied, that no consolidation, as such, was possible, and that no consideration could be given to the project of a sale of a controlling interest in G. E. to the Westinghouse interests until the G. E. Company had gone through a receivership and become freed from its endless entanglements in various towns and cities with local lighting companies and subsidiary manufacturing companies.

This ultimatum stands to-day.

The latest scheme was carefully planned, and was given thorough consideration by several gentlemen who are known as Standard Oil men. After several consultations, it was apparent that the negotiators could not deliver the goods, and the conclusions reached by the capitalists and expressed to the intermediaries were substantially as follows:

It had been represented to us that a proper combination of capital and business ideas could control the electrical manufacturing business, that prices might be advanced somewhat, the product improved and a fair return made sure upon the necessary investment. Investigation has convinced us that this is not the case, and that no combination, of which we can be the head, can possibly control the business.

It looks to ELECTRICITY very much as though the Westinghouse interests were sound in their fixed resolution not to combine on any terms with a company which is already beaten.

The works at Brinton are now in full blast, everything having been transferred from Pittsburg. If there is anything in past experience, with the most modern and thoroughly equipped electrical shops in the world located close to the main base of supplies, with advantageous freight rates, moderate priced labor, low fixed charges, etc., etc., the Westinghouse Company now have the General Electric people at their mercy; and this condition of affairs will show results before many weeks.

The fittest will survive, and ELECTRICITY goes on record in the prophecy that the fifty-million-dollar G. E. enterprise will yet bow at the feet of the ten-million-dollar Pittsburg enterprise—receivership and all.

* * *

The Niagara-Buffalo Transmission. In our issue for March 6th we discussed editorially and at some length the propositions submitted by the Niagara Falls Power Company to the city of Buffalo. These propositions were three in number, and briefly as follows: (1) To sell 10,000 H. P. undeveloped on the lands of the company at $10 per H. P. per annum—the city of Buffalo to make its own wheelpits, side tunnels, put in its own wheels, dynamos, transformers, erect and operate the same and transmit the resulting current to Buffalo, there to find its own market and distribute to its customers. (2) To sell 10,000 H. P. developed on the turbine shaft at $18 per H. P. per annum, and (3) to sell 10,000 H. P. electrical alternating current at 2,000 volts at the dynamo terminals at $18 per H. P., the city of Buffalo to furnish step-up and step-down transformers and line, etc. Our conclusions were that none of these propositions could be considered for a moment from the fact that the questions of transmission and distribution were still unsolved as far as the most economical method was concerned, and that the necessarily heavy fixed charges would in all probability make the power when delivered too costly to enable it to compete successfully with locally produced power by means of steam engines using coal at $1.80 per ton—the figures given by Mr. Perkins as the price of coal at Buffalo.

The light in which we presented the case was a revelation to many who had not looked into the subject further than to accept the rosy statements of enthusiasts on the subject, and our remarks have caused no end of comment among those who had expected better things. Among those who have noticed our editorial is the Buffalo *News* of the 11th inst., which, after quoting us somewhat at length, says:

> "If all this is true it will probably pay the manufacturers of Buffalo to buy coal and turn it into electrical power, as the Buffalo Railway Company is doing, at a reduction of one-third of its cost of hauling cars, rather than buy the Falls power at all. But we believe the figures of ELECTRICITY will bear revision.
>
> "Has it occurred to that authority that the Buffalo Railway Company has already solved the problems of both transmission and distribution? That company is sending power over 125 miles of wire in the City of Buffalo every day and every hour, and distributing it as needed to its different lines—and making money thereby. And every electric railway company in the country is doing the same thing. The 'appalling' figures sound very much like scare talk."

Our contemporary has fallen into a not uncommon popular error, viz., that the length of a city railroad line is the distance of transmission. We have no reason to doubt that the Buffalo Railway Company is distributing current over 125 miles of wire. In some cities, such as Brooklyn and Boston, the mileage of single companies greatly exceeds this, yet probably in no case does the actual transmission exceed six or seven miles. Nor has the question of efficient transmission yet been solved by electric street railways anywhere, for it is doubtful if in the most skilfully constructed and operated road in the country the efficiency between engine and car axle will average 40 per cent., yet with even these large losses greater profits can be made than with horses. The illustration brought forward by our contemporary to contravene our conclusions is therefore an unfortunate one.

It is impossible with the data at hand to go into a detailed estimate of what power will cost after transmission to Buffalo, nor does it seem desirable to attempt such an estimate. All we can do is to deal with generalities, and dealing with generalities the conclusions are as stated. We may take the subject up from another standpoint, however, and this may be better understood by the layman, perhaps, than the other view.

It will be clear that if Buffalo buys, say 10,000 H. P., at Niagara Falls at the rate of $10 per H. P., it is like buying a sixty ride commutation ticket at ten cents per ride, or $6. You are entitled to ride sixty times on that ticket, and if you avail yourself of the privilege your rides will cost you ten cents each. If, however, you ride but thirty times your fare stands you at twenty cents, and if you ride but once it costs you $6.

The proposition of the Niagara Power Company is to sell a H. P. at the Falls for $10. If the city of Buffalo or any one else accepts this proposition it must pay $10 for the H. P. whether it uses it or not. It has the *privilege* of using it for 8,760 hours in the year. What can it afford to sell this power for at Buffalo? Let us take the maximum efficiencies that actual practice under favorable conditions will give, and see how much of this horse power we have to sell after transmission and distribution. We think no one will claim a *better* chain of efficiencies in actual practice than the following:

Efficiency of turbines, 80 per cent; turbine shaft, 95 per cent.; electrical efficiency of dynamo, 90 per cent.; combined efficiency of step-up and step-down transformers and electrical transmission to Buffalo, 75 per cent.; efficiency of transformation from alternating current to direct current, 90 per cent. This will leave but 46.17 per cent. of the power we have bought to sell, and it has cost us $10, or at the rate of $21.66 per H.P. if used continuously. In electric lighting stations the average consumption rarely is as high as 40 per cent. of the maximum, but let us assume that in Buffalo the average demand will equal 60 per cent. of the maximum. The maximum which we have to deliver is but 0.4617 H. P., but the average demand upon which we could rely would be but 0.277. This has cost us $10 at Niagara. Its cost at Buffalo is therefore at the rate of $36.10. If we allow an efficiency of 90 per cent. for distribution, it will cost $40.11 per H. P. But we have charged nothing for interest and depreciation on wheelpits, side canals, wheels, transformers, dynamos, or line: nothing for labor, attendance and administration; nothing for expert advice, cost of experimenting, or interest on investment during period of installation; nothing for right of way, insurance or buildings, and nothing for the interest on the investment for apparatus, etc., which the customer must make before the power delivered at his door can be available, and which will be a factor with him in deciding whether he will become a customer or not. We will not attempt to figure out what these additional charges should be but will leave that for those more directly interested to determine each for himself, but we cannot for the life of us make a favorable showing for these propositions even under assumed almost ideal conditions such as can never be realized in practice.

* * *

One of Our Critics. One P. H. Johnston owns the *Electrical World*. He is therefore the editor or anything else he chooses to call himself. To be sure, he employs men who are thoroughly capable electricians to do most of the technical work for him, and so long as he leaves this entirely in their hands it is exceedingly well done and a credit to electrical journalism. But sometimes he likes to soar above the atmosphere of Baxter street and try to create a flurry in technical circles. He usually succeeds. In one instance he undertook to teach us mathematics and enunciated the astounding proposition "that if our units of linear measure were based on π then the ratio of the circumference (of a circle?) to its diameter would be unity." One of the young men in the office evidently "called him down," for in the next issue he attributed the statement and the arguments based on it to a "*slip of the pen.*"

In the issue for March 16 Mr. P. H. Johnston again lets himself loose as follows:

ELECTRICAL MISINFORMATION.

Referring to the electrical transmission of power from Niagara to Buffalo, an electrical contemporary says editorially: "We think it is safe to say that this transformation of the water power into electricity will not be with an efficiency of more than 85 per cent.; that the *transmission efficiency* will not exceed 75 per cent.; that the trans-

> *formation* at Buffalo will not average 75 per cent., and that the *distribution* in Buffalo will not be at greater efficiency than 80 per cent." In the same article it is stated that the transmission loss in the 110-mile Frankfort-Lauffen experiment was "but 25 per cent.," whereas the entire losses—from the generator, step-up transformer, line, step-down transformer and final distribution—were, in fact, between 24.7 and 31.5 per cent., the power transmitted varying from 78.2 to 197.4 H. P.

Does Mr. P. H. Johnston think that in practice the efficiency of transformation from water power into electricity will average better than 85 per cent? If he does, can he point to a single installation where such a high efficiency has ever been maintained? Does Mr. P. H. Johnston think that it will pay to transmit from Niagara Falls to Buffalo—say twenty miles—with greater efficiency than 75 per cent? If he does, can he mention a single instance on record where such an efficiency, including the losses of step-up transformers, has been *maintained* over a distance of twenty miles? Does Mr. P. H. Johnston think an efficiency of 75 per cent. in step down transformers, and conversion of a portion of the energy into direct currents too low? If he does, can he point to a single case where such an efficiency can be maintained the year round under the fluctuating loads that are likely to be met? It might be said that the transformers can be cut out as the load decreases so as to keep the remaining ones always working at nearly their best load, but if, as in three of the propositions made by the Niagara Power Company, the city of Buffalo is to pay for a maximum amount of power at Buffalo, the efficiency of a transformer that is cut out of circuit because of decrease of load is, so far as the amount of power left for distribution is concerned, zero. Does Mr. P. H. Johnston think that 80 per cent. efficiency in distribution all the year round is too low? Well.

As regards the information volunteered in regard to the efficiency, etc., at the Lauffen-Frankfort experiment, we think Mr. P. H. Johnston would have done well if he had posted himself as to what was actually done there before trying to correct others. As a matter of fact, there was practically *no* distribution attempted there unless supplying a bank of lights directly from the transformer terminals may be regarded as distribution. And further, the high efficiency announced was obtained, not under conditions of variable load, or under commercial conditions, but only from dynamo shaft to point of distribution (?) at *full load*. We make this latter statement on the authority of Dr. Walter Lobach, who was in charge of that portion of the work on the Frankfort-Lauffen plant done by the Allgemeine Electricitats Gesellschaft.

Perhaps, however, all this was a slip of the pen—and if so, we will forgive it.

* * *

I. JOHN BEGGS is again in trouble. Judge Wilson, at Cincinnati, has decided that the contract of the Cincinnati Edison Company for city lighting is void, the city not having the legal power to make a contract at the time it was signed.

Taking into consideration the fact that the same week this decision was handed down a new lighting station was started in Harrisburg as a competitor of Mr. Beggs's old station there, it looks as though John had enough to do to attend to his own business without trying to run the N. E. L. A., where his services are not required.

Under the Searchlight.

Views and Opinions on Timely Topics.

A "Casual Statement."

G. E.'s Enormous Force.

(From the "Boston Advertiser," March 5.)

> The G. E. Company's pay roll Saturday had 40.000 names upon it, a larger number than at any time since the bottom fell out of the electric business in 1893.

Averaging $2 per diem this army would create a pay-roll of $480,000 per week, or $24,000,000 per annum—about three times as much as the gross business of the concern.

Before the above statement can be accepted as fact, however, it will have to be resolved upon by the full Board.

* * *

A DISCRIMINATING VIEW.

High Praise, but None Too High.

(From the New York Sun.)

> The destruction of Nikola Tesla's workshop, with its wonderful contents, is something more than a private calamity. It is a misfortune to the whole world. It is not in any degree an exaggeration to say that the men living at this time who are more important to the human race than this young gentleman can be counted on the fingers of one hand; perhaps on the thumb of one hand.

We believe that nothing is really lost to the world by this fire, and that an unfortunate delay is the worst that has happened. This is serious enough, and the entire world joins ELECTRICITY in the hope that this delay may be brief.

* * *

AND THERE ARE OTHERS.

A receiver has been appointed for the Winona, Minn., Street Railway Company.

The G. E. Company holds $20,000 of the bonds of this company, and is liable, through Northwest G. E., for $100,000 more, sold under guarantee to the United Electric Securities Company.

It is thus the $12,000,000 deficit is being made up.

* * *

Too Late for this Year's Report.

> The Los Angeles Consolidated Electric Railway Company has been taken possession of by the bondholders on account of default in payment of the half year interest on the $3,000,000 bond issue due last September.

The G. E. Company holds $41,440 of these worthless bonds—gone to join Pueblo and Little Rock.

* * *

Will New York be the Next?

> General Manager Hanford says the Harrison Telephone Company will have an exchange in Chicago, and service will cost the public about $60 per year; present Bell charge $125.

* * *

THE strong efforts being made by the National Carbon Company of Cleveland to create a monopoly in that line are attracting considerable attention. So far as their efforts may be in the line of improving product and lowering prices, no one should find any fault. The fact is, however, that improvement comes only with competition, and some of the independent companies have already outstripped the large concerns in producing a cored carbon of unquestionable merit. In an early issue we shall devote more space to this subject, which has two sides, and is, we believe, worthy of discussion. From the point of view of the consumer, it would seem certain that the independent companies should be well supported. Carbons are an important element of central station supply.

They can now be bought *cheap* and *good*. What would be the situation if the smaller concerns should be driven out?

* * *

A CORRESPONDENT calls our attention to what he considers our injustice in not mentioning, in last week's editorial on the Lamp Situation, the fact that the Beacon Lamp Company of Boston was an important factor in the fight which prevented the G. E. interests from obtaining a monopoly of the lamp business between Judge Wallace's decision and the time of the patent's expiration. We were not, however, discussing this phase of the matter, and we mentioned the only two companies which, for legal reasons, were in position to continue making the standard type of lamp regardless of the outcome of the Bate case.

When we consider the value of courage, fighting blood and nerve in blocking the plans of the G. E. monopolists, we give full credit to the Beacon Company and to Mr. H. S. Kaliske. They made a gallant fight, and spent thousands of good money which went far to prevent the business from being bottled up.

* * *

INDUSTRY AND ECONOMY.

We wonder how many reflective men, when they contemplated the scene of gaiety in Dr. Charles Betzler's private office at Cleveland, during the meeting of the N. E. L. A., were reminded, as we were, of a story, often heard in our youth, of the Industrious Farm Hand.

He had hired out for the season at $15 per month and his board. For nine months he had toiled faithfully and had fulfilled the letter and the spirit of his contract. The first rays of morning light had found his cowhide boots brushing the dew from the pasture grass as he rounded up the cows to milk, so that the work of the day proper could begin promptly at 6 A. M. Not until it was too dark to work in the fields had he repaired to the barn to do the evening chores. Sundays he had rested by greasing the wagons, oiling the harness, salting the cattle, splitting wood for the next week, and at other light diversions.

Now the season was ended, the crops were harvested, the corn was husked, the potatoes in the cellar, the threshers had come and gone, and the faithful farm hand decided to take a week or two of rest in the city. His savings had amounted to $125, and with $6 of this he purchased a round-trip ticket. The first evening he wandered forth among the lilies of Hester street. . . . The next morning he was seated on a barrel at the depot waiting for the first train to take him home. He emptied his pockets and found his savings reduced to 18 cents. Between yawns and pangs of remorse, as he thought of the happy summer past and gone forever, he whispered in a languid way, "Oh, well; easy come, easy go."

* * *

You Hit It Right.

The *Progressive Age* in its issue for March 15 gives the whole thing away. We have been found out and must confess. Our contemporary says:

> "Some two weeks ago a thief broke into the First Presbyterian Church, Girard avenue and Hanover street, Philadelphia, and carried away a Welsbach light. Nothing else was missed from the church. It is hard to hold suspicions against one's fellowmen, but could it be that ELECTRICITY's fanatic fondness for the Welsbach has at last developed into kleptomania?"

It was not our fondness for the Welsbach light, however, that prompted us to the act, but our deep veneration for the sanctity of the edifice. We believed that so long as the Welsbach light remained there would be sufficient provocation for profanity on the part of those who had to take care of it or sit under it to warrant irreverent expletives, and we took it merely to remove this temptation. *Respice finem.*

* * *

A LEGISLATIVE investigating committee is now at work in Syracuse on matters pertaining to municipal crookedness. We wonder if ELECTRICITY will be compelled to record improper doings on the part of any of our friends.

Why, O Soul, Art Thou Sorrowful?

And Why Cast Down Within Me?

(From the New York Press.)

Nikola Tesla has lost many months of labor and research, but he still has his eulogist, Colonel Patton, late of the United States Army—Lieutenant Patton in the Army Register, but Colonel by the permission of his friends and himself. . . . But for Colonel Patton it is doubtful if Nikola Tesla would ever have been recognized by the world as the inventor of the rotating magnetic field. The inventor has suffered an irretrievable loss, a loss that cannot be measured by dollars and cents. He is one of the geniuses of this age. He stands beside Thomas A. Edison, the renowned electrician; Prof. Elihu Thomson, electrician of the Thomson-Houston Electrical Company; Charles F. Brush of the Brush Electrical Company; Gardiner C. Sims and Prof. Alexander Graham Bell.

* * *

The Flatlands Station.

Who is in Trouble?

Three Flatlands, L. I., officials have been indicted for bribery in Brooklyn—the Town Clerk, John S. Schenck; the Justice, John T. Ford; and the Tax Collector, Frederick Lemken.

In December, 1893, these officials gave the Flatlands Electric Light Company a twenty years' contract for lighting Flatlands, at $45,000 a year. Ford and the clerk, Schenck, are accused of accepting a $1,500 bribe to vote for the contract. Lemken is charged with paying them the money to influence their vote.

* * *

Twenty Per Cent. Per Watt.

Comptroller Wallace of the Canadian Government has decided that electricity comes under the head of unenumerated articles, and consequently bears a duty of 20 per cent. The question arose over a proposition to transmit power from the American side of Niagara Falls to surrounding Canadian cities.

Which means, we suppose, that the Canadians have not forgotten that they have an opportunity of their own for a large transmission plant—provided the American company proves successful.

* * *

They Don't Want the Earth—Only New England.

(From the New York Tribune.)

The New York, New Haven and Hartford Railroad has the unlimited effrontery to ask the Connecticut Legislature to refuse charters to electric railroads which may seek to compete with the Consolidated system. Meekness, humility and regard for the public welfare were always conspicuously lacking in the management of the New York, New Haven and Hartford Railroad.

* * *

Mr. E. R. Gilman is endeavoring to re-organize the Great Western Manufacturing Company, making the creditors stockholders in the new enterprise. This apt pupil of C. A. Coffin always has a new scheme, but we doubt very much if this one will work. Several charges of fraud should be settled before he makes another public appearance.

* * *

If the system of trying American patent causes were correct, conducted in accordance with the strict rules of justice, the attorney coming into court with a case like one of the recent ones brought by the Otis Elevator Company (and the G. E. Company) against the A. B. See Company would be disbarred. It is blackmail and nothing less, in our judgment.

* * *

Not the least interesting story of intrigues in the electrical business in the past three years would be the connection of the G. E with the Elevator Trust and the doings of that trust.

* * *

We commiserate Mr. A. P. Ide over the disrespectful treatment he is receiving in his own town, where the Capital Electric Company have started in business as competitors of the old lighting company, in which Mr. Ide is interested. The new concern has not bought Ide engines, and Mr. Ide has therefore recommended his employees to boycott the tradesmen and others who are stockholders in the company. We never knew before that Mr. Ide was so funny—we supposed the pull of the Eastern connection with the G. E. interests was so strong that Mr. Ide would not seriously mourn the loss of so small a sale.

* * *

It is not unfrequently that we note gems of literature in Pudd'nhead Johnston's paper—known to some as the *Electrical World*. In fact these gems occur so frequently as not to excite comment, but here is one that is certainly worthy of framing for preservation. Strange to say, it is not of Pudd'nhead's own, but must be credited to Mr. Hering. In the Digest of Current Technical Electrical Literature, in reviewing an article on efficiencies of apparatus in a central station, he says:

"With steam-generated electric energy used for heating, the waste would be 94 per cent., *the amount of coal required* would *therefore be* 94 *per cent.* [Well! well! Carl. We suppose the steam made up the other 6 per cent.!], while in an ordinary stove it is probably about 45 per cent. The amount of coal would therefore be *nine times as little*." Oh my! Carl, how could you! And to think that the literary Frenchman from County Clare—the talented editor of the only Baxter street sheet—passed this. Oh! Pudd'nhead! O'Johnston!

Some weeks ago there was a strike among the pullers-in along Baxter street and the Bowery because some of the clothing houses employed non-union pullers-in. This was at the time that Pudd'nhead Johnston started up his memorable Baxter street methods in his so-called journalism. The union strikers won in the fight, and the Irish philosopher has been in the dumps ever since.

Flushed with the cordial and hearty reception which he received at Cleveland from those who admire him personally and especially his methods, he seems determined to take it out of the hides of his employees, and the result is that it is reported that the offices of our contemporary are in a state of anarchy.

* * *

ALL THE NEWS.

The Russell & Officer Elec. Construction Co.
Western Agents for
Brush Electric Co.
Crocker-Wheeler Electric Co.
Meston Altern'g Fan Motors.
American Circular Loom Co.
Whitney Instruments.
Kester Arc Lamps.
Electrical Engineers
and Contractors.

Denver, Col., Feb. 22, 1895.

To the Publisher of Electricity.

Dear Sir: We do not remember when our subscription expires, and when it does we do not want to be dropped from the list, but would request you to mail us bill for the next year.

We notice in Electricity that the news is not taken from or published in any of the other electrical papers, and therefore we are continually receiving new information, etc., from your paper.

With the other electrical papers, if you take either one you get the news of all.

This is no "blarney," it is a positive fact.

Wishing you success, we are

Yours truly,
Geo. Wm. Russell, Jr.,
President and Manager.

* * *

NURSERY RHYME.

(*Tune*—"A dillar a dollar a ten o'clock scholar."

With a whoop and a whirl the *Electrical World*
To come out quite early does seek;
It used to come out on Wednesday night
But now it comes out next week.

Low Temperatures and the Attractive Power of Magnets.

A communication was made to the French Académie des Sciences on February 4 by M. Raoul Pictet on the "Influence of Low Temperatures on the Attractive Power of Artificial Permanent Magnets." The author stated that the experiments referred to were made with a magnet weighing 493·5 grammes, and formed of three elements in horseshoe iron. After magnetization the magnet was made to carry its charged armature for two years. It could then sustain 4,275 grammes. It was subsequently left for eleven months without armature, and then could only bear 3,226·5 grammes. The magnet was then placed in a small frigorific vessel filled with pure alcohol; it was arranged vertically with the poles or branches in the air and stayed with pieces of wood. The alcohol in which the magnet was placed was caused to touch the surface of a glass 3 millimeteres thick placed horizontally upon the branches. Two thermometers indicated the temperature of the alcohol, maintained constant by an agitator. The armature of the magnet in contact with the upper surface of the glass was fixed to the plate of a sensitive balance. It could only rise one-fifth of a millimeter, and was retained by two points closing an electric current which passed through a galvanometer. The following table gives the averages of the results obtained by four series of observations, in which the differences were always less than 1·50 grammes:

Temperature of the magnet. Degrees.	Power of magnetic attraction. Grammes.	Temperature of the magnet. Degrees.	Power of magnetic attraction. Grammes.
+ 30	57·31	— 40	66·70
+ 25	57·87	— 45	67·41
+ 20	58·48	— 50	68·45
+ 15	59·10	— 55	68·91
+ 10	59·81	— 60	69·64
+ 5	60·36	— 65	70·30
+ 0	61·04	— 70	71·19
— 5	61·80	— 75	71·98
— 10	62·42	— 80	72·70
— 15	63·42	— 85	73·41
— 20	63·93	— 90	74·18
— 25	64·60	— 95	74·95
— 30	65·35	— 100	75·80
— 35	66·09	— 105	76·64

A Long Interurban Electric Railroad.

The construction of the first interurban electric railway system of any magnitude in Western Pennsylvania is, after many delays, an assured fact. The line in question connects Greensburg to Pittsburg passing through Jeannette, the natural gas and great plate-glass center; Irwin, Manor, Penn, Stewart and other towns of the gas coal section; Walls and Carnegie, seats of extensive railroad shops; Wilmerding, the location of the Westinghouse Air Brake Works; East Pittsburg, of the Westinghouse Electric Company's new works; Braddock, the home of the great Carnegie steel plants, and many other smaller towns adjacent to Pittsburg.

The company which will construct the line is largely composed of Eastern capitalists, of whom ex Judge Saddler, of Carlisle, Pa., is the head. All the necessary rights of way have been secured and work will be commenced with the opening of spring. A mortgage for $500,000 was recorded at Greensburg a few days ago by the company in favor of the Union Trust Company of Philadelphia. Bonds will now be issued, the proceeds to be applied to the construction of the road. The first ten motors of the road will be completed within two months, and by August it is expected cars will run from Greensburg to Pittsburg, a distance of about thirty-five miles.

The Greensburg and Pittsburg Company has bought the Greensburg and Hempfield road of two miles in Greensburg for $48,000. This line was the first to be equipped with Westinghouse motors and old United States horizontal type generators. It has not been a paying investment, and the stockholders being anxious to sell, the offer of Judge Saddler was accepted without much delay. The purchasers will incorporate this line as a part of their Greensburg-Pittsburg system.

LARGE ARC DYNAMOS.*

BY CHAS. N. BLACK.

Glancing back over the last fifteen years and noting the rapid progress made in all branches of electrical engineering, it appears strange that arc dynamos have met with so few changes, more especially so when we remember that arc lighting was one of the first branches of the science reduced to practical use on a large scale. It is impossible to ascribe this to the fact that there was nothing left to be desired in the design or the efficiency of this type of machine, since it has always been notoriously weak in respect to efficiency, and has by no means kept pace with the incandescent dynamo. Within the past eighteen months, however, various manufacturers have awakened to this fact, and we have seen the results in numerous descriptions of arc dynamos appearing from time to time in the technical journals. The general tendency seems to be toward larger units and lower speeds; but, although the increase in size has, of course, increased the efficiency to some extent, we still notice the massive field magnets with their enormous amount of copper, and the small armature, which alone is enough to account for the inefficiency of these dynamos. Another noteworthy fact is that, with one exception, which perhaps I need not mention, all the new machines thus far described are of what is known as the closed coil type. This is the more remarkable when we consider that fully seventy-five per cent of the arc lights in this country are run from open coil dynamos. The open coil dynamo at the very earliest date appealed to such men as Charles F. Brush and Elihu Thomson as being especially suited for this constant current work, and by the remarkable genius of these pioneers was so perfected that to-day machines with scarcely a single alteration from the design of fifteen years ago are being sold in competition with the latest closed coil dynamos.

Fig. III

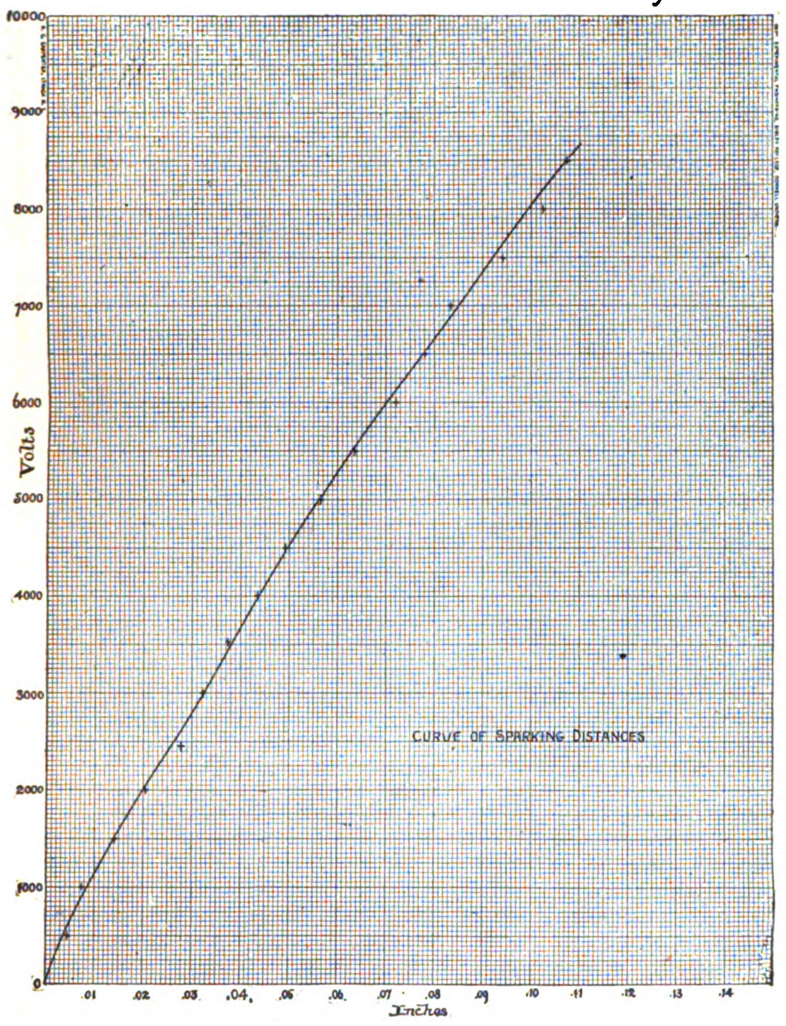
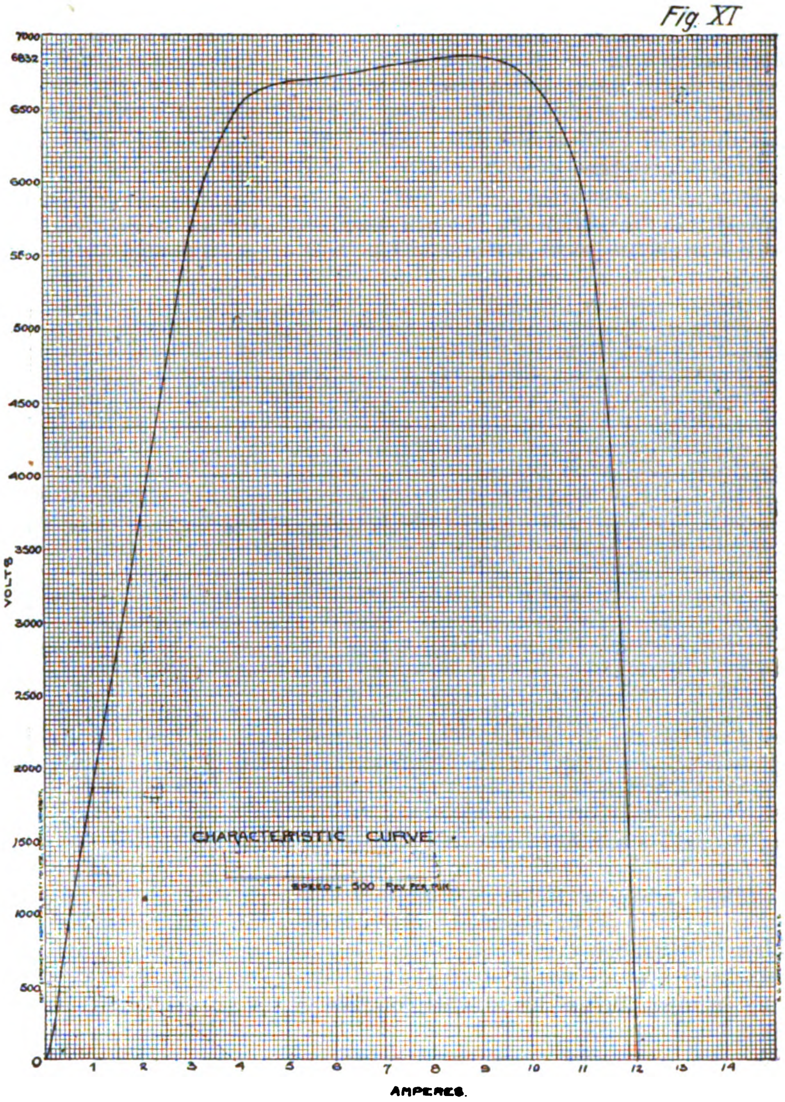


Fig. XI



The question as to the reasons for this preference naturally suggests itself, but before answering it I will briefly describe some of the most marked points of difference between the two classes of machines. As the name implies, the open coil machine has the separate coils or sections of the windings of the armature entirely distinct one from another. In other words, they do not form a closed circuit.

It will be observed in the open coil armature that each coil or bobbin, as they are generally called, has a large number of turns, and that there are but few commutator segments, while in the closed coil armatures we have exactly the reverse, namely, few turns per coil and a large number of commutator segments. This is due to the different manner in which they commutate. In the open coil machine a large amount of self-induction in each bobbin is by no means objectionable; in fact, one might almost say that it is essential in order to obtain the best results, while in the closed coil machine the less self-induction there is in each bobbin the better the action at the commutator. The latter is true of all closed coil machines, whether for arc or incandescent lighting, as all engineers well know who have had any experience in the designing of dynamo electrical machinery.

The first statement, however, is not nearly as well understood even by those who have had considerable experience with the open coil machine. The fact that a large amount of self-induction is advantageous in an open coil machine has never, to my knowledge, been stated before, although on it depends the successful working of a machine of 2,000 volts or more. Silvanus P. Thompson in his "Dynamo Electric Machinery" gives a very clear account of the manner in which an open coil machine commutates. To one unfamiliar with this dynamo, it is always a matter of wonder that the spark does not cut away the segments. As a matter of fact, it does so to a certain extent, but the current is so small, and whatever heat there is is radiated so rapidly, that the effects in practice are almost inappreciable. At this point the self-induction of the bobbin plays an important part; were it not for this, the current in the bobbin, which is being cut out, would be reversed before the segment had reached a sufficient distance from the brush to prevent the current jumping back across the heated air space and thus causing the machine to flash.

The design and proportioning of the field magnets are the same as in the closed coil machines. It is in the commutator and commutation, then, that we find the most marked difference between the open and closed coil arc dynamos, and herein lies the great superiority of the former over the latter. Take, for example, a new open coil 125 lighter and one of the latest closed coil 100 light machines. In the one there are 24 segments in the commutator, while in the other there are 160. To go into details as to which is the easiest to insulate and keep in repair is scarcely necessary before a society of practical managers and engineers.

Some advocates of the closed coil dynamo, however, claim that such a small number of commutator segments causes a discontinuity in the current and consequently a greater strain upon the insulation of the line. This is not a new objection to the open coil dynamo, and has been answered long ago. It seems, however, to have been revived recently, and I have noticed that one builder of closed coil apparatus lays great stress upon the fact that its machine generates an absolutely steady current, and therefore puts no undue stress upon the insulation of the line.

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*Paper read before the National Electric Light Association, February 19, 20 21, 1895.

In 1887, Mordey, in England, made the following experiments upon a Brush machine in order to determine how much fluctuation there really was. Six converters, each made to transform from 2,000 down to 100 volts, had all their primary and all their secondary coils joined in series. The current from the Brush machine was sent through all the low tension coils, and then, with a Cardew voltmeter, he attempted to measure the difference of potential at the terminals of the secondary or fine wire coil. The pointer, however, remained at zero, showing absolutely no E. M. F. He then applied the wet hands across the terminals of the whole series, but with equally negative results. An experiment which I myself made not long ago confirms fully these results. The current from a closed coil dynamo, which had 72 bars in its commutator, and which therefore gave practically a steady current, was passed through the field coils of a 125 light arc dynamo, and the fall of potential was measured with a Weston voltmeter. The machine was then run self-exciting, and the drop through the field was again taken. The currents in both cases gave identically the same readings on the voltmeter. That there is a discontinuity in the current, no one will deny, but that it is so slight that no instrument less sensitive than a telephone will show it appears to be n by the above experiments. This conclusion being reached, it is difficult to understand how the insulation of the conductor would be more strained by an open coil than by a closed coil machine.

Fig XII

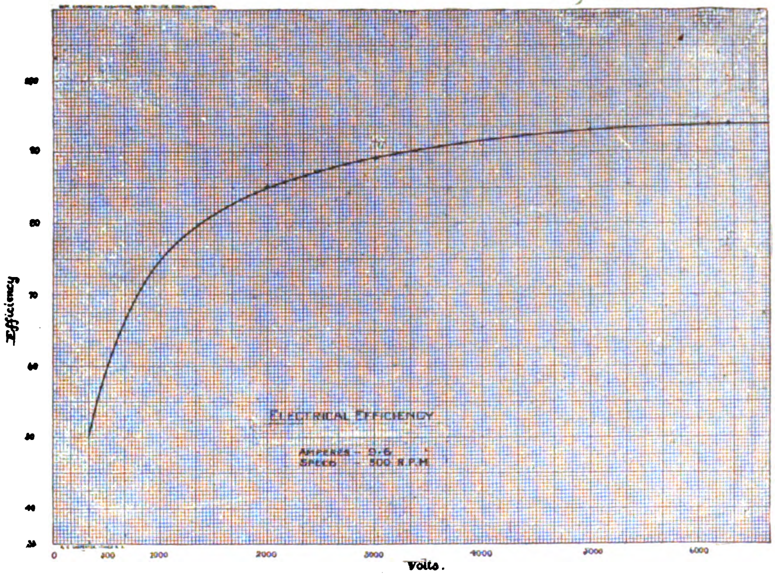
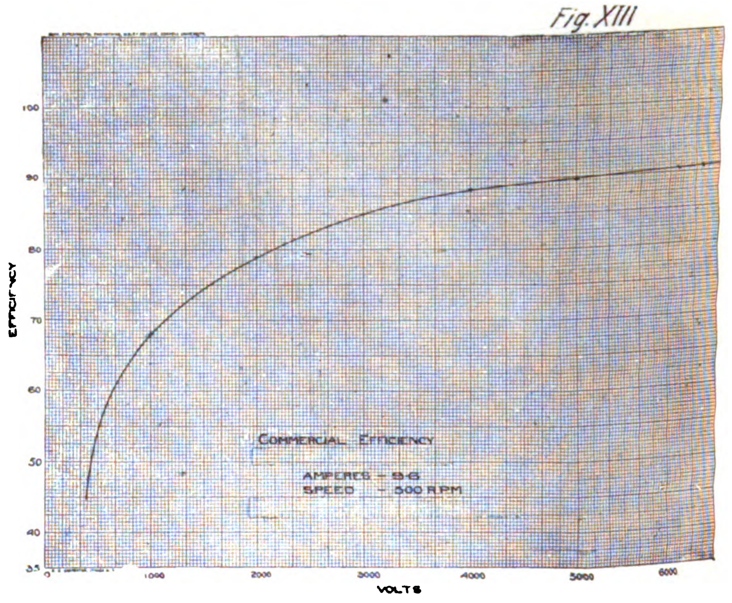


Fig. XIII



A much more vital question in connection with these large units delivering current to the line at the enormous E. M. F. of 6,000 volts or more is this: What value will the E. M. F. attain in case the circuit is suddenly broken? From a theoretical standpoint, basing our deductions on the manner in which the two types commutate, the open coil machine has largely the advantage.

Opening the circuit is the same in one sense as suddenly throwing a high resistance into the line; and when we do this we shift the point of commutation back under the brush, owing to the reaction of the armature current being reduced. Consequently the bobbin, which should not be cut until after its segment has passed from under the brush, short-circuits the one in parallel with it, and as a result the segment connected with this bobbin carries the arc around to the opposite brush, thereby causing the machine to flash; this short-circuits the armature, and the E. M. F. drops to zero. This flash is not due to the insulation breaking down at any point, but is simply drawing the arc of a short-circuited bobbin part way round the commutator, and in this way is acting like a safety-valve. The machine is not injured in any way, and as soon as the break in the circuit is repaired it is ready to again deliver current to the line. In order to prove this by a practical demonstration and to learn accurately just what value the E. M. F. attained when the circuit was suddenly broken, we made the following experiment: The sparking distances, from 500 up to 9,000 volts, between two carbon pencils, one with a flat end and the other with a rounded one, were accurately determined within a few thousandths of an inch. The results are plotted in Fig. 8. It will be noticed that the curve is almost a straight line, and let me add, it agrees very well with that obtained by De La Rue and Muller, who made quite extensive series of experiments upon sparking distances. The terminals of the 6,250 volt machine were then connected to these carbon pencils, and the greatest distance the current would jump on suddenly breaking the circuit was determined. This distance corresponded to a little less than 8,000 volts, showing that the E. M. F. had risen between 1,500 and 2,000 volts. This can be accounted for by the fact that it takes an appreciable moment of time for the arc on the commutator to be carried from one brush to the other. Owing to each segment extending about 60 degrees around the commutator, the time required to short circuit the commutator is just one-third of what it would be in the closed coil machine; consequently I think the statement that in a closed coil machine the voltage would rise to fully double its normal value, under the same conditions, would be a very conservative one. In fact, I have many reasons for believing that it would go considerably beyond this, providing of course that the insulation of the commutator did not break down. If this occurred, the machine necessarily would be unfit to run again until repaired. This peculiarity, if I may be allowed to call it such, of the open coil machine, is especially important where underground circuits are employed, since a breakdown in the insulation, due to an abnormal rise in the voltage, is something that can only be repaired at considerable expense.

Knowing that some tests on underground circuits would be of interest to central station engineers, I arranged through the courtesy of Mr. E. A. Leslie of the Manhattan Electric Light Company in New York, to make some determinations as to the rise in voltage when a long underground circuit was suddenly broken. A Brush open coil 125-light machine was connected to a twelve mile underground circuit, supplying current to 125 arc lamps. The voltmeter registered 6,850 volts at the machine terminals. The circuit was then broken a number of times with the carbon points in shunt with the break. At first, the carbons were separated by a distance corresponding to 10,000 volts, and this distance was then gradually reduced until the current jumped the air space. This indicated only 5,000 volts. The carbons were then set for 6,000 volts with the result that the current jumped twice in breaking the circuit eight times, showing that we had about reached the limit. It was then decided to try breaking the circuit near the center. Under these conditions, 5,000 volts was the highest reading we obtained, but there was a marked difference in the time of discharge. In the first case there were two discharges in rapid succession within a half second after the break while in the second case fully two seconds elapsed before the current jumped. In both cases there were two discharges before the arc was established, the first one being short and snappy, resembling a static spark. From this it will be seen that the capacity of the circuit more than counterbalanced any rise in voltage due to self-induction of the machine and line. With these results before us we can safely assume that the insulation of a cable will not be overstrained by an accidental break in the line. All these considerations led the company with which I have the honor to be connected to adhere to this, the open coil type of machine, in designing their large units.

Fig. 11 is the characteristic of a 125 light machine. This machine runs at five hundred revolutions per minute, and its rated capacity is 125 50-volt 9.6 ampere arc lamps, or 60 K. W. It will, however, give 6,700 or 6,800 volts without undue heating. Its weight, including sub-base, pulley and regulator, is exactly five tons. The frame proper is made of the best grade of soft gray iron and is cast in three pieces. The two upper caps can be readily removed, thereby giving free access to the armature, which can be taken out and replaced in a very few minutes in case of necessity. The journals are self-oiling and self-aligning, with gauge glasses, so that the amount of oil in the well can always be ascertained at a glance. The field magnet cores are hammered steel, very low in carbon, and showing very high permeability. The pole shoes are steel castings, tapered at the tips to prevent excessive heating due to eddy currents. No. 8 wire is used in the field, which is two sizes larger than on the majority of arc dynamos of other makes. The current per square inch is only 746 amperes, consequently the temperature rises but little even after a 24 hours' run. The armature is of the well-known standard type, the only difference being that, on account of the machine being four pole, four bobbins are connected in series instead of two. We now come to the commutator, that part of all continuous current dynamos which is a source, directly or indirectly, of more perplexity and trouble than all the other parts combined. Three objects were aimed at in designing the commutator for this machine. First, simplicity; second, durability; third, ease of repair. There are three distinct rings, each one of which is built up in sections of thoroughly dried applewood, filled with boiled linseed oil. Over this is forced a mica ring one-sixteenth of an inch thick, and on the sides mica disks protect the wood from the arc. Upon the mica are mounted the brass segments, and on these in turn the copper.

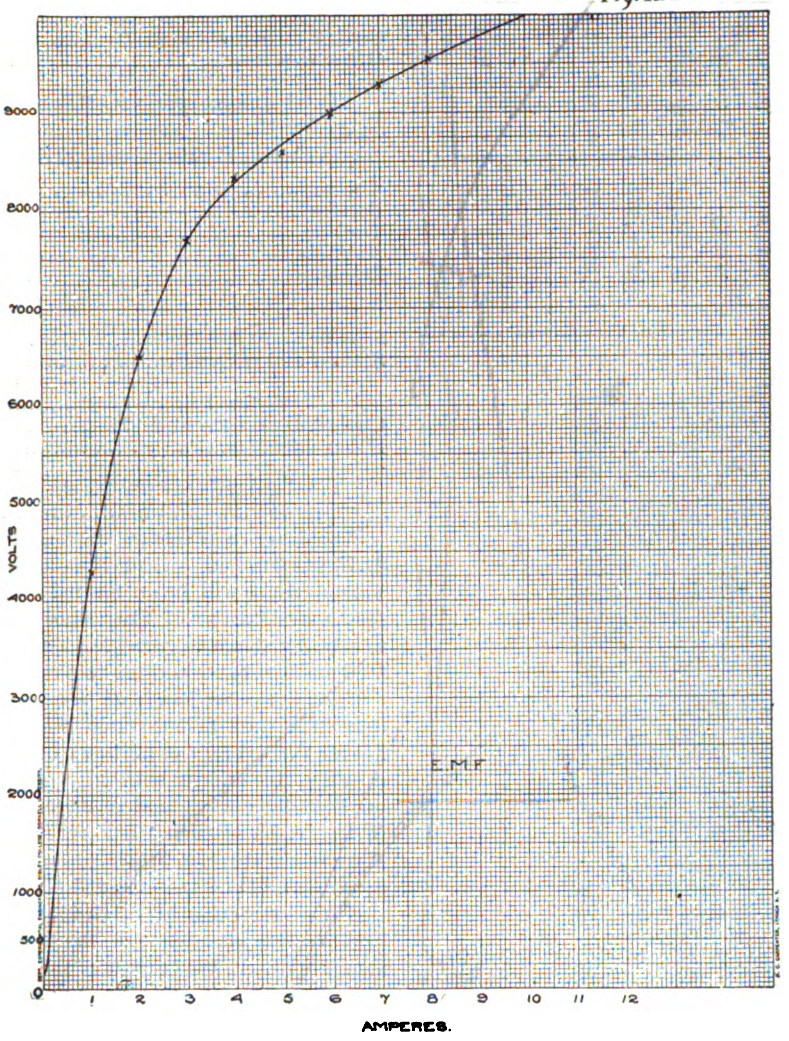
Lignumvitæ blocks 2¾ inches long serve for insulating pieces between the segments. The brushes are the tangential type, the same as those used in connection with all open coil dynamos of this design. An automatic regulator, for shifting the brushes and shunting more or less of the current from the field magnets as the load varies, is fastened to the front of the machine, under the commutator. The small shaft which passes across the front is driven through a worm by a small belt from the armature shaft. On this shaft are mounted two magnetic clutches which are regulated by two relays in the wall controller. The electrical energy consumed in operating the regulator is less than one-tenth of 1 per cent. of the output of the dynamo. The machine is absolutely automatic from one lamp to the full capacity, and the whole load may be thrown on or off with impunity.

Fig. 11 is a characteristic curve of this machine without any regulator. The readings were all taken at the sparkless position of commutation. This is remarkable from the fact that after we get over the bend the curve is almost perpendicular, and is probably the nearest approach to a constant current machine ever attained. By winding more wire on the armature we could have made this machine deliver a constant current of 9.6 amperes at all loads without shunting any of the current from the field, but this would have increased the internal resistance and also have made the machine much less efficient at light loads. By the present method of regulation, we reduced the C^2R loss at quarter load from 4,018 to 3,367 watts, or in other words, we gain almost one electrical horse-power. Fig. 12 is a curve of the electrical efficiency. It will be noticed that this at full load reaches 94 per cent., which is accounted for by the liberal allowance of iron in the armature, thus reducing the reluctance of the magnetic circuit, and by the large size of the wire used on both field and armature.

Fig. 13 is a curve of the commercial efficiency. At full load this is over 90 per cent., and approaches very closely the efficiency of incandescent dynamos of equal capacity, but the most noteworthy point is the high efficiency shown at quarter load.

Fig. 14 is a curve of the machine separately excited, with no current in the armature. The ordinates are the volts at the armature terminals, and the abscissæ the amperes in the field. This is really a permeability curve of the magnetic circuit. By a comparison of the voltage shown here, when there are 9 amperes in the field, with that of the machine when delivering current, can be seen the enormous armature reaction. The curve also indicates a new departure in arc dynamo design, namely, that the magnetic circuit is not worked at nearly as high a point of saturation as in the old types.

Fig. XIV



American Institute of Electrical Engineers.

The 95th meeting of the Institute will be held at 12 West 31st street, New York City, on Wednesday, March 20, at 8 P. M.

A paper will be presented by Prof. Harris J. Ryan, of Cornell University, and Mr. Milton E. Thompson, entitled "A Method for Preventing Armature Reaction."

Storage of Energy Essential to Economy of Working in Central Stations*—III.

BY N. W. PERRY, E. M.

THE FEED STORAGE SYSTEM.

According to this system, approximately the whole of the feed water required for the twenty-four hours is pumped into the feed tanks during the time of light loads; so much of it as the boilers require during this time is supplied from the tanks, and the rest (which will be that wanted during the heavy load time) is retained in the tanks and heated up by the surplus steam during the said light load time up to or nearly to the temperature of the steam in the boiler, viz., 347°, and is used as boiler feed during the heavy load.

By this method of working, the duty required from the boilers will be considerably lessened, for, while during the time of maximum load they will still be required to supply steam at the rate of 6 inches × 27,500 = 165,000 pounds per hour, the total heat which they have to gather from the fuel and impart to the water will be lessened by the increase in temperature of feed from 100° to 347°, a gain of 247°. The total heat of 180 pounds absolute steam being 1,219°, we have the maximum heat to be supplied by the boilers at present $= 165,000 \times (1,219° - 100°) = 165,000 \times 1,119 = 184,635,000$ units of heat hourly. Whereas with the feed storage the maximum required $= 165,000 \times (1,219° - 347°) =$ only 143,800,000 units. In other words, $\frac{1}{4.53}$ of the maximum work of the boilers is avoided and a corresponding number can therefore be laid off.

During every stage of the heavy load, with 347° feed, the same proportion of boiler work is saved, and this is illustrated on the diagram by the dotted curve and figures, 4.67 inches representing the maximum required work with feed storage, against 6 inches without, equal to a gain of 1.329, which is $\frac{1}{4.53}$ of 6.11, or 22 per cent.

The dotted curve of required boiler duty, during the seven and a half hours under the new conditions, is, therefore, quite definite as to form and also as to area enclosed by it. The dotted curve during the remaining sixteen and a half hours of light load must be such that the deficiency in work during these hours equals the excess of work during the heavy load time, and the area it encloses is, therefore, quite definite, while its form depends upon the rate of working both as to firing and to feeding, and this form can with moderate care be made to assume that shown, which will give a maximum amount of work measuring 0.73 inch, so that the ratio of maximum to minimum becomes six to one, viz., $\frac{4.671}{.73}$, instead of the present 23.4 to 1, a reduction of irregularity of working which must necessarily be beneficial to the general working of the boilers and must effect a considerable saving of fuel.

The required tank capacity is easily estimated, being the total of water evaporated for seven and a half hours, viz., $(1.624 + 2.465) \times 27,500 \times 7\frac{1}{2} = 843,150$ pounds. Taking the size of tanks proposed by Mr. Halpin of 8 feet in diameter by 30 feet in height and allowing for their not being emptied within some 3 feet of the bottom, so as to leave room for deposited mud, etc., they may each be taken as containing a working quantity of 75,000 pounds of water, so that full eleven of them would be wanted, viz., $\frac{843150}{75000} = 11.24$.

The cost of these, including fittings and coverings, I will take at £500, which I believe to be a liberal estimate, so that if we allow for a reduced number of boilers, according to the reduced maximum work required for them, we shall have the cost of boiler plant on this system :

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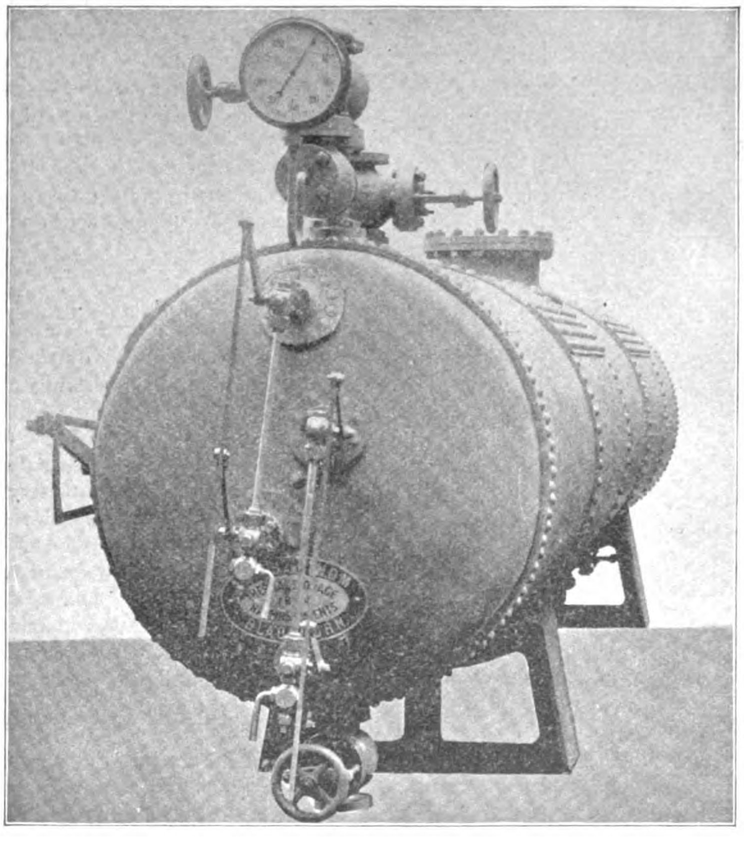
*Read before the National Electric Light Association at its Eighteenth Convention, held at Cleveland, O., February 19, 20 and 21, 1895.

Boilers, $\frac{4.671}{6}$ × £30,000 =	£23,360	
Tanks, 11.24 × £500 =	5,620	
Total	£28,980	

COMBINED FEED AND STEAM STORAGE.

The same authority gives the estimated cost of this as follows: The saving of boiler duty, due to the feed storage only, is the same as for the previously taken case of feed storage, and is represented by the area enclosed between the full and the dotted curves during the seven and one-half hours of heavy work, and the extra steam to be produced is represented by the area enclosed between the dotted curves during the seven and one-half hours and the straight mean lines for twenty-four hours. This extra steam will amount to 1.60 × 27,500 pounds × 7½ hours = 330.000 pounds requiring 330,000 × (1,219° — 876°) = 278,190,000 heat units. The water in tanks giving us, as before, 59 heat units per pound in cooling, we shall want $\frac{278190000}{59}$ = 4,715,100 pounds of water, which will require 63 tanks. Add tanks for feed storage as before = 11 = total of 74.

The boilers will cost as for steam storage	£8,526
The tanks will cost 74 × £500 × 1.05	38,850
Total cost	£47,376



HALPIN'S THERMAL STORAGE TANK.

This is over 20 per cent. less cost than for the steam storage alone. It is not more complicated, since the feed and the steam may be stored in the same tanks; and it has the additional advantage of supplying nearly clean water to the boilers, as has the simple feed storage system, and the work on the boilers is uniform for the 24 hours, which will necessarily produce a considerable economy of fuel.

Comparing now the above four modes of working the boiler plant of such an installation as the Berlin electric station and tabulating Mr. Schonheyder's results we have the following tabular view :

	Present System.	With Feed Storage.	With Steam Storage.	With Feed and Steam Storage.
Steam pressure	115 lbs.	115 lbs.	115 to 250 lbs.	115 to 250 lbs.
Feed temperature	100°	100° to 347°	100°	100° to 347°
Rate of working	24.4 to 1	6 to 1	Uniform.	Uniform.
Feed water	Dirty.	Clean.	Clean.	Clean.
Cost of boilers	£50,000	£23,360	£8,526.	£8,526
Cost of tanks	....	£5,620	£50,925	£38,850
Total cost	£30,000	£28,980	£59,451	£47,376

All of the above was embodied in an article of mine published in the *Western Electrician* of January 5, 1895.

Let us see how the data here presented, when interpolated in the case we assumed in starting out, affect the results:

WITH FEED STORAGE.

Engines	$274.56
Boilers	113.47
Buildings	120.00
Dynamos	120.00
Tanks	29.32
	$657.35

Allowing 10 per cent. for interest, depreciation and maintenance on the investment, exclusive of tanks—which is the same as before—and only 5 per cent. on the tanks, we have:

$628.01 at 10 per cent	$62.80	
29.32 at 5 per cent	1.47	
Total fixed annual cost		$64.27
Coal	$20.00	
Other expenses as before	13.31	33.31
Total annual cost per electrical horse-power		$97.58

WITH STEAM STORAGE.

Engines	$274.56	
Boilers	37.13	
Tanks	236.70	
Buildings	120.00	
Dynamos	120.00	
	$788.39	
$551.69 at 10 per cent	$55.17	
$236.70 at 5 per cent	11.83	
Total fixed annual cost		$67.00
Coal, 2.21 pounds at $1.75	$16.93	
Other expenses	13.31	30.24
Total annual cost per electrical horse-power		$97.24

COMBINED FEED AND STEAM STORAGE.

Engines	$274.56	
Boilers	37.13	
Tanks	180.37	
Buildings	120.00	
Dynamos	120.00	
	$732.06	
$551.69 at 10 per cent	$55.16	
$180.37 at 5 per cent	9.02	
Total fixed annual cost		$64.18
Coal, 2.21 pounds at $1.75	$16.93	
Other expenses	13.31	30.24
Total annual cost per electrical horse-power		$94.42

The above calculations show that with coal at $1.75 per ton and a load line such as that assumed there will be an annual saving with the feed water storage of $20.20 per horse-power annually, by steam storage $20.54, and by combined feed and steam storage an economy of $23.36.

If, on the other hand, we assume coal to cost double this, or $3.50, which would perhaps be nearer the average conditions obtaining in this country, our energy without storage would cost us $148.40 per annual electrical horse-power. With feed storage, $117.58; saving $30.82. With steam storage, $114.27; saving $34.13. With combined, $111.35; saving $37.05.

Being aware that Mr. Halpin had already put into practice his system of thermal storage, immediately upon the receipt of the invitation from your president to address you upon the subject of storage of energy, I solicited from Mr. Halpin information in regard to the results obtained. The time allowed for a reply was exceedingly limited, but he was kind enough to send me a letter, together with the two photos and diagrams which are here reproduced.

The half-tones are of small feed storage tanks used in a plant already erected, represented in sketch No. 2. The two boilers shown in sketch are "Cornish," 5 feet 6 inches diameter by 26 feet 6 inches long, and have flues 2 feet 9½ inches diameter and 5 feet 6 inches grates with heating surface of 500 square feet and a grate area of 15 by 35 feet. But Welsh coal is used, containing about 15,000 Board of Trade units, and the plant drives the laundry, the electric lighting, duplex pump for elevators, the whole of the radiators, provides steam for cooking in the kitchen, and supplies the hot water service of a large hotel.

The feed is delivered from the town's water supply into the tank under the feed water heater, and by means of duplex pumps it is passed through the feed water heater, where it is raised to a temperature of about 200° Fahrenheit, and from there it is forced into the top of the thermal storage vessel, where the feed pipe delivers horizontally into the steam space, towards the back end of the vessel, or away from the firing end of boilers. The blow-out for the dirt deposited in the thermal storage vessel is also at the back end, and this blow-out is connected directly with the main blow-out in front of boilers.

The feed passes along the thermal storage vessel, and is led out near the firing end of boilers by a pipe standing about nine inches above the bottom of the vessel. From here it gravitates into the boilers, the quantity being regulated by these valves.

There is a pipe from the steam space of boiler direct into the top of the thermal storage vessel, so that there is always the same steam pressure between the boiler and thermal storage vessel, and the feeding into the boiler is effected by the head of water in the thermal storage vessel above the boiler.

He writes:

"I was obliged to start the plant before the makers had completed the thermal storage vessel and its connections, and when the boiler working them was emptied it was found to contain thirty-five buckets of sediment and incrustation.

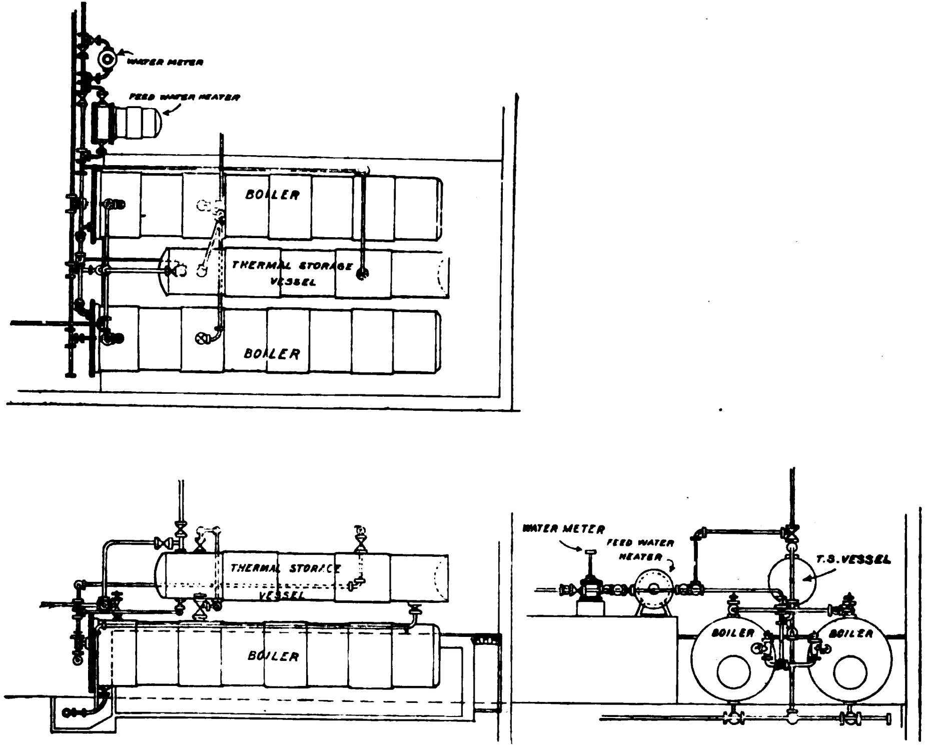


FIG. 2.

ARRANGEMENT OF STEAM PLANT WORKING UNDER HALPIN'S FEED STORAGE SYSTEM, SUPPLYING STEAM FOR LIGHTING, HEATING, COOKING, ETC., IN LARGE ENGLISH HOTEL.

"After the feed storage was got to work one boiler ran twenty-two days and nights continuously, and on opening out it was found absolutely devoid of scale or dirt.

"I caused two tests to be made of eighteen hours each, during which the coal was accurately weighed and the water measured through a meter I had previously checked, with the following results:

"When working without thermal storage the evaporation reduced to 'from and at 212° Fahrenheit' was equal to 10.95 pounds of water per pound of coal, and on the second test, when the thermal storage was at work, the evaporation was raised to 12.21 pounds.

"Of course, you must bear in mind that this particular apparatus was only designed for feed storage, as *steam* storage was not required under the special conditions which had to be dealt with in this case.

"Sketch No. 3 of the storage vessels, to work in connection with refuse destructors, shows four thermal storage vessels, the number required in this case.

"You will, of course, observe that any possible effect of radiation, about which I am not at all frightened, is minimized, as the cylinders here radiate against each other, so that only one-quarter of the total surface, or, say, one cylinder, will be under the influence of losses from radiation.

"I have arranged this plant so that there is a wooden gallery in the roof, and into this gallery *all* the various handles are brought for working the apparatus. I have taken this precaution so that should any joint break the men in charge are perfectly safe, and being in the gallery they can control the valves and blow the vessel off, any escaping steam passing out through louvres in the roof. The boilers for this plant are not shown.

"You will observe the thermal storage vessels are completely finished in the riveting machine, not a single rivet being put in by hand, and owing to the form of the dished ends there is not a single stay in the whole vessel, so that they are absolutely free to expand in any direction without doing injury by tearing themselves to pieces. All the valves, etc., are arranged so that any one or all vessels can be cut out of use."

In conclusion I will say that, of all the methods of storage available, the storage battery would, on theoretical grounds, be the best, because of its forming the last link in the chain, thereby giving the economies of continuous working to all that precede. Unfortunately, it involves such large losses in itself as to nearly if not quite nullify the advantages it would otherwise present. And again, its heavy cost above all other methods renders it unavailable in any complete storage project unless fuel is dear.

We are therefore compelled to go back of the engine for our equalization schemes and put up with the losses due to variable load upon all that follows. Fortunately the losses which we can overcome at this early stage are quite considerable, and we have a number of methods at hand. Of these the gas engine—involving a gas storage—seems to give the best results. Very closely following this comes Halpin's combined feed and steam storage, followed by feed storage and steam storage. Below is given, in tabular form, the cost to produce for one year one electrical horse-power, with coal at $1.75 per ton and at $3.50 per ton; also, the saving effected by the various methods over present methods in a station having a mean load 25 per cent. of its maximum:

	RECAPITULATION.		SAVING EFFECTED.	
	Coal $1.75 per ton.	Coal, $3.50.	Coal, $1.75.	Coal, $3.50.
Present method, steady load........	$48.68	$65.62	......	......
Present gas engine..	88.28	103.61	$29.50	$44.79
Combined feed and steam storage......	94.42	111.35	23.36	37.05
Feed storage.........	97.58	117.58	20.20	30.82
Without storage, load factor 25 per cent...	117.78	148.40	......	......
Steam storage........	97.24	114.27	+ 20.54	34.13
Complete battery storage.............	128.18	145.74	— 5.35	+ 2.66

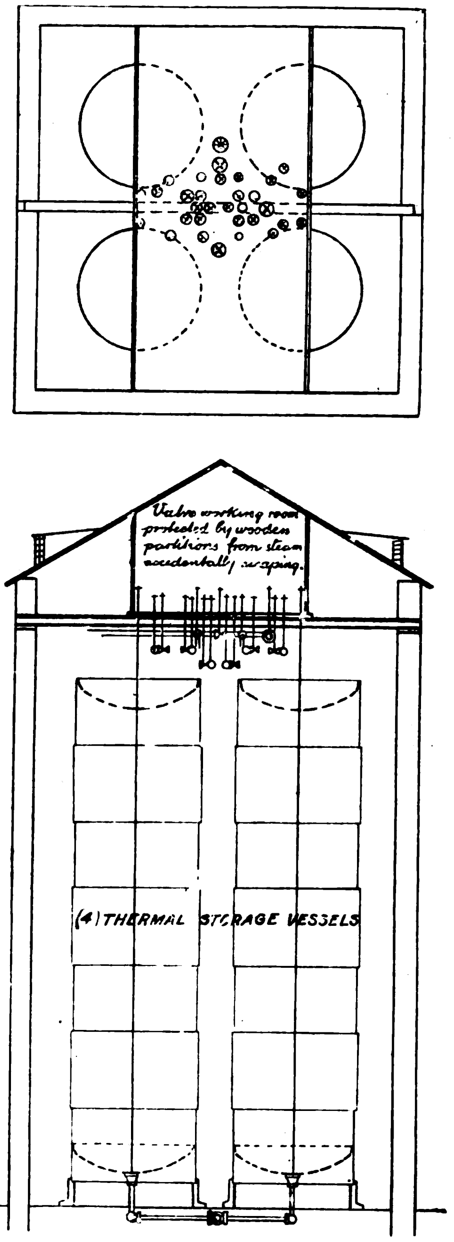

Valve working room protected by wooden partitions from steam accidentally escaping.
(4) THERMAL STORAGE VESSELS

FIG. 3.

HALPIN'S COMBINED FEED AND STEAM STORAGE SYSTEM, IN CONNECTION WITH REFUSE DESTRUCTORS, TO SUPPLY STEAM TO A MUNICIPAL LIGHTING STATION.
(*Boilers not shown.*)

Detroit Lighting Plant to Start.

It is reported from Detroit that there will soon be six 100 light dynamos, two engines and four 300 horse-power boilers ready for operation in the plant. There are 200 lamps strung and circuits tested in the underground district, and 23 lighting towers equipped. Besides this there are about 50 lamps ready to start outside the underground district. The incandescent plant is all wired and 2,000 incandescent lamps will also be lighted when the wheels of the plant first start up.

Lake City, Minn.—The question of putting in electric lights is to be submitted to the voters this spring.

ARC LAMP NEWS.

Mr. R. B. Corey has concluded an arrangement with the General Incandescent Arc Light Company by which Mr. Corey will be the sole selling agent of the product of the Bergman factory, the latter manufacturing, in addition to their present well known line of lamps, imported carbons, etc., all the various styles of Knight lamps.

Mr. Corey is established in his new offices in the Havemeyer Building, and is now prepared to give prompt attention to the wants of his innumerable friends and customers.

More Telephone Competition.

Messrs. W. D. Jameson & Co. have opened offices at 150 Broadway, New York, as general United States agents for the Gerson telephone, made in Philadelphia. Their line comprises apparatus for all services, which is sold outright.

Personal.

Mr. Herbert Wagner, of the Wagner Electrical Company, St. Louis, was in Philadelphia last week.

Mr. C. H. McIntyre, of Newark, accompanied by Mrs. McIntyre, is spending a couple of weeks in Florida.

Mr. W. J. Clark, of the General Electric Company, whose health has not been good for several months, has gone abroad to recuperate, and will spend most of his time in Italy and Southern France.

Among the Buffalonians in town last week were Messrs. Charles L. Huntly and Tracy Becker, the latter being the counsel of the Buffalo G. E. Company.

Mr. John B. Wallace, of the Wallace Electric Company, who has been in the East for several days, has returned to Chicago.

Mr. P. C. Ackerman, of the American Electrical Works, leaves New York for a Western trip to-day.

Mr. Brainerd Rorison, of the Ft. Wayne interests, arrived home from Europe last week. Mr. Charles S. Knight, manager of the Ft. Wayne Electric Corporation was also in the city.

Mr. James Cummings, of the firm of Cummings & Engleman, Detroit, is a New York visitor this week.

Mr. P. H. Alexander has returned from a successful trip in the interests of the Electric Selector and Signal Company.

Mr. M. M. Hayden, now with the National Carbon Company, has been shaking hands with many New York friends this week.

Mr. G. H. Van Voorhis, who was for a long time with W. R. Mason in Chicago, is now located in New York with Messrs. W. D. Jameson & Co., 150 Broadway.

The Brooklyn Electrical Society in Permanent Quarters.

The members of the Brooklyn Electrical Society have opened their new laboratory and reading rooms at 370 Pearl street. In these rooms are soon to be carried on several interesting experiments in the latest electrical inventions, while students of the science will be able to find the latest electrical literature. An electrical library will be inaugurated for the use of the members, and a novelty in the shape of a classified catalogue library is to be introduced.

The society will hold lectures in the Edison Assembly Rooms every Tuesday evening.

Membership in the Brooklyn Electrical Society is open to all interested in the study of electricity, and communications should be addressed to the chairman of the Membership Committee, Thomas A. Bamford, 370 Pearl street, Brooklyn.

COMMUNICATION.

PERKINS LAMPS.

To the Editor of ELECTRICITY.

DEAR SIR: We find a statement in your issue of March 13 which we desire to correct. On page 126, top of middle column, under the heading "Another Perkins Lamp," a statement is made to the effect that Mr. C. G. Perkins will shortly begin the manufacture of the Perkins incandescent lamp. We are not definitely informed as to the plans of Mr. Perkins, but have heard that he intended to manufacture incandescent lamps. However, we desire to state that the right to make "Perkins" incandescent lamps, or any lamp in which the name of "Perkins" is associated in any manner, belongs exclusively to this company, and we would, therefore, ask you to correct the paragraph as above. The only "Perkins" lamps to be obtained are manufactured and sold by this company. We presume the statement in your paper of the 13th was made inadvertently, but desire it corrected before it has been too widely spread. Thanking you for your courtesy in advance, we are very truly,

THE PERKINS LAMP COMPANY,
A. D. CLAFLIN, Treasurer.

Boston, March 14, 1895.

LEGAL NOTES.

Thomas J. Mooney, receiver of the National Electric Manufacturing Company of Troy, N. Y., has brought suit against the Wisconsin Company of the same name (also in the hands of a receiver), on a claim of $25,000, which was disputed in the settlement between the companies, who were allied to each other.

An execution for $65,887 has been received by the sheriff of New York, against the New York Electrical Engineering Company, in favor of Wareham & Hughes for balance due on the construction of an electrical railway from Pittsburg to Munhall Station, Penn. The total amount of the contract was $94,000. The firm claimed that it did work to the amount of $84,000 and received $19,050 in payment. Judge Giegerich has appointed R. A. Stackpoole receiver for the company.

The electric light plant at Paducah, Ky., owned by the Consolidated Engineering Company of St. Louis, has been attached by the Standard Electric Company of Chicago, for $4,900.15. The city owes $12,000 to the St. Louis Company.

General News.

What is Going on in the Electrical World.

Spartanburg, S. C.—A survey has been made for an electric railway from this city to Glendale and Clifton.

Independence, Iowa.—At the city election on the 5th there was a large majority in favor of the city erecting an electric light plant.

Shelbyville, Ill.—Trout Bros. have been granted a franchise to establish an incandescent electric lighting system in this city.

Lake City, Minn.—The question of bonding the city for an electric light plant will be submitted to the voters at the charter election on April 2.

Carbon, Ind.—The city council has accepted the Fox Brothers' proposition to put in an electric light plant here and furnish the town with electricity.

Lynchburg, Va.—The city council has by vote authorized an issue of $60,000 of 5 per cent. city bonds to defray the cost of establishing an electric light plant.

Hudson, N. Y.—The Kinderhook and Hudson Railway Company are considering the advisability of using electricity on their line. Steam is at present employed.

Niles, O.—The council has passed the ordinance granting the Mahoning Valley Electric Railway Company a franchise. This line will connect Niles and Youngstown.

Woods, Ore.—A subsidy has been raised here to build an electric railway to Ocean Park, and the people are discussing the question of waterworks and electric lights.

Cleveland, O.—The property of the Cleveland Gas Fixture Company was purchased lately in the Probate Court by the Cleveland Gas and Electric Fixture Company, a new concern.

Jackson, Tenn.—The city council has decided to have an electric light plant of its own to light the streets. An arc plant will be put in and operated in connection with the waterworks.

Rossville, Ill.—The village council has granted to Frank L. Stewart, of Rossville, a franchise for an electric light plant, a telephone exchange and an electric street railway.

Portland, Me.—A survey has been made for the new electric road in this city by representatives of the firm of Hodges & Harrington, of Boston, who are the supervising engineers for all the construction.

Annapolis, Md.—The city counsellor has been instructed by the council to prepare a contract and ordinance granting a street franchise to the Annapolis, Brighton Beach and Bay Ridge Electric Railway Company.

Abilene, Kan.—The Abilene waterworks and electric light plant has been sold at master's sale as part of the assets of Coffin & Stanton, New York. It brought $22,700 and was bought in by the bondholders' committee.

Kansas City, Mo.—The first bondholders of the Northeast Street Railway Company are considering the advisability of selling the road, now under foreclosure, in April, and buying it in with the purpose of reorganization.

Holton, Kan.—The electric light plant owned by John I. Myers and James H. Lowell, of Holton, and Dr. M. B. Smyth, of Springfield, Mo., was totally destroyed by a fire here on the 4th. The plant was valued at $14.000.

Indianapolis, Ind.—The bill allowing electric street railway companies to supply steam, light and power passed both branches of the Legislature; also the bill authorizing cities and towns to operate their own electric light plants.

Concord, N. H.—The bill in relation to the incorporation, organization and regulation of street railway companies, and authorizing the use of electricity as motive power by existing steam railroads, has passed the Senate.

Mt. Clements, Mich.—The required bonds for the electric road to Detroit has been raised by the people of Mt. Clements, and the electrical equipment has been ordered. The builders promise the best electric road in America.

Los Angeles, Cal.—The holders of the bonds of the Los Angeles Consolidated Electric Railway Company have decided to assume the control of that organization, to greatly improve its plant and to endeavor to place the road upon a paying basis.

Middletown, Conn.—The work of constructing the Middletown and Cromwell electric road is to be commenced in a few weeks and the company, of which Israel A. Kelsey of West Haven is president, will expend about $50,000 in completing the road.

Bristol, Tenn.—The sale of the Bristol-Goodson gas and electric plant to S. C. Hurt & Son, of Lynchburg, Va., and their Bristol associates, at the price of $20,600, has been confirmed. The new company will spend several thousand dollars in improving the plant.

Elwood, Ind.—The Elwood Electric Street Railway, Light and Power Company, whose buildings and cars were destroyed by an explosion last December, have completed the work of rebuilding, and will resume operations at once. The expense of rebuilding was $40,000.

Fall River, Mass.—The Barrington and Warren Railroad Company has applied to the Rhode Island General Assembly for a charter which if granted and the road is built will give a complete chain of trolley roads between Fall River, New Bedford, Providence, Pawtucket and Central Falls.

Auburn, N. Y.—President C. D. Beebe of the Auburn City Railway and President Thomas Craig of the Seneca Falls and Waterloo road have a project under consideration which they hope to see accomplished, to wit, the connection of Auburn with Geneva and Syracuse by electric roads.

West Point, Miss.—Hosmer & Bell, of this city, have just completed an incandescent dynamo at their foundry and machine shops. This is said to be the first dynamo ever manufactured south of the Mason and Dixon line. Its capacity is 400 incandescent lights.

Birmingham, O.—The road to be built by the Milan, Birmingham and Elyria Electric Railway Company will run from Milan through Berlinville, Florence, Birmingham, Henrietta and South Amherst to Elyria. The capital stock of the company is $100,000.

Boston.—A. W. Mitchell, of Crescent Beach, Mass., has patented a controller for electric cars which does away with the brake and power cranks, substituting in their place a large iron wheel which does the work of both. The car is started by turning the wheel to the left when the brakes are released and the power is put on. A turn to the right reverses this order, and the car is brought to a stop.

Milford, Conn.—Francis W. Marsh, Sherman H. Baldwin, J. D. Brown, Howard H. Scribner, John W. Thompson, Frank L. Rogers and Chas. W. Beardsley have asked the Legislature for incorporation as a company to build and operate an electric road in Milford with an extension to Stratford and Bridgeport, and thence to Seaside park. This is the first electric company in the field in Milford.

Chicago.—The plant of the Chicago Electrical Supply Manufacturing Company, which has long been idle, is to be removed to Marion, Ind., and put in active operation. The work of erecting the necessary buildings and removing the machinery has already been commenced, and it is expected to have the plant in operation within sixty days. Employment will be given to several hundred men.

McKeesport, Pa.—The *Times* of the 9th inst. has the following: "Next Monday the three departments of the Westinghouse Electric Company's plant at Brinton that have been idle will resume and the works will then be on full. This week 3,000 men were at work, next week the number will be increased to 4,000. The Westinghouse Air Brake Works at Wilmerding are running double turns, employing 3,200 workmen."

Staten Island, N. Y.—The Staten Island Belt Line Railroad Company's property, appurtenances, equipments, etc., have been purchased by J. P. O'Brien, of the Thomas syndicate, for $75,000.—The Edgewater board of trustees have granted the application of the Midland Railroad Company to change the motive power on the line from Stapleton to Concord from horses to electricity. The trustees also granted the Staten Island Interior Company rights of way over a number of streets.

Buffalo, N. Y.—A company is being organized here to build an electric road between this city and Hamburg, the estimated cost of which is $100,000. The road will be nine miles long. Among the Buffalo men interested are William Ellwood, S. H. Koopmans, John O'Brian, L. L. Long, James E Curtiss and R. L. Banta. The Hamburg men interested are Hon. Thomas L. Bunting, George M. Pierce, Jacob Peffer and H. Spencer. Pittsburg and Titusville men are also interested.

Washington, D. C.—A force of men are at work on the construction of the new underground electric system that is to be used on the Ninth street section of the Metropolitan road. The power house for this new plant has already been built, and the engines have been in working order for some weeks past. The street work will now be pushed with all the energy that can be put into it by an experienced contractor, and he promises to have the new line in running order within sixty days.

Green Bay, Wis.—By an agreement between the Wisconsin Interurban Railway Company and Elmore & Vanderzee of Green Bay, rival aspirants for franchises to build an electric line from Neenah to Kaukauna, the Wisconsin company withdraws and leaves the Green Bay gentlemen in possession of the field for ninety days. If they can get the franchises and raise the money within that time they are to build the road. If not, they are to step aside and leave the field clear for the Wisconsin Interurban Railway Company.

Pittsburg, Pa.—An electric railway scheme that comprehends the tunneling of Mt. Washington and supplying quick transit to all the territory lying south of the Monongahela River as far out as Carnegie and West Liberty is to be carried out in a short time, the project being in the hands of men who have the means and the spirit to push the matter to completion. James M. Bailey is at the head of the company. The route includes a number of suburban villages and will enter Pittsburg by way of the Smithfield street bridge.

Hartford, Conn.—The fire board has decided to replace the present liquid batteries in the battery room with a storage battery system (chloride accumulators), complete, with switches, rheostats, etc., including a spare battery for each of the four fire alarm circuits. The system is the same as that now being adopted by the Western Union Telegraph Company in all its offices. The total cost will be $767 for the equipment, which will last five years. The Hartford Electric Light Company has agreed to furnish the current for charging the batteries for $40 per year.

Atlanta, Ga.—A company has been organized here whose object is to erect an electric generating plant on the Chattahoochee River at an available point for the development of water power, and transmit electric current to this city for power and lighting purposes. The principal promoters are E. A. Thornton, James D Collins, Evan P. Howell and John A. Grant of Atlanta, James Swann, Jonathan H. Vail and Hugh R. Garden of New York and Richard N. King of Dayton, O. The capital stock of the company will be $100,000 actually paid in with power to increase the same to any amount not exceeding $2,000,000.

Baltimore, Md.—The Susquehanna River Electric Company, which was recently incorporated in Baltimore, has purchased the plant of the Susquehanna Water Power and Paper Company, near Conowingo. With this purchase the electric company now controls about six and a half miles of water-front on the Susquehanna river, having a fall of 100 feet and affording excellent power to generate electricity. The buildings of the Water Power and Paper Company will be converted into an electric plant at once. All the present machinery will be taken out and the interior remodeled into a power-house. The promoters of the electric company say they expect to have their plant in operation within a year.

New York.—A fire in the building 33 35 South Fifth avenue on the 13th inst. destroyed all the apparatus used by Mr. Nikola Tesla in his electrical experiments, together with models, drawings, etc., of inestimable value to him and some of which it will be impossible to reproduce. The money value of the articles consumed belonging to Mr. Tesla was at least $15,000, but this he considers of small account as compared with the trouble he will be put to in restoring a collection of working materials, including many delicate instruments used in his extraordinary experiments, which has taken him several years to devise or otherwise obtain. Much sympathy has been expressed in the public press and among electrical people for Mr. Tesla, who was greatly affected by his loss, but promises to continue his work with redoubled ardor.

Tacoma, Wash.—The project of the White River Water Power Company, to erect a water power plant in the Stuck Valley capable of developing 50,000 electrical horse-power, is second only to the Niagara Falls enterprise in extent and importance. The location chosen for the generating station is on the White River, ten miles east of Tacoma and twenty-eight miles south of Seattle, and power will be transmitted to both of these cities and to a number of contiguous villages. The amount estimated for present needs is 25,000 H. P. The White River Water Power Company is already incorporated, with a capital stock of $2,000,000. Preparations have been made to begin work at the opening of the season, and it is expected to finish construction and have the entire plant in operation before the end of the year. The equipment is to be furnished by the Westinghouse Electric and Manufacturing Company, who are now putting in the great dynamos at Niagara Falls.

Pittston, Pa.—The electrical hoisting plant that is being built at the Priceburg mine of John Jermyn is a matter of interest to mining engineers, on account of certain difficulties to be overcome in applying electricity to hoisting apparatus, the chief one being the dead resistance of a train of cars at the foot of a slope or a loaded carriage at the bottom of a coal shaft. The hoisting apparatus in question consists of two motors, the armatures of which are not connected except by means of the gearing on the second shaft. The principal reason for this arrangement is that one motor can be used should the other break. The great advantage of the electric hoist at Priceburg lies in the fact that it is located 5,000 feet from the power house, upon the side of a mountain, where it would be practically impossible to use a steam plant, there being no water convenient. The next step will be the application of electricity to hoisting from shafts. This will be the critical test for the new power so far as the mining industry is concerned.

Albany, N. Y.—In the Assembly a bill has been introduced to incorporate the Niagara River Tramway Company, with power to associate with any other persons or company in Canada not having banking or insurance power. The company has a capital of $50,000, and is to construct and operate a tramway over, across and along the Niagara River in Niagara County and from the east or American side of that river to the opposite shore in Canada. John A. Merritt, John E. Pound and George W. Pound, of Lockport; George Baltz, of Buffalo; L Clarke Raymond, of Welland, Ontario; Robert N. Campbell, of Niagara Falls; A. Monte Cutter, of New York City, and John Fleet and Joseph Tait, of Toronto, are named as commissioners to open the subscription books. The company proposes to operate cars by electricity on a cable suspended in front of the Falls, between the American and Canadian sides, and already has the right to do so from the Canadian Government.—Gov. Morton has signed Assemblyman Higbie's bill exempting the counties of Richmond and Queens and the village of White Plains from the provisions of the act authorizing the village boards of trustees to contract with electric light companies organized in this State for lighting village streets and public grounds.

Telephone and Telegraph.

The Bell Telephone Company has reduced its rates for the use of 'phones in Philadelphia to $50 a year as the minimum instead of $120, the former charge.

The county court has granted the St. Louis County Electric Light and Power Company the right for twenty years to erect and maintain its wires upon the poles of the St. Louis County Telephone Company.

Paul Minnis has applied to the city council of Mobile, Ala., for a franchise to operate a telephone exchange in that city.

The new telephone company at Petersburg, Va., has completed its organization by electing the following officers: President, William B. McIlwaine; vice-president, E. A. Hartley; secretary and treasurer, R. D. Gilliam; directors: T. S. Beckwith, John O'Connor, T. F. Heath, W. S. McCance, T. H. Woody, Louis C. Wright, A. Rosenstock.

Wm. N. Cannon, of Binghamton, has made arrangements to put in a telephone system at Deposit, N. Y. About twenty miles of wire will be strung.

The Central New York Telephone and Telegraph Company have applied to the city council of Utica for permission to construct underground subways in the streets.

Marshfield, Wis., is now connected by telephone with the outside world by a private line to Aspin, where it connects with a line to Grand Rapids. Theodore Springborn, the builder of the new line, will next build a line from Marshfield to Stratford and another to Nasonville.

At a hearing before the Assembly Committee on Gas, Electricity and Water Supply, held at Albany, N. Y., on the 12th inst., Mr. Rush C. Taggart, appearing for the Western Union Telegraph Company, spoke in opposition to the Wieman bill proposing a reduction of telegraph rates. In the course of his argument, Mr. Taggart said: "The present rate for sending a message of ten words is 25 cents. To reduce the rate would mean an impairment of the capital stock of the Western Union Company, which was now paying 23 3-10 cents for every message of ten words sent."

The stockholders of the Alexandria Telephone Company, of Alexandria, La., have elected the following officers: President, Thos. Clements; vice-president, J. C. Ryan; secretary and treasurer, L. A. Stafford. It is the intention of the company to construct telephone lines in Alexandria and the surrounding country.

A franchise asked for at Toledo, Ohio, by the American District Telegraph Company, has been approved by the Committee on Railroads and Telegraph. It places the company on the same footing as other companies using electric wires in Toledo.

The Niagara Mutual Telephone Company has opened subscription lists at Tonawanda, N. Y. The promoters of the company are local business men who consider the present telephone rates exorbitant and believe that a local corporation could furnish as good service for much cheaper rates. As soon as 150 subscribers are secured the company will take steps toward incorporation.

The Hudson River Telephone Company reports gross revenue for the year $260,977, expenses $178,857; net revenue $82,120. A comparison with the report for 1893 shows an increase in the gross revenue of $11,147.44, a decrease in the expense account of $8,369.33, and a gain in net revenue of $19,516.77.

The movement for the installation of a new telephone system on Staten Island is being vigorously pushed by the projectors. The new enterprise is called the Staten Island Automatic Telephone Company. It has secured the right to erect poles and wires from the New Brighton trustees, and has made application to the Edgewater board. The representatives of the company state that 150 subscribers have been secured in New Brighton.

The Gamewell Fire Alarm Telegraph Company of Newark, N. J., has been awarded the contract for the new police patrol telegraph system at Rochester, N. Y., the cost to be $2 100. The Gamewell Company has also signed a contract to put in its fire alarm system at Amsterdam, N. Y.

The superintendent of the Central Union Telephone Company has lately been in Belvidere, Ill., endeavoring, it is said, to make contracts with the residents, agreeing to furnish telephones free. The contract calls for $18 per year, but when the contract is signed the subscriber is presented with a receipt for one year. Belvidere was one of the first towns in the country to put in an opposition telephone exchange, and this action on the part of the old company is intended to cripple the others.

The American Telephone and Telegraph Company of New York City has filed with the Secretary of State at Albany a certificate of increase of its capital stock to $12,000,000. The amount of capital of the company actually paid in is $7,500,000, and the whole amount of its debts and liabilities is $3,019,005.

At Dubuque, Iowa, several hundred business men have, it is reported, signed contracts to take the Harrison telephone for five years. The Bell Company, which has 500 subscribers at $48 per year, threatens to give the instruments for nothing and is introducing long-distance telephones to improve the service.

Partrick & Carter's House Goods Specialties.

Sample Board for Agents.

The Partrick & Carter Company of Philadelphia have prepared a very handsome Sample Board of some of their House Goods Specialties, designed especially for small dealers and those who do not as yet carry a stock of such supplies. Everything is connected and in complete working order for practical exhibition. The Board is made of hard wood with dealer's name and address in gilt letters. An advertisment in this issue shows an illustration of this new Sample Board, which will be boxed and shipped complete with battery on receipt of price.

Mather Company's Sales.

The Mather Electric Company of Manchester, Conn., report the sale through Messrs. H. B. Coho & Co., of the "Mail and Express" Building, New York City, of one 250-light and one 350-light Improved Mather Ring Type Dynamos for the new lighting plant of the Portland apartment house, Washington, D. C., Messrs. Coho & Co. having been awarded the contract for the entire plant, including McIntosh & Seymour engines, piping, fittings, etc.

MICANITE.

The latest specimens of the product of the Mica Insulator Company, New York, show the highest developments in their process yet achieved. The concern has been very prosperous, even during the past two years of general depression, and has found a regular and persistent increase of business. This is due, of course, to the fact that they make something which the people want. They draw special attention to the Micanite Plate, Cloth and Paper. The Plate, from which Commutator Segments, Rings, etc., are made, is of lighter color, almost transparent, showing a smaller proportion of cement than heretofore. This improvement has been attained by special machinery and greatly improved methods.

RECENT COMPANY ELECTIONS.

New York and New Jersey Telephone Company, New York. President, Charles F. Cutler; vice-president and general manager, W. D. Sargent; secretary, Joel C. Clark; treasurer, Henry S. Snow. Directors: C. F. Cutler, Alexander Cameron, M. F. Tyler, J. P. Davis, C. A. Nichols, Hugh Kinnard, W. D. Sargent, D. B. Powell, G. H. Prentiss, J. C. Clark, Felix Campbell and E. J. Hall.

Bennington and Woodford Construction Company, Bennington, Vt. President, H. W. Martin; vice-president, Dr. D. M. Gorton; treasurer, W. F. Keefe; secretary, C. H. Mason. Directors: W. J. Turck, Jr., C. W. Crispel, W. F. Keefe, John Robinson, H. W. Martin. The company's charter gives them the right to build railroads and erect telegraph and telephone lines.

Bennington and Woodford Electric Railway Company, Bennington, Vt. President, C. W. Crispel; vice-presipent, H. W. Martin; secretary, C. H. Mason; treasurer, W. F. Keefe. Directors: C. W. Crispel, W. F. Keefe, W. J. Turck, Rondout; Amos Aldrich, Woodford; H. W. Martin, Bennington.

Consolidated Telegraph and Electrical Subway Company, New York. Directors: William M. Wolverton, Robert M. Gallaway, Edward Lauterbach, Charles F. Cutler, Edward Hall, Edgar L. Ridgway, John H. Cahill, Edward E. Gedney and John Jameson.

Hudson River Telephone Company, Albany, N. Y. President, Gen. Selden E. Marvin; vice-president, James H. Manning; general manager, Henry E. Hawley; secretary and auditor, Walter B. Butler; treasurer, Jas. J. Fitzsimmons. Directors; James Bigler, Henry L. Storke, Selden E. Marvin, John E. Hudson, James H. Manning, Joseph P. Davis, C. Jay French, D. Cady Herrick, D. B. Parker.

Little Falls and Herkimer Street Railroad Company, Herkimer, N. Y. President, J. V. Quackenbush, of Mohawk; vice president, Charles Bailey, of Little Falls; secretary, Nelson J. Davis, of Utica; treasurer, Clinton Beckwith, of Herkimer; executive committee: William F. Lansing, of Little Falls, and Robert Earl, 2d, of Herkimer.

Cleveland Gas and Electric Fixture Company, Cleveland, Ohio. President, R. E. Gill; vice-president, Bernhard Schatzinger; treasurer, B. G. Tremaine; secretary, H. L. Taylor. The officers and L. Poplowsky constitute the board of directors.

Salt Lake and Ogden Gas and Electric Light Company, Salt Lake City, Utah. Directors: C. S. Hilton, W. S. McCornick, P. L. Williams, T. W. Ellerbeck and James A. Keaman.

INCORPORATIONS.

The Interurban Street Railway Company, Saginaw, Mich.—to build an electric road between Saginaw and Bay City, Mich. Directors: Frank E. Snow, John M. Nichol and W. A. Jackson, of Detroit, and Isaac Bearinger and W. J. Hart, of Saginaw.

The Marion Light, Heat and Power Company, Marion, Iowa—to make, buy, sell and deal in electric light, power, machinery, fixtures and appliances used for same. Capital stock, $50,000. Promoters: J. E. Bowker, C. C. Hodges, W. M. Hodges, Marion.

Certificates of incorporation are being prepared for the Baltimore, Westport and Annapolis Electric Railway and Tramway Company. The capital stock of the proposed road is $100,000. Among the incorporators are Henry Yewell Bready, A. C. F. Boehme, Jr., O. Parker Baker and others, all of Baltimore.

The Woodruff Place Light, Heat, Power and Water Supply Company, Woodruff Place, Ind. Capital stock, $10,000. Promoters: Jas. R. Carnahan, John M. Spann, J. F. Bent, Indianapolis.

The Citizens' Light, Heat and Power Company of Mahanoy Township, Shenandoah, Pa.—to supply light, heat and power. Capital stock, $10,000. Promoters: Jno. Riley, Harvey W. Wood, Jno. T. Lamorell, Philadelphia, Pa.

The People's Electric Light and Power Company, Calais, Me.—to furnish incandescent and arc electric light and power to the city of Calais. Capital stock, $50,000. Promoters: Martin Cone, Geo. S. Murchie, Ashley St. Clair, Calais.

The Ironton Electric Railway, Light and Power Company, Jersey City, N. J.—to erect, own and operate works for electric light, heat and power. Capital stock, $300,000. Promoters: Lucius C. Joyce, Plainfield, N. J.; Geo. L. Choarer, T. Channon Press, New York City.

The Faultless Gas Saver Company, San Francisco, Cal.—to purchase patent rights for gas, water and electrical machines, appliances, regulators and savers, to manufacture appliances for measuring, and contract for water, gas and electricity. Capital stock, $100,000. Promoters: E. J. Norris, A. K. Stevens, J. Kroaker, M. S. Fernburg, C. W. Nevine, San Francisco.

The Joplin and Galena Electric Railway Company, Webb City, Mo.—to build and operate street railways. Capital stock, $120,000. Promoters: Gahen Spencer, A. H. Waite, of Joplin, Mo.; H. H. Harding, Carthage, Mo.

The Canajoharie Electric Light and Power Company, Canajoharie, N. Y.—to manufacture electricity for Canajoharie and Palatine Bridge. Capital stock, $25,000. Directors: W. J. Arkell and Bartlett Arkell, of Canajoharie, and Austin L. McCrae, of Gouverneur.

The Brandenburg Under-Car Electric Railway Company, Chicago—to manufacture street car appliances. Capital stock, $5,000,000. Incorporators: George Brandenburg, George W. Van Zandt and William A. Youmans.

The Fishkill Electric Railway Company—to build and operate a street surface railroad from the village of Matteawan to the village of Fishkill, N. Y. Capital stock, $50,000. Directors: John T. Smith, E. K. Tompkins, Chas. H. Watson, John Place, W. Weston, B. L. Smith, of Fishkill-on-Hudson; S. K. Phillips, W. H. Southard, of Matteawan, and Wilbur H. Weston, of Newburg.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MARCH 12, 1895

ELECTRIC RAILROADS AND APPLIANCES.

535,345. Closed-Conduit Electric Railway. Edward M. Bentley, Boston, Mass. Original application filed Dec. 11, 1885. Divided and this application filed Feb. 25 1891.

535,398. Conduit Electric Railway. Daniel O'Flaherty, Kansas City, Mo., assignor to Ella A. O'Flaherty, same place. Filed March 31, 1894.

535,524. Clamp for Trolley-Wires. Warren W. Annable, Grand Rapids, Mich., assignor of one-half to Butterworth & Lowe, of Michigan. Filed Nov. 23, 1894.

535,679. System and Apparatus for Applying Brakes to Electric Cars. Charles E. Davis, Chicago, Ill., assignor by mesne assignments, to James Parmelee, New York, N. Y. Filed Dec. 29, 1893.

ELECTRIC LIGHTS AND APPLIANCES.

535,443. Electric-Lighting System. Joseph I. Conklin, Brooklyn, N. Y. Filed July 30, 1894.

535,589. Electric-Arc Lamp. John C. Knight, New York, N. Y. Filed March 2, 1894.

535,692 Carbon-Holder for Arc Lights. Adam W. France, Philadelphia, Pa., assignor of one-half to Arthur H. Jones, same place. Filed Nov. 10, 1894.

DYNAMO ELECTRIC MACHINERY.

535,488. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed March 8, 1893. Renewed Aug. 14, 1894.

535,489. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed March 8, 1893. Renewed Aug. 14, 1894.

535,490. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed March 8, 1893. Renewed Aug. 14, 1894.

531,491. Indicating System for Thermo-Electric Generators. Harry B. Cox, Hartford, Conn. Filed Jan. 31, 1894. Renewed Feb. 13, 1895.

535,511. Electrical Controller. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company of Ohio. Filed Nov. 11, 1893.

535,530. Starting Alternating Motor. Ossian Chytraeus, Pittsfield, Mass. Filed Dec. 4, 1894.

535,579. Armature-Conductor for Dynamo-Electric Machines. Henry Geisenhoner, Schenectady, and Christian Sandman, Niskayuna, N. Y. Filed Jan. 15, 1895.

535,796. Construction and Regulation of Dynamo-Electric Machines. Charles D. Haskins, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Aug. 6, 1894.

535,797. Regulation of Dynamo-Electric Machines. Chas. D. Haskins, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Aug. 6, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

535,540. Automatic Telephone-Switch. Newman H. Holland, Montreal, Canada. Filed Aug. 10, 1894.

535,615. Telephone. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Sept. 24, 1894.

535,745. Telephone-Exchange Apparatus. Charles Felix Gaston Marie Bigot de la Touanne, Paris, France. Filed Dec. 30, 1893.

535,806. Automatic Central Telephone-Switch Apparatus. Franz Nissl, Vienna, Austria-Hungary. Filed Feb. 17, 1894.

BATTERIES.

535,464. Battery. Henri N. F. Schaeffer, Manchester, N. H., assignor to Gilbert Brothers & Co., Boston, Mass. Filed Jan. 9, 1893. Renewed Jan. 31, 1895.

535,541. Method of Constructing Secondary Batteries. Arthur Hough, San Francisco, Cal. Original application filed Sept. 14, 1893. Divided and this application filed Dec. 14, 1893.

MISCELLANEOUS.

535,363. Electric Heating Apparatus. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Electric Heating Company, same place. Filed March 12, 1894.

535,370. Electric Clock-Striking Mechanism. Fred L. Gregory, Chicago, Ill. Filed Jan. 30, 1894.

535,481. Electric Burglar-Alarm and House-Call. Henry L. Carpenter, Minneapolis, Minn. Filed April 16, 1894.

535,533. Electric Switch. Mark W. Dewey, Syracuse, N. Y. Filed Jan. 11, 1895.

535,660. Insulator. Warren J. Belcher, Hartford, Conn., assignor to the Billings & Spencer Company, same place. Filed Jan. 16, 1895.

535,703. Electric Cableway. Richard Lamb, New York, N. Y. Filed July 19, 1894.

RE-ISSUE.

11,478. Electrical Fixture. Luther Stieringer, New York, N. Y., assignor, by direct and mesne assignments, to George Maitland, Detroit, Mich. Filed Dec. 31, 1894. Original No. 259,235, dated June 6, 1882.

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EDITORIAL NOTES.

"ELECTRICITY'S" PLATFORM STANDS.

On August 31, 1892, ELECTRICITY outlined the policy upon which it would thereafter be conducted. The situation changes in detail only; the main features remain. Human motives and ambitions remain the same, whether expressed in one or another trade combination.

The question as to whether or not the electrical manufacturing industry shall be free to whomsoever has the capital, the knowledge and the legal and moral right to engage in it remains undecided.

The fundamental article of faith in the creed of the New York bankers who have been connected with the industry from the early eighties seems to be that they have *exclusive rights*, and that those who have come in since are trespassers, infringers and pirates who should be stamped out.

When one set of bankers, whose attempt at setting up a comprehensive monopoly in 1892 has been proved to be a flat failure, realize their impotence against the law of the world's progress, they yet refuse to read that law aright, cast about for others to join them, and outline new plans for the centralization of the business, still aiming at the annihilation of the rank and file.

ELECTRICITY will be here when all such schemes are buried beneath the crushing weight of individual effort and public sentiment.

Our platform to-day is just what it was in 1892, just what it will be in the next century. We reprint that platform from our issue of August 31, 1892:

"ELECTRICITY, under new ownership, will be conducted as an *entirely independent journal*, free to give its candid opinion on any and all matters of interest to the electrical fraternity. Our columns will be open at all times to those who have opinions to offer on such matters, whether they agree with us or not.

"We believe that these are the only correct lines upon which a journal, whether electrical or otherwise, can be conducted. We appeal for support to those who believe, as we do, in the fullest possible discussion of all matters of public interest; to those who believe, as we do, that the recent combination of electrical interests is foredoomed to failure in its main objects, and that its success, if possible, would work infinite injury to the development of the electrical industry of America.

"On this platform we stand, with the courage of our convictions and with no fears as to the result."

* * *

Consolidations.

Since the birth of the industry in America the business world has been upset with an almost systematic regularity by the announcement of trades, deals, absorptions, consolidations, or what not, that the parties to which, always in the earlier years, claimed were necessitated by the growth of the business and would result in benefit to the trade as a whole.

The history of these trades of all kinds is interesting, but at the same time not pleasant to consider. Time has shown that not one was ever made for a laudable purpose, and that with every new one the bedevilment of the whole business has been brought nearer to completion.

However humiliating it may be to admit it, we all must admit that the electrical manufacturing industry has been a veritable graveyard for the capital of the honest small investor. The reason is not hard to learn. The development of all the succeeding deals to their ultimate wreck has shown that the insiders feathered their nests without compunction at every step, while the small investor was being deceived and milked.

The overwhelming desire of those capitalists who have dictated the policy of the large companies from the beginning has been the manipulation of stocks; it has not been to establish a *manufacturing business* on honest and conservative lines. The large apparent profits made in the early days were spent in rascally schemes of one kind or another, and the backers relied for their profits on the gullibility of the public as to the enormous possibilities for riches in any commercial electrical scheme. A large part of the money was wasted in salaries to incompetent men of small caliber—men who might earn $2,500 in any old line business—drawing from $10,000 to $20,000 a year, not because of their ability to conduct an honest business, but for their willingness to negotiate crooked deals in country cities, or to *interest capital.*

The rights of the common stockholders have been ignored, the public has been worked persistently for 15 years. From the time when Edison Electric Light stock was sold at $4,000 to $5,000 a share, through all the successive "reorganizations" of the Edison interests up to 1892—a period taking in those wonderful financial transactions of the T.-H. Company and the raising of money by directors of the old United States Company on their own notes for the payment of dividends to keep up appearances as long as possible—the record is one to bring the blush of shame to the cheek of any man who has the best and honest interests of the trade at heart.

Many of the soundest thinkers in the business to-day are ready to express their opinion that the trade will never be upon a sound basis, offering a safe place for the investment of capital, until this entire element of traders and hucksters has been forced out. That they can ultimately survive in their battle against the fundamental laws of business is impossible, and Electricity is firm in the conviction that every new deal brings the inevitable so much nearer.

It is yet too early to state as a fact that a consolidation, a working arrangement, or any other arrangement, has been closed between the General Electric and Westinghouse interests. Negotiations are in progress—this much is not denied. That an understanding of some kind has been or will be reached may be stated as almost assured. Electricity will regret to chronicle the event when it happens. We do not see how it could be to the benefit of the trade as a whole, or even to the Westinghouse Company itself.

We assert unhesitatingly that we have fuller information at hand covering the history of the art and its commercial applications in this country than is possessed by any other newspaper in America, or by the bankers who are controlling the situation to-day. History does repeat itself, and the record of the trades of the eighties will be the record of all trades of to-day or of to-morrow.

The idea or theory of all combinations is one of hostility to the public interests and of injustice to all smaller competitors. In the early days of all Trusts, honeyed words are not soft enough to express the consideration felt by the managers for the public. Once established, or on the way to establishment, the cloven foot is disclosed; and thenceforth is never absent for one moment.

The comprehensive and detailed history of all the attempted combinations up to date which could be prepared in this office would leave no room for doubt in the minds of any thinking man that our deductions from known facts are entirely correct.

Electricity, with full knowledge of all that has been done, yet expresses the hope that the present proposed trade or arrangement will result in a failure to agree between the two large companies, and that the trade may be spared the disturbing effect of one, two or three years more of a policy of extermination whose mainspring would be a multiplicity of blackmailing patent suits against established businesses. Of the final end of any attempt to bottle up this business there is no doubt in our minds.

We hold that patents, as patents, should be respected, but that a conspiracy to form an unholy combination to make unjust use of such patents is not only unworthy of respect, but demands active opposition.

The American patent system is the best system in vogue in any civilized country. It is the dishonesty displayed in the procurement and handling of these patents, in addition to the perjury and concealment of truth on the part of so-called experts, the rottenness of the whole plan of expert testimony, which has brought the patent system itself into undeserved disrepute.

It is not possible now to prophesy except upon a hypothetical basis. On this basis Electricity gives its opinion unreservedly, based upon a thorough knowledge of the history of the past 15 years, that IF any combination of any character is officially admitted by the two large companies, the next twelve months will see the end of one of them. Not only this, but we believe we are safe in stating that the minute such trade is announced the companies will not be longer under separate management, but will be controlled absolutely by a committee of bankers who will dictate the policy and see that there is no conflict. It is not too much to fear that the plan which Mr. Coffin used in handling the Brush, Schuyler, Ft. Wayne and Excelsior companies would be adopted with some modifications.

We hope it will not occur. If it does, Electricity will be found battling as heretofore for the inherent rights of the independent element in the trade, backed by larger capital than any other paper in the field, prepared for a long fight, and with a knowledge how to fight which has been in evidence for nearly three years.

* * *

Preventing Armature Reaction. One of the most interesting and, in our opinion, most important papers that have come before the Institute in a long time was the one presented by Prof. Harris J. Ryan and Mr. Milton E. Thompson on Wednesday, March 20, in which was described a method for preventing armature reaction. While a paper of purely theoretical interest attracts due attention and is apt to give rise to some discussion, one which describes perfected methods calculated to supplant those in use is sure to be analyzed most critically. Prof. Ryan's paper, which was one of the latter class, proved no exception to the rule, and while there were few who were bold enough to come out strongly in advocacy of his methods, there were not a few who differed with him as to the necessity at this time of providing in any way by additional winding against armature reaction. The method chiefly relied upon up to this time to prevent sparking has been to make the fields relatively so strong that the cross-magnetization of the armature coils even at the highest load will not be sufficient to change materially the axis of commutation from the position it occupies at very light load. This, together with a proper proportioning of the poles, the shaping of the pole-horns and a proper adaptation of air-gap, as well as the use of carbon or other high resistance brushes, has enabled skilled designers to construct machines that are claimed to be practically sparkless throughout their whole range of load. This was in fact the basis of all the criticisms offered against the method described in the paper, and yet, notwithstanding the great perfection thus obtained, the commutator is still admitted to be the weak point in direct current machinery. In direct current generators the amount of copper that can be put on the armature is limited by practical considerations; the clearance or air gap reluctance must in one way or another be made large, which is a step in the wrong direction when efficiency is the ultimate end. It is a question of the choice between two evils, and with present methods *it is found* that the lesser evil is the increased reluctance of the magnetic circuit, introduced *purposely* at one point while at all other points every effort is made to reduce it by the use of *iron of high* permeability and ample section. The limitations thus placed upon the voltage *which* can be used in direct current machines have thrown them into the background where *long* transmissions are concerned, and again it becomes a question of choice between two evils. It is found that where high potentials are necessary it is better to put up with all the difficulties inherent in alternating currents than to use the more convenient direct currents and endure the sparking which inevitably results from attempting too high potentials.

It seems to us that there can be but one reply to the abstract question, "Is the prevention of armature reaction a desirable *attainment?*" and that reply is in the affirmative. Practically, however, we must consider the cost at which this is attained. We cannot afford to pay for this more than it is worth, and in all attempts that have heretofore been made the costs have been out of proportion to the results. On purely theoretical grounds the invention of Messrs. Ryan and Thompson seems to be open to at least two criticisms—1st, that the enlargement of the pole pieces rendered necessary by the balancing coils is not conducive to weight efficiency, and 2d, that the balancing coils themselves must interfere in a large measure with that freedom of ventilation so essential to efficient working. Practical use of the apparatus can alone settle to what an extent these seemingly objectionable features are controlling. On the other hand, the efficiency curve shown is a most remarkable one, and will overbalance many shortcomings in other directions. Thus a machine which at $\frac{1}{10}$ load has an efficiency of 70 per cent. and at $\frac{1}{3}$ load of 85 per cent. is one that must have some very serious counterbalancing disadvantages not to come into great popularity, especially under conditions of varying load such as are met with in street railway and central station practice.

We believe that Messrs. Ryan and Thompson have made a most important and valuable advance in dynamo and motor construction, and that if their machines can realize in actual conditions of practice the promises held out by test results, they will find a wide field of application.

Effects of Trolley Competition. We have commented at some length on the opposition of the New York, New Haven and Hartford Railroad to the granting of further franchises to electric systems paralleling the steam road and its branches in New England.

Our opinion has been expressed that the opposition was misplaced, because the best system will surely win ultimately.

The effects of the trolley roads upon the business of the N. Y., N. H. and Hartford Company are plainly shown in the arguments advanced before the Railroad Committee of the Connecticut Legislature by Judge John M. Hall, vice-president. The loss of business by his company due to trolley competition is given by him as follows, and we suppose his figures are approximately correct:

"Between Norwalk and Rowayton, a loss of 50 per cent. of the entire business. Between Bridgeport and Southport, a loss of 80 per cent. of all business. Between Bridgeport and Stratford, $35 per day. Between New Haven and Woodmont station, 50 per cent. of all business. Between New Haven and West Haven, 70 per cent. of all business. Between Wallingford and Meriden, 30 per cent. of all business. Between New Haven and Lake Saltonstall, 45 per cent. of all business. Between Meriden and Yalesville, about 90 per cent. of all business. Between Southington and Plantville, practically all the business. Between Unionville and Hartford, 40 per cent. of all business. Between Hartford and Glastonbury, 30 per cent. of all business. Between Derby, Ansonia and Birmingham, 90 per cent. of all business. Between Ansonia and Derby, $1,500 a year. Between Naugatuck and Waterbury, $300 a month. Between Union City and Waterbury, $170 per month. Between Waterbury and Naugatuck, 96 per cent. of all business. Between Winnipank and South Norwalk, 50 per cent. of all business. Between South Norwalk and Winnipank, 90 per cent. of all business. Between Norwalk and Royalton, 50 per cent. of all business. Between Danbury and Bethel, 75 per cent. of all business."

If these figures are anywhere near correct they prove that our argument is unassailable. They show that trolley lines between cities and villages are patronized vastly more than the established steam lines offering the best of steam service. This means, of course, that the people prefer to ride on the electric lines. Now, if the people *prefer* to ride in that way, and if the trolley lines, on an insignificant investment compared with that of the steam road for track and equipment, can draw 50 per cent. or more of the traffic, capital will seek the former as an investment, the people will *demand* the service, and the trolley lines will continue to be built.

Progress is the order of the day, and it cannot be stopped for long by even the New York, New Haven and Hartford Railway.

The best thing for the latter to do, under the circumstances, is to buy up the electric lines, put on more cars, and cultivate the popular desire to ride in clean cars, running frequently and stopping for the passenger anywhere along the line, instead of compelling him to go out of his way to a depot and wait, oftener than otherwise, for a train which is not on time.

For long-distance traffic steam will probably have its own way forever; but for interurban traffic at moderate distances the trolley has already won, and the victory cannot be nullified by any protest, however strong, from the directors of steam roads.

From the exquisite impudence of these Connecticut directors one would suppose that that State had guaranteed a perpetual profit to the company when she gave the latter its charter.

Away with such small notions. Let the trolley proceed on its onward march. The people want it and the people always win in the long run.

Under the Searchlight.

Views and Opinions on Timely Topics.

WHO CAN TELL THE TRUTH?

In 1892, only three days before the news of the G. E. consolidation was public property, Charles H. Coster told the best friend he had in this city at that time that no such deal was in contemplation and that it *could not* take place. This was some time after the final papers had been signed and Mr. Coster had been present in his official capacity.

It is also on record that Mr. Samuel Insull, then the active manager of the Edison interests, was not aware that a trade was in progress until the morning after the *final* meeting of bankers at Mr. Villard's house up the river.

It is further on record that after every detail had been perfected and there was nothing further to discuss, the various heads of departments and officers of the Edison Company were called together to discuss the PROPOSED CONSOLIDATION. Is history repeating itself?

* * *

The Sagacity of the "Electrical World."

When the *Electrical World* attempts criticism of a contemporary it invariably omits the name of the journal, fearing that by naming it it will thereby give it a little free advertising. In its issue for March 16 it refers to us in the following manner:

> A BRILLIANT DISCOVERY.
>
> An electrical contemporary informs its readers that according to the recent Bate Refrigerating decision, the Edison lamp patent expired on May 10, 1894, and, therefore, "This decision will also have the effect of throwing out of court those cases for infringement of the lamp patent brought by the General Electric Company since the date of May 10, 1894, and doubtless affect other litigation of the same character!"

Scarcely had the ink gotten dry when the editor of the *Electrical World* was thrown into confusion by the actual fulfilment of our prophecy which he attempted to ridicule. The daily papers of March 23 contain the following:

> Judge Lacombe, in the United States Circuit Court yesterday, issued an order dissolving temporary injunctions obtained by the Edison Electric Light Company against the United Electric Light and Power Company, the Sawyer-Man Company, the Mount Morris Electric Light Company and a number of individuals.
>
> The order was made because the patent, No. 223,898, obtained Jan. 27, 1880, had expired.

Doesn't everybody think Mr. P. H. Johnston would better retire to the familiar atmosphere of Baxter street and leave electrical matters severely alone?

* * *

The "Electrical Age" Got This Off and It Is Good, Too.

One of our contemporaries symbolizes itself by an owl, and proclaims the fact that "We Never Sleep." An owl is a nocturnal bird of prey, with a large head. Owls in all ages and countries have been regarded as of ill omen. Does the shoe fit? We do not think it is at all creditable for one to admit that he never sleeps. It implies a sore head and muddled brain, when both should be clear. The brain needs a rest. But, of course, if there is no brain, that is a different matter.

* * *

IN the early weeks of the G. E. Company Messrs. Villard, Coffin, Hastings, etc., etc., cautioned the writer of this paragraph against speaking of the new company as a consolidation. Amalgamation was the word they preferred to use then—implying an even trade on both sides. A little later it was claimed by the T.-H. people that the Edison Company was bankrupt at the time they came together. And a little later the world knew that both the Edison and T.-H. companies were hopelessly bankrupt at that time and that six months' more of fighting would have landed them both in the hands of receivers.

Nearly three years after the event, it is now known to every one that no permanent benefit was derived from putting two bad eggs into one omelet. And no matter what breed of fowl laid them, there can never be a good omelet made from any number of bad eggs.

* * *

WHEN Mayor Schieren of Brooklyn gets round to appointing his committees on investigation as to granting franchises, charters, etc, etc., he should not overlook the electrical transactions that have taken place in the City of Churches. We opine that some of these transactions would be found to have been of a decidedly spicy and novel character.

* * *

NO KING abdicates his throne until he has become senile or insane—unless he is beaten in conflict.

* * *

To WHOM now belongs the title "The Leading Independent Electrical Company of America"?

THE S. K. C. SYSTEM IN BROOKLN.

Exhibition in the Station of the Citizens' Illuminating Company.

On Friday evening, March 22d, an informal reception was given at the station of the Citizens' Electric Illuminating Company in Brooklyn, the guests being invited especially to see the S. K. C. two-phase system in operation.

A 60 K. W. generator supplied current, operating both a 3. H. P. and a 10 H. P. motor, in connection with a bank of 250 110 volt 16 C. P. incandescent lamps and twenty-eight arc lamps. The system worked to perfection, and nothing but favorable criticism was heard.

There was a large attendance of Brooklyn people, and a goodly delegation of New York men who had not been fortunate enough before to see the practical workings of the system.

The Citizens' Company, until recently, had been unable to make a feature of incandescent lighting owing to the patent situation. Now, however, it is freed from further annoyance, and will no doubt be a stronger factor than ever before in the local lighting situation in Brooklyn.

Their plant is equipped with three Wright engines aggregating 1,100 H. P., driving thirty-nine 45-light Thomson-Houston arc dynamos, with a total capacity of 1,755 arc lights. A new addition is equipped with two McIntosh & Seymour vertical triple expansion condensing engines of a capacity of 400 H. P. each, and twenty-eight Thomson-Houston 45-light dynamos. The steam plant is composed of nine Logan boilers with a capacity of 150 H. P. each, and six Cowles water tubular boilers of a maximum capacity of 250 H.P. each. The feed pumps and condensers are of the Worthington duplex type, and the feed-water heaters are of the Goubert manufacture.

The president of the company, Mr. Bernard Gallagher, and the superintendent, Mr. E. F. Peck, entertained the guests in a royal manner.

A METHOD FOR PREVENTING ARMATURE REACTION.[*]

BY HARRIS J. RYAN AND MILTON E. THOMPSON.

In the designing of continuous current dynamo machinery probably nothing has presented so much difficulty as the problem of avoiding the various evils resulting from the magnetic effects of the current that passes through the armature of the machine. Such magnetic effects are usually spoken of as armature reaction. These evils are at the present time well known and pretty well understood by the electrical fraternity in general, and the modern dynamo designer who is not thoroughly well posted on the subject would be wholly unable to design machinery capable of successful competition with some of the machines now on the market. The tendency of the currents that circulate in the armature coils is to produce a cross magnetism through the core at right angles to the natural field, resulting in a distortion to the natural field of the dynamo—a piling up of the magnetic lines under the trailing pole corners and a weakening of the field under the leading pole corners. This distortion, of course, increases with the current furnished by the machine, and if not specially provided against it may result in bringing the trailing pole corners to complete saturation and in completely reversing the field under the leading pole corners. While this distortion is no great evil in itself the resultant effects may be, and usually are, very serious evils. All distortion of the natural field of a dynamo is sure to be attended by a diminution of the field strength, resulting in a falling off of the E. M. F. produced by the dynamo, and if the distortion be very great no amount of compounding will cause such a dynamo to give constant potential. The most serious evil, however, arises from the fact that the weakening of the field at the leading pole corners results in a shifting forward of the neutral point or diameter of commutation of the dynamo. The amount of such shifting depends on the amount of distortion, and this in turn varies with the load on the machine. Consequently if the brushes are set on the normal neutral point when running light the machine will spark badly under load and it becomes necessary to keep shifting the position of the brushes to meet every variation in load. More than this, unless the pole tips or armature lugs are saturated, a point of loading is soon reached beyond which one finds no diameter of sparkless commutation, and the output of the machine has reached a maximum at this point, notwithstanding the fact that the load may be below that allowed by a safe heating limit. The facts, as before stated, are well understood by the more competent dynamo designers and receive the most careful consideration in the preparation of new designs. It must be confessed, however, that the principal part of the knowledge on this subject is the result of dearly bought experience and costly experiments, rather than of scientific study of the principles involved. Designers of dynamo machinery, with few exceptions, instead of aiming to prevent armature reaction, have endeavored to avoid its bad effects in various ways, and in some cases with fairly good results. The distorting effects of armature reaction become less in proportion as the reluctance of the air-gap and armature core teeth is increased, and the wiser designers of the present day, taking advantage of these facts, are producing some very creditable machines. Probably some of them still believe, as some of the very best authorities on the subject of dynamo machinery have confessed to believing until quite recently, that armature reaction is a necessary evil, and if it were possible to prevent it entirely the whole utility of the machine would disappear at the same time.

While making a thorough consideration of the subject of armature reaction some time since, one of the authors of this paper devised a means of entirely preventing armature reaction and resulting field distortion. On looking up the literature of the subject we found, mainly through the Patent Office records, that there were several workers in the field at a comparatively early date, viz., Prof. Elihu Thomson, Messrs. Andrews and Spencer, Mather, Forbes and possibly one or two others. The specifications given by Andrews and Spencer indicate clearly the technical side of this method for preventing armature reactions, while our part appears in the development of a plan for the practical application of the scheme technically outlined by them in 1886. This method consists in general in surrounding the armature with a stationary winding exactly similar in its magnetic effects to the armature winding, but directly opposed to it, and thus completely balancing all armature reaction. Fig. 1 is a diagram that shows the manner in which the coils are applied. Holes are provided immediately back of the pole surfaces, and through these holes are wound conductors which are placed in series with the armature. The number of ampere turns of the balancing coils crossing each pole face is equal to and opposite in direction to the number of ampere turns on the corresponding part of the armature.

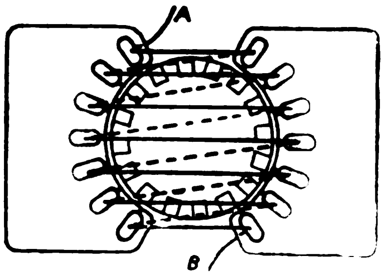

FIG. 1.

A small bipolar machine of about 2½ kilowatts capacity was designed, constructed and tested during the spring and summer of 1891, and the results obtained were very encouraging, demonstrating beyond doubt the correctness of one's understanding of the principles involved. Since that time some half-dozen or more multipolar machines of various sizes have been designed and constructed. All employ these balancing coils with various modifications of design and gave the following results.

Brief mention of these results has been made heretofore in the literature, while a complete report of the same is now made for the first time[*]. The following are the essential data of construction :

Field of cast-iron, two poles.	
Diameter of the armature core over all	6 in.
Length of armature core	6 in.
Number of teeth	64
Number of commutator bars	64
Armature turns per bar	3
Size of armature conductor, B. & S. G	12
Resistance of armature, ohms	.34
Speed, revs. per min	1,800
Output, amperes	25
Output, volts	100
Turns on field, 250 of No. 7 B. & S. G.	
Balancing turns, wound in six grooves per pole face, 16 turns per groove, or a total of 96 turns of No. 8 B. & S. G.	
Resistance of balancing coils, ohms	.24

There was no sparking at any point of the overloading ; the brushes were fixed on the no-load position, i. e., at the zero of field induction, and at all loads the currents in the sections were easily reversed without spark by the potential differences that were caused by the resistance of the carbon. There was no observable falling off of the induction through the armature under load when the balancing coils were used.

By operating as a dynamo or motor without the coil, extraordinarily powerful armature reactive effects are produced. It is seen that the brushes are in the presence of a reversed field that is quite as great as the normal no-load field of 3,000 lines per square centimeter, and moderate sparking with the carbon brushes occurred. Here the balancing coils bring out an interesting effect. One would expect that the effects of their over-balancing action would be *felt* more at lower excitations. In this experiment the induction at the advance pole tip or the position of the "commutation fringe" is almost doubled from the normal no-load value instead of being diminished as is ordinarily the case. It is appreciated that the effect of such behavior is to increase the strength of the commutating fringe at the leading pole tip in proportion to the load, thereby diminishing the range of change of the non-sparking point with metallic brushes, or enabling carbon brushes to be easily adjusted so that when in a fixed position there will be practically no sparking at all ranges of load.

The second machine that was built, and which made use of balancing coils, was a small one of the four-pole type with cast-iron field magnets. This machine was designed to have a capacity of 25 amperes at 80 volts, or 2 kilowatts when running at a speed of 1,200 revolutions. Fig. 16 is made from a photograph of the actual machine. The essential features of the design were as follows : Type of machine, 4 pole; field, cast-iron in two pieces. Armature, two circuit drum winding through 58 grooves; 5 No. 10 B. & S. G. wires in each groove; 29 commutator bars; grooves milled out, size $\frac{3}{8}$'' x $\frac{9}{64}$''; outside diameter of core 7½'', inside 3''; surface of completed armature wound with No. 14 B. & S. G. iron wire. Length of armature and poles, 6'' each. Effective length of iron in armature core, 5''. Magnetic leakage, 15 per cent. Field cores, 5'' x 2''. with rounded ends; area, 9.14 square inches. Mean length of field magnetic circuit, 12.5 inch. Magnetic density in armature core, 5,400 gausses; in air-gap, 4,900; in the armature teeth, 8,400; in the field cores, 6,800. Field winding, mean length of turn, 15 inches; requisite exciting M. M. F. for field circuit, 1,145 gilberts; for armature, 31.3 gilberts; for air-gap, 1,258 gilberts; or a total of 2,434 gilberts. Size of field wire, No. 18 B. & S. G. Number of holes for balancing coils, five in each pole-piece, even conductors per pole or 140 conductors total. Weight of complete machine, 400 pounds.

An examination of this data discloses the fact that no regard is had for the pernicious effects that are ordinarily met with in the use of so short an air-gap with a comparatively large number of armature ampere-turns. With the use of the balancing coils no such effects were observed; the machine performed precisely in accordance with the original estimate made in designing it, and exactly as theory shows that ordinary machines would perform if armature reaction were entirely absent.

During test the machine was belted directly to a ten H. P. Sprague motor, and ran at a speed varying from 1,500 to 1,650 rev. per min. The commutator was quite small for a four-pole machine; it had only 29 segments and was very poorly suited for the pressure of 100 volts at which it was tested. The machine was loaded down to 43 amperes at 100 volts, speed 1,650, and an exploration curve taken around the commutator. This curve clearly indicates the entire absence of field distortion. It was found that the machine would easily carry a load of 45 amperes continuously without overheating. After this curve was taken, the machine was loaded down as heavily as the driving belt would permit, and ran at a load of 80 amperes and 80 volts for about fifteen minutes. Under this load there was no appreciable difference from light load in the behavior of the commutator. The balancing coils were short-circuited for an instant while the machine was loaded to 40 amperes, and the vicious sparking that ensued showed that the dynamo could not be operated at this load without the balancing coils. Indeed the indications were, that it would have been fatal to the welfare of the commutator, and perhaps to the armature itself, to entirely cut-out the balancing coils when the machine was carrying this load. The balancing coils were then cut out and the dynamo gradually loaded down to test the performance without balancing coils. The brushes were shifted forward to prevent sparking as the neutral point changed, and the potential was kept up as much as possible by cutting out field rheostat. The maximum current reached was 37 amperes at 85 volts, with field rheostat all out, and speed 1,800 rev. per. min. At this speed and with this excitation the machine would have given 120 volts instead of 85 if the balancing coils had been used to prevent armature reaction. After a load of 37 amperes was reached, it was found impossible to raise the current by cutting down the external resistance, owing to the rapid fall of potential due to armature reaction. The capacity of this particular machine was about doubled by the addition of the balancing coils, and a comparison of the 37 amperes maximum with the 80 amperes which was by no means the highest possible current, shows that the overload capacity of this machine may be doubled by their use.

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[*] Abstract of a paper read before the American Institute of Electrical Engineers, March 20, 1895.

[*] "On a Method for Balancing Armature Reaction," *Sibley Journal of Engineering*, October, 1892, Vol. VII, p. 17. "Electromagnetism and the Construction of Dynamos," by Dugald C. Jackson, p. 172.

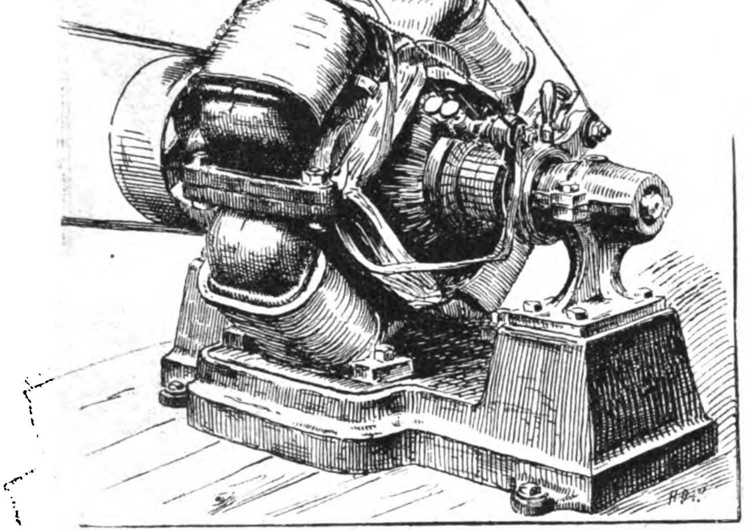


FIG. 2.

Two more machines of the same general design as the latter were built and tested. These machines were built with field magnets of mitis metal, and the pole-pieces and armature cores were one inch longer than the machine last described. The armature windings were different from each other and different from the cast-iron machine. One was wound with a two circuit winding and the other with a four circuit winding. Total weight of each machine was 450 pounds. Each machine, after running at 1,200 rev. per. min., carried a load of 85 amperes at 110 volts for two hours continuously, and was then loaded down to 100 amperes for a quarter of an hour. The performance of the machines confirmed in every particular the results previously obtained.

Two other machines of this same type were built—one of which was wound for a current of 10 amperes at 600 volts, and the other for a current of 550 amperes at 110 volts, or 60 kilowatts.

This type of machine was found to be expensive to construct, and owing to its exceeding compactness very hard to ventilate. The main plan in view when designing these machines was to lessen the total weight for a given output by taking advantage of the fact that when the balancing coils are used one may greatly increase the amount of copper on a given armature and still obtain the same satisfactory performance at the commutator.

Machine No. 7 was therefore built with a field of the ring type. This machine embodied a number of important improvements in details of construction, as will be hereafter noted. Fig. 3 shows a photograph of the machine from the pulley end, and Fig. 4 is a view from the commutator end. Fig. 5 is a view of the armature, which was wound with No. 6 wire cable. Both commutator and armature core were hollow, and the winding thoroughly ventilated. All armature coils were wound simultaneously and the winding was perfectly symmetrical. Fig. 6 is a view of the pole ring. This ring which carries the six balancing coils was made in halves, and the pole-pieces were joined together by small connecting lugs, as seen in the Figure, in order to make the casting continuous. This construction permits the field coils to be wound in a lathe, and to be easily removed from the fields at will. It is also a decided advantage to have the balancing coils and the pole-pieces through which they are wound separable from the rest of the field. The following are the more important details of the design of this machine: Capacity, 91 amperes at 110 volts or 10 kilowatts. Type of machine, six-pole, ring field of steel. Armatere winding of cable through grooves in core. Armature, ten inches in diameter outside by five inches inside; number of grooves, 61—six conductors per groove; grooves, $\frac{7}{32}$" wide by $1\frac{1}{4}$' deep; number of commutator bars, 122; total number of conductors, 366. Armature core and pole-pieces, five inches long. Mean distance between poles, $\frac{3}{4}$". Total magnetic flux, 1,800,000 webers. Maximum density in armature teeth, 14,400 gausses. Maximum radial density in armature core, 8,500. Mean air-gap density, 5,000. Maximum field density, 14,000. Length of air-gap, $\frac{1}{16}$"; M. M. F. for field, 642 gilberts; for air-gap, 1,600 gilberts; for armature, 99 gilberts; total M. M. F., 2,341 gilberts. Fields wound with No. 20 B. & S. G. wire. Armature, 366 conductors of No. 6 cable; five holes in each pole-piece for balancing coils. Balancing coils wound with copper ribbon. Compounding two series turns on each field coil.

Weight of field casting, actual	218	lbs.
" " armature core, shaft and spider	98	"
" " " and commutator complete	185	"
" " " copper	48	"
Weight of copper for balancing coils, actual	55	lbs.
" " field copper, actual	40	"
" " dynamo complete, including base bearings, brush holders, brushes and 14 x 9-inch pulley	865	"

This machine was completed and tested in October, 1894, and the results of test were as follows: Speed of dynamo, 1,065 rev. per. min. Voltage, 110. Current, 110 amperes. Time of run, one hour. Temperature of room, 71° F. Temperature of armature, 128° F. Temperature of field, 108° F. Rise of armature, 57° F. Rise of field, 37° F. Field resistance, 110 ohms. Field current, 100 amperes. Field energy, 110 watts. Armature resistance, .0512 ohms. Armature winding loss, 618 watts. Balancing coil resistance, .0202 ohms. Balancing coil loss, 242 watts. series resistance, .00955 ohms. Series loss, 115 watts. Core loss, friction, etc., obtained from energy absorbed as motor running light at full pressure, 450 watts. Total losses, 1,408 watts. Total output, 12,100 watts. Gross energy absorbed, 13,508 watts. Commercial efficiency, 88.7 per cent. This test was made after the machine had been running for several hours under various loads. On another occasion the machine ran one hour and twenty minutes under a load of 115 amperes at 105 volts with a rise of temperature of armature of 48° F. This load, it will be noted, is 25 per cent. above the rated full load. Yet there was an entire absence of armature reaction. The machine has also carried 135 amperes for one-quarter hour, and has several times been loaded down to 180 amperes for a few minutes at a time without damage.

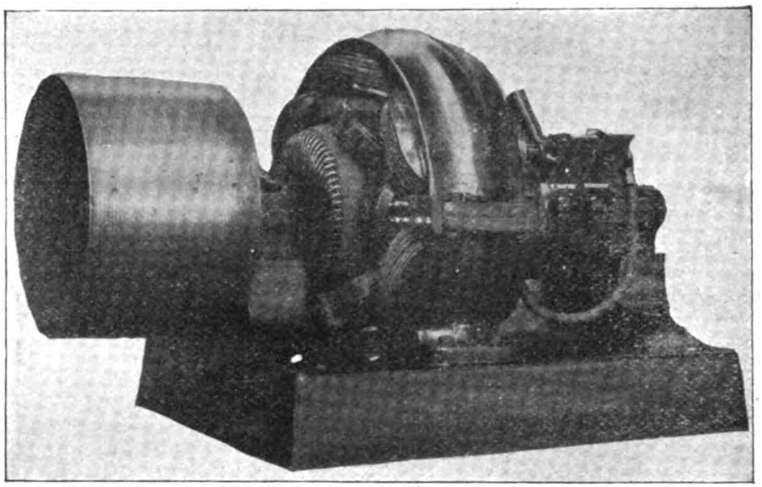


FIG. 3.

While the "balancing coils," as may have been seen from the foregoing results, entirely prevent field distortion and shifting of the neutral point, there is still something lacking for ideal commutation. In a constant potential dynamo, the following are the conditions for perfect and sparkless commutation: When a coil is short-circuited as it passes under a brush the current in the coil must fall to zero, reverse, and rise exactly to the original value in the opposite direction at the instant the short-circuited coil is opened by the passage of the tip of the brush from the commutator bar. To bring about this reversal properly, the short-circuited coil must move during short-circuit through a field whose strength is proportional to the armature current. In other words, the short-circuited coil should move in a neutral field when the machine is unloaded, and should move in a field of considerable strength when fully loaded. The field strength required for sparkless commutation under any particular load depends first on the resistance of the short-circuited coil; second, the self-induction of the short-circuited coil; and third, the duration of the short-circuit, which in turn depends on the width of brush and speed of the dynamo. Preferably the short-circuited coil should move in a uniformly distributed field. It is evident from this consideration that we do not get the conditions for perfectly sparkless commutation even where armature reaction is prevented if we attempt to commutate under pole corner. It is also evident that if armature reaction and field distortion *are* not prevented, we get just the opposite effect on our commutation from what we would wish—that is, our commutation field grows weaker as the current increases instead of growing stronger as it should. From this we may set it down as a settled fact that no dynamo of any considerable voltage and range of capacity which commutates under the leading pole corner and is not provided with some special spark preventing device or arrangement for preventing field distortion can be worked from no load to full load without sparking or without shifting the brushes. During their experimental work on balancing armature reaction, the writers devoted considerable time to the problem of sparkless commutation, and as a result have devised an improvement to be used in connection with balancing coils by means of which ideal commutation is attained. The device is simple, and accomplishes the desired end perfectly. It consists in bridging across the gap between the pole-pieces, attaching a commutation lug to the center of this bridge, and making this lug the center of the balancing coil, the latter being provided with a few extra turns. The arrangement is shown in Fig. 7, which represents a portion of the field circuit sectioned centrally in the plane of rotation. Referring to the Figure, *aa* and *bb* are two field coils wound round the pole necks C and D; G is the commutation lug which is attached to the middle of the lugs H I, which latter bridge across the gap between the pole-pieces E and F. The balancing coil (not shown) is wound through the holes K, L, M, N, O, P, with the commutation lug G at the center of the coil. The path for magnetism is indicated by the dotted lines. It will be noticed that a part of the magnetic lines are shunted across between the pole-pieces *e* and *f*, through the bridge lugs *h i*, and do not pass through the armature. Now when there is no current in the armature or balancing coils, it may be easily seen that the fall of magnetic potential from *e* to *f* is the same by either the path through the bridge lugs or through the armature, and that the commutation lug *g* attached to the middle of the bridge lugs must be at the same magnetic potential as the armature teeth opposite, for the latter are connected to the middle of the armature circuit. Therefore, under these conditions, which are practically what we have when the machine is running light, there will be no field between the surfaces R and S of the commutation lug and armature respectively. If then our brushes are set so that commutation takes place while the short-circuited coil is passing under the commutation lug, we have the correct conditions for sparkless commutation. When the machine is loaded, the excess of ampere-turns of the balancing coils over ampere-turns of the armature brings a magnetizing force to bear on the lug *g* in the direction indicated by the arrow. This tends to increase the magnetism through *h* and lessen it through *i*, but as *h* is normally saturated, there will be very little increase in its magnetism. There will, however, be a field established under the commutation lug, by the deflection of the lines from the bridge lug *i* through the commutation lug and armature, and it is evident that the stronger the current in the balancing coils the stronger will be the field under the commutation lug. We therefore again have the correct condition for sparkless commutation when the machine is loaded, provided our balancing coils are so proportioned as to give us a commutation field of proper strength. From this it will be seen that at all times the commutation field is proportional to the current, and that for all loads we have the requisite conditions for sparkless commutation without shifting the brushes.

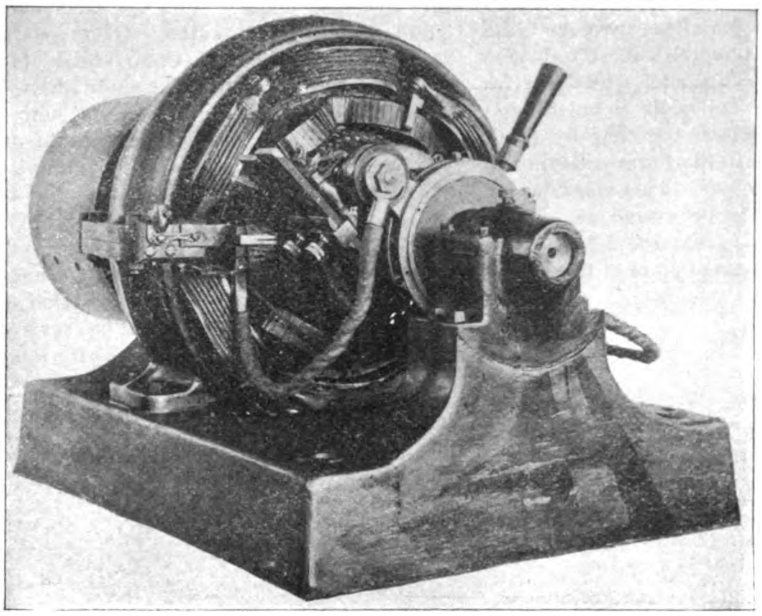


FIG. 4.

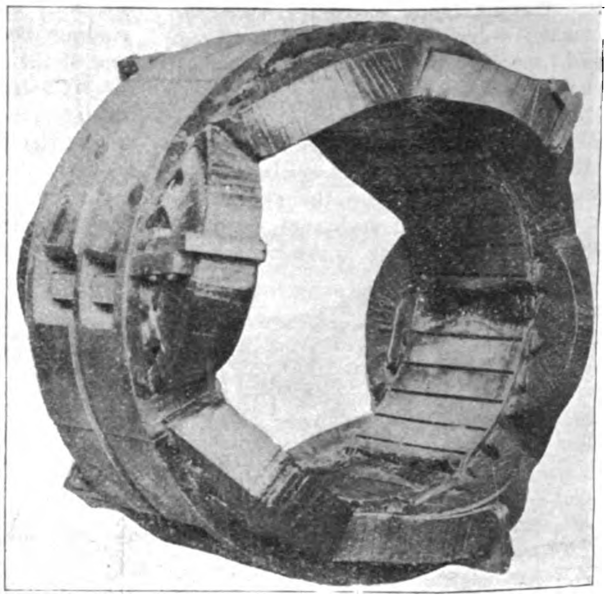


FIG. 6.

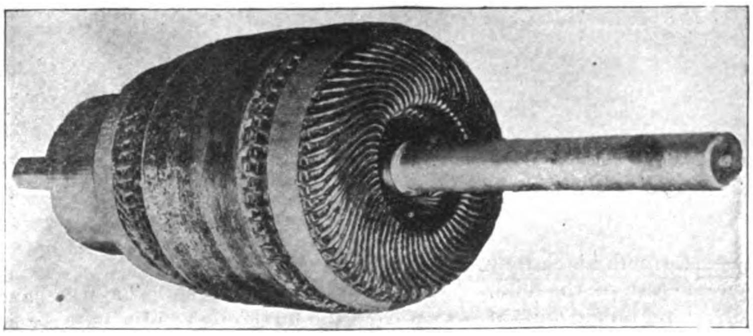


FIG. 5.

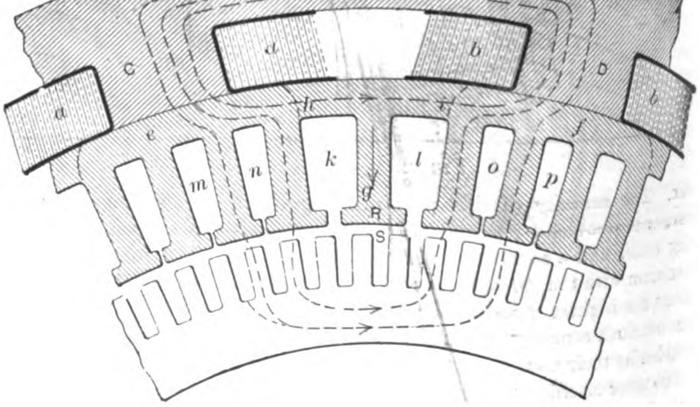
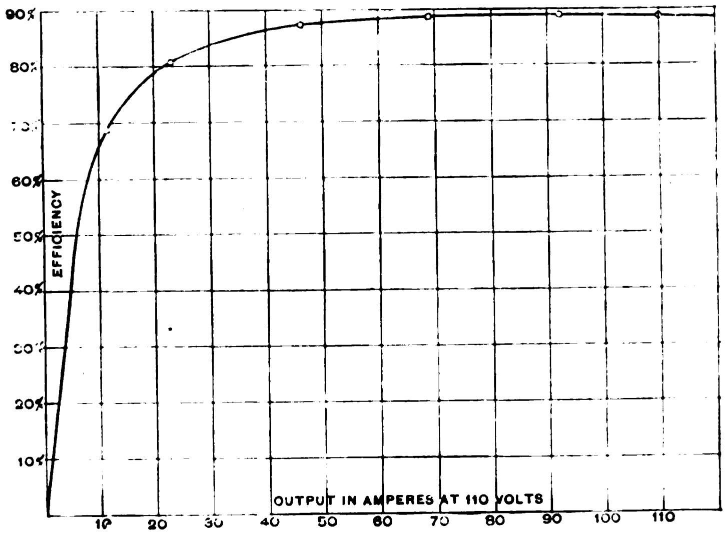


FIG. 7.

So much for the theory of this plan, and now comes the important question, "Will it work in practice?" We are able to answer without hesitation that such a machine performs as well in practice as in theory, and that actual tests show absolutely sparkless commutation from no load to 50 per cent. overload with fixed metallic brushes. More than this, practice confirms another theoretical advantage of this improvement which we have not yet touched upon. It will be noticed that the commutation field is obtained by the deflection of lines from bridge lug I and that the lines so deflected pass through the armature and consequently are added to the useful magnetic field. We might expect from this, and from the fact that since the brushes are midway between the poles there are no back ampere-turns, that the machines would compound somewhat without a regular compound winding. This theory was entirely sustained by actual trial. It was found under test that by slightly shifting the position of the brushes forward or backward it was possible to make a few of the armature turns act with or against the field winding at will, and this without any effect on the sparkless commutation, so long as the brushes were not moved beyond the limits of the commutation field. The result of this is that by simply shifting the brushes the compounding of the machine may be so changed that it can be adjusted at any point from 10 per cent. drop to 10 per cent. over compound, and this without interfering with the commutation in any way.

Thus by this simple contrivance we obtain sparkless commutation without shifting of brushes, and a compounding adjustable at will. It is not claimed that the broad idea of a commutation lug is new, but the success of such a contrivance depends altogether on the way in which it is applied. Unless the magnetic effects of the armature currents are taken care of properly, a commutation lug would prove worse than useless, and we would be likely to get an effect just the opposite of that desired. Thus it will be seen that the advantages which we have shown as resulting from the use of this system of commutation arise, not from the use of a commutation lug alone, but from its use in connection with coils for balancing armature reactions. Direct experiment has shown that this system of commutation will not give satisfactory results except when used in connection with balancing coils. Aside from the effect on commutation, however, balancing coils have some very important advantages to which we will briefly call attention. By their use the capacity of a machine of given size and weight may be greatly increased, and the resulting machine still be far better in quality and operate more satisfactorily than those of ordinary design. The reasons for drawing this conclusion are briefly these: Since the output of these machines is in no degree limited by armature reaction, it is possible to load the armature with as much copper as can be crowded onto it and to work this greatly increased amount of copper to its safe heating limit, the heating of the armature conductors being the only limit to the capacity of a given armature; and the core losses may be much less in a machine of this type since the magnetic densities in the core may be made as low as we choose, and this will permit the armature to be loaded with still more copper.



Efficiency Curve.

With the standard peripheral velocity of 3,000 feet it is easy to get an output of 20 to 30 watts per pound total weight of dynamo, and for large sizes of machines even still greater output per pound. With armature reaction balanced, there is no necessity for high reluctance in air-gap and teeth, and it is therefore made as low as possible for the whole magnetic circuit. The air-gap is reduced to what suffices for clearance, and the armature and field are worked at as low densities as is consistent with economy of iron. By this means from one-half to three-fourths, or even more, of the ampere-turns on the field may be saved with a corresponding saving in field copper and field energy. This and the reduced core losses reduce the fixed losses in the dynamo to a minimum, bringing them below what is possible with the ordinary construction, and the result is a very material change in the shape of the efficiency curve of the machine. Since the fixed losses are very small, the machines will have unusually high efficiency on light loads; the efficiency curves run up very sharply and bend off to a very uniform efficiency throughout the greater part of the range of load. This is a very decided advantage where machines are expected to work under considerable range of load, as they usually are both for lighting and power purposes. In designing machines it is also an easy matter to proportion materials according to their relative prices. Thus, with a design containing a given amount of copper we can increase the copper slightly and reduce the iron and steel, keeping the capacity of the machine the same, and thereby effect a saving in cost perhaps, or we may increase the iron and steel and reduce the copper to effect a similar saving. With ordinary designs such an adjustment as this would be out of the question, except at a sacrifice of valuable qualities of the machine, for the invariable rule is that the M. M. F. of the armature ampere-turns may never exceed the M. M. F. impressed by the field between the pole faces.

The value of sparkless commutation is almost beyond price. Commutation has long been recognized as the greatest bugbear of continuous current machinery. Whatever adds to the life of the commutator adds to the durability of the machine, and the entire prevention of sparking is therefore an important feature. To be able also to have the brushes permanently fixed is of decided value, and this when taken with sparkless commutation makes a dynamo self-attendant to a greater degree than usual. The extra cost of applying these improvements to a dynamo is far more than balanced by the saving effected in materials, and the writers believe that the application of these methods of design in dynamos would make a pronounced and important step towards the practical perfection of this class of machinery.

George C. Pyle, of Indianapolis, has invented an electric headlight for locomotives which he thinks will entirely eradicate the objections which have hitherto prevented the general adoption of electric headlights. His new engine for driving the dynamo is a compound steam turbine and capable of very high speed. It is exceedingly simple, compact and light, weighing only 200 lbs., and there is nothing to get out of order about it, nor is there anything to wear out except the bearings and they run in oil. The expansive force of the steam is used to its utmost limit. The dynamo and engine are cast together and the armature is mounted directly on the engine shaft, which runs at 2,000 revolutions per minute. The lamp used feeds the carbon in a novel manner, having no gears or clutches about it. A company will be organized at once to place the light on the market.

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND*—III.

Discussion.

Mr. Townsend Wolcott—I would like to ask Mr. Leonard if he can account for the difference in the efficiency of the Parsons and the Laval turbines. There seems to be, according to the figures given in the paper, a great deal of difference in favor of the Parsons. I was not aware that there was any such difference. In fact, I thought that if there was any difference the Laval was rather the better so far as coal consumption per horse-power was concerned.

Mr. Leonard—I do not think there is any difference, and if there is a difference I am inclined to think also that it is in favor of the Laval. The tests made by Profs. Kennedy and Ewing were upon larger sized units than the ones in case of the Laval. I fancy that it may be that the smaller size was influential.

Another point which may perhaps be a little confusing is this: that the consumption of steam quoted for the Laval steam turbine of twenty pounds of water per horse-power hour is per horse-power actually delivered, as you may say, in the generator armature. In other words, the friction of the bearing and the loss of the gearing is eliminated, and it is a horse-power actually delivered, available in producing electric energy—of course, the efficiency of the armature is one thing left to consider—whereas the figures I quoted for indicated horse-power are, of course, at the beginning before any of the friction is eliminated.

Mr. John W. Lieb, Jr.—The author of this interesting paper informs us in the first few lines that his observations were made during a trip through England and France. Later on we find that in making a comparison with central station practice in this country he has drawn his conclusions so as to cover in his comparison not only England and France, but the whole world, and in this generalization he has, I think, fallen into an error which should not pass unobserved. While there are no doubt many excellent central stations in England and France, it is generally admitted, I believe, that the best types of both the low-tension three-wire and the alternating current systems of distribution are not to be found in the countries visited by Mr. Leonard. The claims of preëminence for American stations of these types which the author has advanced can be shown to be not well founded if the comparison is extended, as it should be, so as to include other European countries where central station construction has been less hampered by local legislation. I would therefore call attention to several stations in European countries not visited by the author, which, had he found it possible to visit them, would have won his admiration and made his comparisons more just to European central station practice.

I would in the first place cite as types of the three-wire low tension central stations which the author did not visit the central stations at Berlin. The Berlin stations have a combined output inferior only to two or three stations in America. They supply with current a connected installation equivalent to about 95,000 amperes. The equipment of these stations—boilers, steam piping, engines, dynamos and electrical apparatus—would certainly not suffer by comparison with any of our best equipped and most recently constructed American stations. I am not in a position to quote any figures as to the economy of operation of the Berlin stations, having seen only one figure given as to the economy of generating. It is claimed that on the average throughout the year 220 watts are delivered to the customers' premises per pound of coal, which is certainly an excellent economic performance. Although Mr. Leonard did not visit either the Dusseldorf or Hanover stations, both of these should have been included in such a comparison as he has made. In the case of the Hanover station, it is claimed that on an average during 1893, 220 watts were generated and 180 watts delivered to the customer per pound of coal; Dusseldorf during the same period averaging 140 watts delivered per pound of coal. Neither of these stations would suffer by comparison with our best types of American low tension stations. From the table compiled by the National Electric Light Association, including a number of

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* H. Ward Leonard's paper read at a meeting of the A. I. E. E, February 27.

American stations, it appears that the best 24 hours' record covered by the table gave 208 watts generated per pound of coal.

Coming to the alternate current stations which are included in the comparison, the author refers to conversion from 1,000 to 50 volts. As a matter of fact there are very few stations in England, France, or in Europe generally, transforming from 1,000 to 50 volts; the European standard for alternate current stations being 2.000 to 2.400 volts primary, transforming down to 100 to 110 volts secondary. Mr. Leonard has not included in his comparison with American statistics the Vienna alternate current station, which would certainly not suffer by comparison with any station in the world. I must admit a limited familiarity with the alternate current stations in this country, owing to the fact that I have been abroad a number of years, but I think I am safe in saying that there is not an alternate current station in this country which in excellence of equipment, perfection of distribution, regularity of service, or economy in operation, is the equal of the Vienna station of the Internationale Electricitats Gesellschaft. Among the other European stations which ought certainly to be included in such comparisons as these, I would mention the alternate stations at Cologne and Rome. Both of these stations are excellent examples of alternating current station construction and contain characteristic types of modern equipment.

Passing along the paper I notice that the author calls attention to the system of charge to the consumer for current used by Mr. Wright at Brighton. I would say at this time that this system of charging on the basis of what the author happily calls the "load factor of the consumer" was first developed by Prof. G. Colombo, of Milan, Italy, the general manager of the Italian Edison Company, and it is still the basis of charge for current delivered from the Milan Edison stations. This system was first adopted in 1887 or 1888, and has been in use ever since with entire satisfaction to the consumer. I do not know that a definite claim for precedence in the application of sliding scale of charge has been put forward, but I take this opportunity to mention it. According to the system of charging for current in use at Milan the consumer is at liberty to choose between two systems of payment, either on the basis, first, of a fixed charge of a certain sum, 30 francs ($5.75) per lamp installed per year, plus a charge of 3½ centimes (.67c.) per lamp hour as registered by the meter, or, second, a charge per lamp hour as registered by the meter on a sliding scale at a rate varying from a maximum of 7.7 centimes (1.5c.) per lamp hour to a minimum rate of 4.8 centimes (.96c.), depending upon the number of lamp hours used per month per lamp equivalent installed. This system covers fully and satisfactorily the question of a consumer's load factor, and gives the best consumer—that is, theone giving the company the greatest return per lamp installed—the benefit of the best basic rate.

Another interesting point referred to by the author of the paper is the question of the station load factor. In Mr. Crompton's inaugural address before the Institution of Electrical Engineers in London he presented a curve showing the load on all of the London stations combined on the day of greatest output of last year, December 19. The load factor on this day was shown to be 33 per cent. It may interest the members of the Institute to know that the load factor of the combined stations of the Edison Electric Illuminating Company of New York on the day of last year when the output was greatest (December 10) was 34½ per cent. The load factor of the lower district supplied by the company, in which is included a large motor load, is somewhat less than 34 per cent.; the load factor of the upper district, which has only a small motor load, being slightly greater. The total K.W. hours of output of the combined London stations on the date referred to was 96.240. The combined output of the Edison stations in New York City on December 10 was 60,633 K. W. hours. The maximum load carried at any one time was in the case of the combined London stations 11.600 K. W.; combined Edison stations in New York 7,354 K. W. The connected installation in the case of the combined Edison stations in New York was: incandescent lamps, 234.494; arc lamps 3.014; motors, 7.616 H. P.; or a total equivalent installed of 178.000 amperes. It may seem strange that the load factor of such a district as the lower district of New York City, in which the motor capacity connected (in K. W. equivalents) represents 42 per cent. of the total connected installation, is not greater than in the case of the upper district, where the motor load represents only 16 per cent. of the installation. It should be remembered, however, that the lower district is eminently a business and industrial locality, and that after 6 o'clock the load curve drops off very rapidly to a minimum, while in the upper district we have a business and residential locality where the day load is light, but the evening load keeps up well and falls off gradually.

The President—In a paper so varied as this, and covering so many different fields experts in which are present, unless a desire is expressed to the contrary, I shall limit the speakers to ten minutes.

Dr. Chas. E. Emery—The author of the paper has in a racy and attractive way brought to the attention of those present matters in which he has been interested and instructed abroad. For this pleasant duty, well performed, I am personally much obliged to Mr. Leonard.

Taking up my marginal notes in order, the paper on page 134 states that the Parsons steam turbine delivers one kilowatt for 28 pounds of feed water, and continues: "This is equivalent to about 15.7 pounds of water per indicated horse-power per hour." The difference is so great it would seem that these figures need revision.*

I have been interested in considering the possibilities of the Parsons and the Laval steam turbines. The high speed should permit the use of a small and comparatively cheap dynamo, and eventually the engines should not be as expensive as ordinary engines. Moreover, the very small space required is of importance in a large city. I have wondered why the turbines have not been introduced here. I made a special examination of the Laval steam turbine at the Columbian Exposition, and though I had a special invitation and wore a judge's badge I could not get the operator to put a load of more than three or four kilowatts on an engine rated at 15 H. P., the excuse being that there was water in the steam. The reported tests of this turbine are very satisfactory, but it is a question if it has yet been put in commercial form.

As to the question of the load factor, I think the critical point has not been referred to in the paper. It is a question more of the distribution of the load through the day than of the inequalities of local demands. It is considered unfortunate to take an elevator as an illustration, for, although it may take 15 to 20 kilowatts at times, and be shut off entirely for considerable intervals, the demand is distributed throughout the day and into apartment houses far into the night, and as it is very rare that the heavy pull required by each of a large number of elevators will come at the same moment, by the well understood law of averages, such elevators make a fairly uniform load. It is very much like the average in railroad work. When a few cars are running the fluctuations are very great, but as the number is increased the load, though still fluctuating, gives a large load factor during the time of operation. It seems to me that the use of elevators and of electric current for various household uses should be encouraged, because such uses are distributed through a large number of hours per day. The real cause of the low load factor is that so many consumers want light at the same time. The evident cure, if practicable, would be to charge a higher price during the rush hours. The method which would best appeal to consumers would be to reduce the price for current used during other than rush hours. The Wright plan mentioned in the paper (p. 140), with a proper scale of prices, would possibly accomplish these purposes, but the results would probably be better understood by consumers if expressed somewhat as above.

The description of the Heilmann electric locomotive and its operation is certainly very interesting and involves some important considerations. It is fair to say that I had not thought of this system respectfully until I read the paper. It did seem to be impossible, when there are steam engines and a steam boiler already on a locomotive, to install an electric plant in addition to a steam plant on a special car, and in that roundabout way make a locomotive which would in any respect be more efficient than the direct use of steam applied to driving wheels in the first place. A few facts and some very simple calculations show that the idea is not as ridiculous as it seems. It would be unreasonable to dispute the statement that the cost of power from an ordinary locomotive is double that of stationary engines of the best type. There are two reasons for this: one, the necessity of obtaining such an enormous power from a locomotive boiler which with the customary construction must be put in a certain place under limited conditions, the effect of all of which is to bring the evaporation down to 5 or at most 7 pounds instead of 8 or 9. The other is the difficulty of obtaining economy with the simple arrangement of valve gear which has been adopted and with such variable piston speeds as are necessary. If, therefore, the steam plant of the Heilmann locomotive can be operated for one-half the fuel or anywhere near that, this saving, not considering interest charges, will more than compensate for the losses incident to the generation and utilization of electric current, even if the 50 per cent. extra weight of the Heilmann locomotive be considered as to that extent reducing the weight of the train The question immediately arises, however, why not adapt the distinguishing features of the Heilmann steam plant to a steam locomotive? It is perfectly possible to mount a boiler of larger size on a platform and to make locomotive steam cylinders which will operate as economically as those of an engine mounted on a platform itself, even if we have to increase the size of the drivers to bring down the number of revolutions of the engine. Were this done, the locomotive would be as economical as the steam plant of the Heilmann locomotive and the intervening electric machinery would produce loss instead of gain. That is, when the progress that has been made in the construction of the Heilmann locomotive is analyzed along more general engineering lines, the improvement suggested is one in locomotives, and not specially in electric locomotives. Curiously enough the general features of the system have been already worked out for ordinary locomotives, but were so far ahead of the times that they have not been generally adopted. What was called the Farlie locomotive, built some years ago, had two boilers mounted on a platform supported on two trucks containing only driving wheels. The steam was introduced to the cylinders through ball and socket joints. The system operated well, all the weight was on the drivers, and I think some of the original engines are still at work in one of the South American States. The Mason Locomotive Works took up the system later, using a single boiler, and with one propelling truck containing drivers at one end and an ordinary truck at the other. This arrangement enabled short curves to run on suburban routes, but Mr. Forney, now present with us, showed that this could be done with a locomotive of the ordinary type, carrying its own tender on the frame, but supported by a truck, as evidenced in the locomotives on the elevated railroads, and the Mason system has not been extended. The success of the Heilmann system will then only show the desirability of reviving the Farlie system, perhaps using only a single boiler of large size.

At present, as Mr. Leonard suggests, it is well to encourage the development of the Heilmann system as a means of ascertaining the desirable details of a practical electrical locomotive, even if the steam machinery afterward be taken off and the current supplied by some modification of the trolley system.

Mr. Herbert Lloyd—The conclusions Mr. Leonard comes to, resulting from his inspection of a single battery plant in Paris, are, I think, a little unjust to accumulators.. His figure of $107 per kilowatt for three hours' discharge about conforms to the American practice, but the statement that a battery worked at this rate will not have an efficiency of over 60 per cent. is, I think, erroneous. All the large batteries installed in this country have been guaranteed at a much higher figure than 60; 75 is more common. In comparing the relative first cost of battery plant and direct power plant, Mr. Leonard gives a first cost for a direct plant of $50 per kilowatt of output as against $107 for a storage plant of the same output. I will quote the remarks of Mr. Edgar, of Boston, at the Cleveland Convention last week. Mr. Edgar says:

"A first-class steam plant costs $100 a horse-power; everything inside of the building. That is being done to-day. The battery costs us a little over $50 a horse-power to do the maximum work."

One hundred dollars a horse-power for direct plant means of course $133 per kilowatt, as against $107 for battery, taking Mr. Leonard's figures. I have had occasion within the past thirty days to get an estimate on a direct electric power plant, and the figure of $100 per horse-power is the result of my efforts.

Were the comparison made by Mr. Leonard

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* This may be explained by using rather low efficiencies. Twenty-eight pounds per kilowatt equals 20.89 pounds per E. H. P., of which 15.7 is practically .75, which is the joint efficiency of the engine and dynamo and corresponds approximately to 88 per cent. for the engine and 90 per cent. for the dynamo, or vice versa.

between the first cost of the two systems correct, his later remarks as to the profitable application of a battery with a 40 per cent. load factor would have some weight, but with batteries costing less per kilowatt of output than a direct plant, that contention falls.

Next, as to the idea of installing small batteries in customers' houses, that is going back to the earliest methods adopted in exploiting storage batteries in this country. In Haverford, Pennsylvania, this was tried eight or nine years ago on a large scale, but the idea of dividing a battery up into a lot of little installations, distributed broadcast, is vastly less practical than the installing of one large plant in the central station, and if it would pay the customer to install a small battery, it would certainly pay the lighting company to install a large one, as the first cost would be proportionally less, and the care and cost of maintenance infinitely smaller.

Mr. Leonard's remark that "the consumers' maximum load will sometimes occur at the time of maximum load in the central station, and when this accumulated load is put upon the central station the kilowatts must be there to meet the demand," is one of the best arguments I have ever heard in favor of accumulators.

Mr. A. E. Kennelly—I think we are much indebted to Mr. Leonard for his interesting paper. A subject of this kind is always interesting, because, while proverbially comparisons are sometimes odious, practically they are also sometimes very pleasant, and by seeing what our neighbors are doing we can often gain some advantage for ourselves.

There are three points in this paper I would like to mention. The first is that mentioned on page 130, namely that this country has suffered by having the electrical industry in the control of large corporations, and then on page 132 Mr. Leonard goes on to state that dynamos and engines are better here than they are anywhere. I suppose Mr. Leonard would not say that lamps are worse here than they are anywhere else, or that motors are worse here than they are anywhere else. So that we are forced to the conclusion that the superiority abroad must lie in the system of distribution, because there is nothing left but the systems to account for it. I can scarcely imagine that it can be maintained that in the commercial application of distribution there is a superiority in European countries, because I think you have only to take up a map of England's electrical distribution systems, for example, to see that the question of systems is a very rife one, and that there is no apparent uniformity of opinion as to which system is the best to employ, even under any given conditions. Thus it is stated by Mr. Leonard that under the most unfavorable conditions he can possibly imagine an alternating system has been put in in the middle of the City of London. He also mentions that dynamos cost much less here than abroad, and this in a country of corporate interference. Is that not an argument in favor of the fact that under the influence of aggregated capital processes of manufacture may have been so perfected as to greatly reduce the cost of construction, and while no doubt the effect of large corporations is to limit and interfere in some directions with electrical applications, yet in this compensatory world the diminished price of electrical apparatus is an evidence of one beneficent effect of large corporations.

The second point is on page 139, where allusion is made to the cost of this storage battery as being capable of supplying 8,000 10 C. P. lamps for three hours, and costing about $30,000, meaning $107 per K. W. That is evidently based on an estimate of an inefficiency in the lamps of 3½ watts per candle. I would like to ask whether that 8,000 lamps is not the true estimate, and that 4½ and even 5 watts per candle would not be a much more fair basis to take, in which the cost would come to $75 or $83 per kilowatt.

The third point I want to draw attention to is one that Dr Emery has already mentioned, and I think that it deserves all the insistence that can be brought upon it, namely that on pages 141 and 142, of this load factor. When you sell light to customers they all practically enter into a conspiracy to throw the light on at the same time, just about dinner time, and you must have power in the station to supply it, but when you sell power to run intermittent 10 horse power motors, even though they each take 30 horse power at starting, by no possibility can the customers enter into any conspiracy to all start together, and all the figures based on such a conclusion with regard to electric elevator motors are greatly exaggerated in consequence, and the rates which should be charged for a kilowatt-hour based on elevator work are correspondingly exaggerated. As a matter of fact, I think it is well known that elevator load is objected to more on the score of the difficulty of maintaining regularity of pressure in the mains than it is on account of the small load factor.

Mr. Wm. Maver, Jr.—I should like to say that there is at least one electric light station in this country that transforms from 2,000 volts to 100 and to 50 volts, the converters being adjusted to either 100 or to 50 volts on the secondary. That is, I believe, the Manhattan Electric Light Company of this city. The change was made from 1,000 volts transforming to 50 in the secondaries over a year ago. Of course, however, they employ the two-wire system in the secondary. I should like to ask Mr. Leonard how the switching of the secondary circuit from the converter to the regular three-wire system in Brighton is performed. Others may be interested also in that. Also on page 134, whether the vulcanized rubber cables referred to are lead covered, or if not, in what way they are covered, if he knows; and also the manner in which the air is chemically dried before it is led into the ducts.

(*To be continued.*)

American Institute of Electrical Engineers.

At the regular meeting of Council, held March 20, the following associate members were elected:

Thomas D. Boyles, W. J. Davis, Jr., Chas. T. Mosman, Schenectady, N. Y.; John D. E. Duncan, Pittsfield, Mass.; William Esty, Urbana, Ill.; Joseph W. Frost, Rollen N. Larrabee, Mariano L. Mora, Alex. Stratton, New York City; W. L. Garrels, St. Louis, Mo.; Lucien H. Gilmore, Stanford University, Palo Alto, Cal.; James E. Grist, Price I. Patton, Chas. H. Stanton, Philadelphia, Pa.; Wm. J. Hiss, Jr., Bethlehem, Pa.; Henry C. Jones, Montgomery, Ala.; P. R. Middlemiss, Tulane University, New Orleans: Ralph D. Mershon, Pittsburg, Pa.; M. J. O'Sullivan, Baltimore, Md.; Thos. A.W. Shock, Sacramento, Cal.

The following associate members were transferred to membership:

William Henry Powell, Manchester, Conn.; Alonzo S Kimball, Worcester, Mass.; Edgar Woods Mix, Thomson-Houston International Electric Company, Paris, France.

The Council has canvassed the nominating papers received from the membership and prepared the following ticket:

For President—Dr. Louis Duncan, of Baltimore.

For Vice-Presidents—Dr. M. I. Pupin, of New York City; W. F. C. Hasson, of San Francisco, Cal.; Angus S. Hibbard, of Chicago.

For Managers—Carl Hering, of Philadelphia; Bion J. Arnold, of Chicago; Charles F. Scott, of Pittsburg; Dr. Cary T. Hutchinson, of New York City.

For Treasurer—George M. Phelps, of New York City.

Three vice-presidents and managers hold over by the rules as follows: Vice-presidents—Prof. W. A. Anthony, Prof. Francis R. Crocker and James Hamblet, of New York. Managers—Prof. Harris J. Ryan, of Ithaca, N. Y.; Chas. Hewitt, of Philadelphia; J. J. Carty and W. J. Hammer, of New York; A. E. Kennelly, of Philadelphia, and W. D. Weaver, Chas. S. Brailey and W. B. Vansize, of New York.

At the meeting of the Institute in the evening eighty members and guests were present.

Attix Tube and Wire.

At a meeting of the New York Board of Fire Underwriters held on the 20th inst., on the recommendation of the Committee on Electricity, the following resolution was adopted:

"*Resolved*, That the Superintendent be authorized, until further notice, to approve the use of the Attix tube and wire, when equal in quality and insulation to the samples submitted to this Board and tested, under the same conditions where tubing would be permitted; provided that there is no splicing or tapping of the wire, but that its introduction shall be in all cases by the loop system; that in new buildings when necessary to carry it between floor and plastering it shall be through holes bored in the beams, not less than two inches apart, a single conductor in each hole, out of the reach of nails; and in old buildings where necessary to carry it within the reach of nails it shall be protected by some device from perforation; and provided further that the wire and tube be carried intact into the cut-out boxes, and that in no case shall the outer covering be removed before introducing the core wire into the cut-out box."

Cape Town, South Africa, is to have a municipal electric street railway to cost $500,000.

The Buffalo-Niagara Transmission Scheme.

The New York *Tribune* is one of the very few daily papers in the country that seem to be able to grasp the situation and at the same time dare to express their opinion. In this respect at least i is ahead of all of the electrical papers in that they grasp the situation but don't dare to enlighten the public.

When we see the Baxter street sheet, the *Electrical World*, defending the propositions submitted to the city of Buffalo by the Niagara Power Company we wonder what advertising patronage it is laying for. Since there can be no advertising whichever position it takes, perhaps our contemporary has been subsidized. At any rate the editor of the *Electrical World* has gained the reputation of *thinking* that he knows on which side his bread is buttered. The *Tribune* for March 18, in speaking on the subject of the Niagara transmission, says:

> There would be four kinds of losses: (1) In transforming at the power house up to a high voltage, (2) on the line, (3) in transforming down at Buffalo, and (4) in distribution over street lines to consumers. These could not well amount to less than 20 or 30 per cent. altogether, and they might, perhaps, reach 50 or 60 per cent. But if, for example, they amounted to just one-half, the $18 rate at the generator shaft would mean $36 to the consumer, without adding anything either for interest on the cost of the transmission plant or for operating expenses. This, however, is probably an extravagant estimate. The prices actually given, by the way, are for a twenty-four-hour daily supply. Some establishments require power, however, for only ten or eleven hours. Whether it would pay to put in storage batteries to utilize the surplus is a question which their managers must naturally consider. Richard Hammond writes to the Buffalo *Courier* to say that steam power, on a scale of 1,000 horse-power for ten hours daily, can be generated in Buffalo, where coal is very cheap, for $21 per horse-power. The Power Company, however, denies this, and estimates the cost at $32, besides quoting various experts as estimating the cost on a twenty-four hour basis at between $45 and $60. In some other cities, where coal is more expensive, it is said to be from $60 to $75.
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> If, after this discussion, Buffalo decides neither to buy on the terms offered nor to let the Power Company bring in its own lines and supply the market, more distant cities may possibly be deterred by her example from patronizing the Niagara concern.

General News.

What is Going on in the Electrical World.

Loveland, Col.—The council has granted an electric light franchise to J. S. Alexander.

Aitkin, Minn.—This village at the recent election voted to bond itself for an electric light plant.

St. Louis.—The bill authorizing the Jefferson Avenue Railroad Company to change its motive power to electricity has passed the city council.

Belleville, Mich.—An electric railway from Ann Arbor to Trenton via Ypsilanti and this place is being talked off at Ann Arbor and Ypsilanti.

La Crosse, Wis.—J. B. Caterbury has organized a company to build a street railway line in this city. Horses will be used at first but electricity later.

Middletown, Conn.—It is reported that the Schuyler factory in this city, which has been closed over a year, will shortly be opened by its original sponsors.

Des Moines, Iowa.—The executive council has been considering the question of lighting the State House with electricity, and will probably advertise for bids.

Marion, Ind.—Judge Woods has made an order confirming the sale of the Queen City Electric Railway to Warren T. McWhinney and Charles W. Halderman.

Doyleston, Pa.—Frank Worthington and others are making efforts to secure the $50,000 needed for building an electric road between Doylestown and Willow Grove.

Versailles, Ky.—The council passed an ordinance on the 15th inst. providing for the purchase and erection of an electric light plant to be owned and operated by the city.

Elgin, Ill.—The Carpentersville, Elgin and Aurora Railway Company has applied for a license to incorporate, the incorporators being directors of the Elgin City Railroad Company.

Peabody, Mass.—The special committee on enlarging the electric light plant have made a report, recommending extensive changes, alterations and additions at a cost of $16,000.

Taylor, Tex.—The plant of the Taylor Electric Light Company is to be sold at public sale on the second Tuesday in April to satisfy a judgment in favor of the Taylor National Bank.

Wallingford, Conn.—The borough of Wallingford has decided to apply to the General Assembly for an amendment to its charter which will permit it to start an electric light plant.

Ludington, Mich.—The late contractor having declined the council's offer of $65 for an all-night arc light service, there is a plan on foot to have the city put in its own electric light plant.

Bucyrus, O.—A company, backed by Eastern capitalists, has accepted the franchise granted by the county commissioners for an electric railway to Galion and will begin the work in a few days.

Stowe, Vt.—At a town meeting held here recently a resolution was passed granting $40,000 in 4 per cent. bonds towards building the proposed electric road between Stowe and Waterbury.

Laurel, Md.—The plant of the Laurel Electric Light, Power and Heat Company has been purchased by Messrs. Joseph Friedenwald and Miller, of Baltimore, the heaviest creditors, for $7,000.

Nyack, N. Y.—The board of trustees has granted a franchise for a trolley road in this town to the Nyack Traction Company, the only stipulation being that work must begin by the 1st of July.

Seattle, Wash.—The Union Electric Company has absorbed the old Seattle Gas and Electric Light Company, and the new concern will, it is said, be known as the Union Illuminating Company of Seattle.

Boston, Mass.—The Globe Electric Light Company has made arrangements to purchase the building formerly occupied by the Boston Clock Company, on the corner of Clifton and Shirley streets, Roxbury.

Kansas City, Mo.—Arrangements have been made to equip with electricity the line of the Kansas City and Independence Rapid Transit Railway Company between this city, Washington Park and Independence.

Ogdensburg, N. Y.—The Ogdensburg Electric Trolley Company has purchased a mill property in the suburbs for a site for a power-house. Included in the purchase is a water power capable of developing 350 H. P.

Trenton, N. J.—A bill has been introduced in the Senate making it a misdemeanor, punishable by a fine of $500 or six months' imprisonment, to tap the wires of electric light or power companies or cheat the companies' meters.

Elwood, Ind.—An electric railway is to be built this spring from Elwood to Anderson via Frankton. Another line will be built the coming summer from here to Independence, connecting with the line from there to Marion.

Benton Harbor, Mich.—Peter English, who established the Benton Harbor waterworks has applied for an electric lighting and power franchise for this city, the power to be furnished by damming the Paw Paw river one mile above town.

Omaha, Neb.—The proposition to construct an electric road from this city to Fremont is received with favor by the property owners along the line. Col. J. H. Pratt and Frank Hibbard, of Irvington, are the chief promoters of the project.

Washington, D. C.—It has been decided to open stock books at once for the proposed Washington and Marlboro' electric railroad. W. A. Melay is president of the company, C. E. Coffin, R. V. Hall, J. T. Perkins and J. V. Belt are directors.

Ottawa, Ill.—The city council has notified the General Electric Company, owner of the Ottawa Electric Railway, that unless it operate all of its lines in this city on or before April 1 its franchise granted in 1889 will be forfeited at the first meeting in April.

Bloomington, Ill.—The power-house of the Bloomington Electric Light and Power Company was totally destroyed by fire on the night of the 18th. The loss is $50,000; insurance about one half. The building had just been equipped with new electric and engine plants.

Chattanooga, Tenn.—An equitable distribution of costs and liabilities has been agreed upon by the three classes of bondholders of the Union Railway and there is nothing now to prevent the sale of the road. All debts for running expenses and all damage suits will be shouldered by the Chattanooga Union Railway Company.

Norwich, Conn.—At a city meeting held here recently a resolution was adopted calling for an amendment of the city charter so as to enable the city to establish and maintain plants for the manufacture and distribution of gas or electricity, or both, for municipal use or for both municipal use and the use of the inhabitants of the city.

Baraboo, Wis.—There is every probability of a franchise being granted for the electric road between Kilbourn City and Devil's Lake. The ordinance has received its first reading. The promoters are Henry L. Desanges, Hoboken, N. J.; D. Harvey, Jr., Newark, N. J.; E. N. Marsh, J. B. Donovan and Dr. G. S. Cramer, Baraboo.

New York.—The strike of the electrical workers has ended. Through the mediation of Bishop Potter and others an amicable agreement was arrived at, the point conceded by the Contractors' Association to the men being an eight hours' workday from the 1st of May instead of the 15th of the same month as specified in the contractors' ultimatum.

Orange, N. J.—The South Orange township committee has granted, after several months' discussion, a franchise for a trolley road on Springfield avenue to the New York and Philadelphia Traction Company, thus virtually completing the last connecting link of the surveyed route for a trolley road between New York and Philadelphia.

Brooklyn, N. Y.—The Long Island Traction Company, lessee of the Brooklyn Heights Trolley Company, has passed into the hands of a receiver. Horace J. Morse, of the firm of A. M. Kidder & Co., bankers, New York, has been appointed receiver by the United States Circuit Court of Virginia, in which State the Traction Company was organized.

Brockton, Mass.—The Economic Electric Light Company, which formerly manufactured incandescent electric lamps in this city, and which was driven out of business by prosecutions for infringements of patents, is likely to resume business again, the recent decision of the courts having established the fact that their business is not an infringement.

Greensboro, N. C.—Bids will be received at the office of A. M. Scales, city clerk, until the 26th of April, for the lighting of the city of Greensboro with elctric lights of 1,200 C. P. each. The bids will be on the basis of a contract for three, five and ten years, and for fifty-eight lights, stating also price of each additional light. The board of aldermen reserves the right to reject any and all bids.

Ellicott City, Md.—A mortgage deed of trust from the Edmondson Avenue, Catonsville and Ellicott City Electric Railway Company to the Maryland Trust Company for $500,000 has been placed on record in this city. Bonds of $1,000 each are to be issued and the proceeds will be applied to the building and equipment of the railway company's road, which is to be thirteen miles in length.

Shamokin, Pa.—The Enterprise Coal Company is now fitting up its mine with an entire electric plant, and will after May 1 haul its coal along the gangways and illuminate the mine with electric power. This improvement, when completed, will do away with about thirty head of mules now used in the slope, and will increase the capacity of the colliery fully 50 per cent.

Milwaukee, Wis.—The board of public works considered the bids for putting in an electric light plant at the new city hall too high and will readvertise. The bids received were: Western Electric Company, $33,000, $36,718 and $40,550; General Electric Company, $39,687, $45,080 and $38,262; E. G. Bruckman, $39,856. Four thousand eight hundred and forty-one electric lights are to be lighted by the plant.

Halifax, N. S.—A bill to incorporate a new electric tramway company for this city is in the hands of a committee of the Nova Scotia Legislature. The new company is to be known as the City Electric Transit Company, and among those interested are John Quincy Adams Wentworth, of Boston; Robert C. Geer, of New York; Ephraim Hopkins, of West Chester, Pa.; James M. Pendleton and Charles Perry, of Westerly, R. I.

Lancaster, Pa.—Recently petitions were presented to court asking for the dissolution of the charters of several electric railway companies, the Lancaster and Lititz, Lancaster and Manheim, Lancaster and Strasburg and Lancaster and Middletown and Conestoga Valley. The reason given for asking for dissolution was that other companies had either built lines or it was not deemed advisable to build. The court issued a decree dissolving the charters.

Shelburne Falls, Mass.—The syndicate which recently bought the water power near Hoosac tunnel is rapidly pushing plans for the installation of a gigantic electric power station. If the petition for a charter now before the Legislature is acted upon favorably, as it is confidently expected it will be, the transmission of electric power and light to North Adams and the villages in the Deerfield Valley will be an accomplished fact before the end of 1895. There is about 1,000 horse-power immediately available.

Patchogue, N. Y.—The Port Jefferson and Patchogue Traction Company proposes to build, equip and operate a single track road from the dock at Port Jefferson through the main part of the village to Port Jefferson depot, then through Selden, crossing the Long Island Railroad west of Medford; then passing through Patchogue, reaching the great South Bay by way of Ocean avenue. The capital stock is $150,000. F. M. Wilson, O. T. Fanning and M. L. Chambers have been authorized to solicit subscriptions to the stock.

Harrisburg, Pa.—A bill introduced in the House permitting street railways to carry freight is warmly opposed by the friends of the steam lines, but the country members are red hot for it and it will probably pass.—Among the bills reported to the House from committee was the Senate bill authorizing traction or motor companies to enter into contract with each other to sell, lease and operate their respective franchises; also the Gould bill providing for the issuing of bonds equal to the amount of their capital by traction companies.

Toledo, O.—A new electric railway project has just been announced here. The proposed line is to run from Toledo to Sylvania, thence westward through the northern part of Fulton and Williams County, making it one of the longest of its kind in the United States. Instead of using the public highway it has secured over 45 miles of right of way upon private property. This is sufficient to take the road as far as Fayette, and such towns as Metamora, Lyons and Sylvania will be touched. George W. Acker, of Toledo, is at the head of the enterprise.

Chicago.—Two important mortgages have been placed on record here recently, both running to the Illinois Trust and Savings Bank, and aggregating $3,000,000. Of these two instruments one by the Chicago Electric Transit Company is for $2,000,000, for twenty years at 6 per cent., the other is by the Chicago Electric Railway Company for $1,000,000, for twenty years at 6 per cent. Both mortgages are given to secure a like issue of bonds, to be issued as required. They cover all the property and franchises of the grantor companies and are for equipment of electric lines and extensions of the North and West Chicago street car companies.

Philadelphia.—Proposals will be received at the County Prison until the 29th inst. at noon for incandescent and arc electric light plants, boilers, telephones, electric bells, burglar alarms, etc., for the new county prison in the 35th Ward of this city. Plans and specifications can be seen and all information obtained at the office of Wilson Bros & Co., engineers and architects, Drexel Building, Philadelphia.—The Electric Traction Company has completed the laying of six cables under the Schuylkill River at the South street bridge. They will carry power to lines of the Lombard and South streets division in West Philadelphia.

Baltimore, Md.—The Baltimore Traction Company is arranging for the introduction of palace cars for "trolley" parties during the summer, and are now corresponding with the builders for their construction. It is likely these cars will be run to the Arlington and Gwynn Oak sections, and will be leased to parties for the evening. Arrangements will also be made to serve luncheon on board the cars and music will also be furnished.—The contract for the cable and apparatus for the underground police telegraph and fire alarm systems has been awarded to the Western Electric Company of Chicago and New York. The contract price is $36,779.85.

Norwalk, Conn.—The Consolidated Railroad Company is said to be formulating plans to purchase several trolley railroads along its lines in Connecticut, including the Bridgeport Traction, the Norwalk Tramway, the Westport and Saugatuck Horse Railroad Company, the Westport and Southport Tramway Company, and such other street railroads along its lines the control of which will best serve Consolidated interests. The Consolidated, it is said, has become convinced that the extension of electric roads under old charters and under new ones, for which so many petitions have been presented to the Legislature, will parallel its lines to such an extent as to affect its income from short-distance traffic.

Springfield, O.—A. S. Krotz, electrician and chief engineer of the Springfield Electric Railway, has invented a gun with which he hopes to revolutionize modern armaments. The weapon he is experimenting with is a brass tube 5 feet long and 2½ inches diameter, with a smooth half-inch bore. The barrel is fixed to a wooden stock and an electrical current is applied directly to the projectile. There is no cartridge, powder, dynamite, smoke or noise. The advantages of the gun are that it may be made very light weight, that it cannot explode, that it is economic in expense of operation and that the limit of the number of balls it will throw within a given time is the number of balls that can be got within its breach consecutively in a given time.

Noblesville, Ind.—Experiments in carbon manufacture at the American Carbon Works here are said to promise a revolution in the manufacture of carbons for use in electric lighting. The process employed is a discovery of electricians connected with the Marks Electric Company of New York, who say that after five years' hard study they have virtually completed an invention for the prolongation of the life of a carbon. They do not hope to do this by changing the material from which the common copper-tipped carbon is made, but by bringing another and an entirely new method into use. Instead of the tips meeting and producing light on the streets in the open air, surrounded by a globe, open at both the top and bottom, the scheme now on foot is to have a perfectly air tight chamber, from which the light is emitted. This, the inventors claim, will enable carbons that now burn from eight to ten hours to last from seventy to ninety hours.

Telephone and Telegraph.

The Bell Telephone Company has nearly completed the installation of a telephone system in Tallahassee, Fla., and expects to be ready for business by the first week of April.

The dummy telephone has been of practical service in many country towns in ridding telephone subscribers of dead-beats.

The board of supervisors of Clay County, Ill., have granted the right to the Clay County Telephone Company, whose headquarters are at Clay City, to erect and operate a telephone system.

The Baldwin Bros. Co., bankers and brokers, of Boston, has purchased all the property of the New England Printing Telegraph Company.

The Middleburg and Oak Hill Telephone Company has been formed for the purpose of operating a line of telephones from Middleburg to Franklinton, to Livingstonville, to Hawverville, to Preston Hollow, to Oak Hill, to Durham, these places being in the counties of Schoharie, Albany and Greene, N. Y. Directors: Elias W. Dutton, A. B. Brayman and W. J. Chase, of Livingstonville; William Earles, George Graham and Absalom Graham, of Franklinton; A. S. Coons, George F. White and George M. Hallenbeck, of Preston Hollow; Emerson Ford, of Oak Hill, and Wellington E. Bassler, of Millersburg.

Representative Cody's bill, now before the committee on corporations of the Illinois House, proposes to regulate telephone charges in the State of Illinois and to empower certain State officers to revise and regulate the same. The leading provisions of the bill are similar to those of the bill now before the New York Legislature.

The Central Telephone Company is to have a competitor in New Castle, Pa. A new company is about to be formed there, and already over 100 signatures have been obtained of proposed customers; its rates are put at just half those of the Central Company.

Wisconsin Telephone Company officials are looking over the ground preparatory to building a metallic circuit line direct from Watertown to Chicago by way of Elkhorn, Williams Bay, Lake Geneva and Genoa Junction.

A bill has been introduced in the Illinois Legislature requiring telegraph companies to make a report to the Auditor of Public Accounts and fixing the assessment of such companies at the rate of 80 cents a mile for each separate wire.

The central office of the Southern New England Telephone Company has been removed from Essex to Saybrook, Conn.

The New England Telephone and Telegraph Company is getting ready for a large amount of new construction work during the coming summer. Among other things it is planning for a rebuilding of its trunk line from Keene, N. H., to St. Johnsbury, Vt., with copper metallic circuits. It will also rebuild, in the same way, its line from Rutland, Vt., to Burlington, Vt., thereby giving it a first-class metallic circuit line through from St. Albans, Vt., to Boston. It will, still further, put in the same kind of service between Portland, Me., and the White Mountain section, giving all the summer resorts there the best kind of lines. Down in Maine a copper metallic circuit line is to be built from Cherryfield to Machias, and a large amount of this work is also to be done in other sections.

The Franklin Telephone Company is canvassing for subscribers to establish a line between Englewood and Hackensack, N. J., and proposes an annual rental of $25 for each telephone. The present rate is between $60 and $100.

George W. Scheuing and associates have been granted the right to erect, maintain and operate a telephone exchange in Tallahassee, Fla.

The Southwestern Telephone Company of Martinsville, Ind., has been incorporated with a capital stock of $5,000. The company was organized for the purpose of operating a telephone system in the counties of the southwestern portion of the State from Marion to the Ohio river. The directors are Clark S. Crary, Sarah P. Crary and Charles W. Barkhurst.

A move is being made for the establishment of a telephone exchange to give service to Pierre, East Pierre and Fort Pierre, S. D.

The Phœnix Telephone Company has been organized in Indianapolis for local service, with a capital stock of $200,000. The principal stockholders are R. K. Syfers, Rollin H. McCrea, C. F. Smith, George Webster, Benjamin Webb, Charles McCreary, A. B. Gates, George W. Stout and William N. Gates. The list of subscribers already obtained, it is said, numbers 2,000.

The Bell Telephone Company is about to erect a long-distance telephone line from Griffin to Columbus, Ga., via Warm Springs, Greenville, Hamilton and Chipley.

At a recent meeting of the stockholders of the Le Sueur Center and Montgomery Telephone Company at Montgomery, Minn., it was decided to build the line at once. Officers were elected as follows: Charles C. Kolars, Le Sueur Center, president; J. R. Stratton, Montgomery, secretary; Charles L. Mark, Montgomery, treasurer.

The hearings on the Telephone bill at Albany are not yet closed. Another adjournment has been taken to the 12th of April. One of the strongest advocates of the bill considers this delay as tantamount to the defeat of the bill.

The highest special license assessment in Richmond, Va., is that of $800 against the Bell Telephone Company. The Western Union Telegraph Company is down for $500 and the Postal for $200.

The telephone war between the Central Union and Pana companies at Elwood, Ind., promises to bring free service. The Central Union has cut rates to $1 per month for business houses and 66 cents for residences.

J. E. Keelyn, president of the Western Telephone Construction Company of Chicago, has lately been in Pittsburg, Pa., and has taken steps to organize a new telephone company in that city.

The Germans are taking the lead in Europe in the erection of long-distance telephone lines. They have just put up four silicon bronze telephone wires between Berlin and Vienna, a distance of 409 miles. There is a longer line—496 miles—between Berlin and Konigsberg, and the German administration expects to build a 682-mile line from Bodenbach to Trieste, while it has also been experimenting between Berlin and Trieste, a distance longer than any, namely, 725 miles.

Police Commissioner Andrews made a thorough inspection of the New York Police Headquarters a few days ago, and among other things criticised the telegraph system, which he said was primitive and wholly inadequate to the needs of the department. He said that it was imperatively necessary that the department be equipped without further delay with a complete signal system. "A signal box," he said, "should be placed on the post of every policeman, thus enabling him to communicate at a moment's notice with the station houses."

Alfred L. Tetu, late manager of the Chicago Telephone Company, has taken a place with the Central Union Telephone Company at Chicago and will have control of the superintendents of the various local exchanges. It was Mr. Tetu who made the black dress and short skirts a compulsory working costume for the telephone girls of Chicago, which raised a howl of indignation that would have daunted a man of less altitude of spirit than Mr. Al. Tetu.

COMMERCIAL PARAGRAPHS.

The Mather Electric Company of Manchester, Conn., have secured through Mr. J. Holt Gates, of Chicago, their well-known Western contractor, the order for five 100 k. w. Multipolar Generators, with station equipment, for the new station of the Indiana Electric Railway Company at Goshen, Ind. This contract was secured against the strongest competition, and reflects great credit on the success of Mr. Gates as a hustler and the merits of the new Mather Multipolar Apparatus.

The Metropolitan Electric Company have been appointed agents for the Solar Arc Lamp, a lamp of unusual merit for incandescent circuits. Its feed mechanism is so simple and adjustable that it has been found to be a most thoroughly economical and practical lamp. It is simple in construction, has a positive action of feed. no springs or dash-pot, no see-sawing. The lamp is manufactured plain or in various styles of ornamentation to meet requirements. Samples are being exhibited at the warerooms of the Metropolitan Electric Company, 186 and 188 Fifth avenue, Chicago, where they carry a stock for immediate shipment. Prices are made to suit the times.

Looking for Larger Quarters.

(From the Elgin (Ill.) News.

The Standard Electric Company of Chicago, which has been negotiating for the purchase of the Mason Air Brake Company's plant, is rated way up by Dun's commercial report. The company is accredited with capital from $200,000 to $300,000 and its general credit is placed "high." The company will employ 200 to 300 men. It has made the present owners a bona fide offer and the sale is very near consummation.

A New Water Wheel Governor.

For many years, in fact almost from the time when water power first began to be utilized in the operation of the more modern types of machinery, engineers and all others interested have more or less appreciated the difficulties attendant on the governing of the various kinds of water wheels. And the impossibility hitherto of effecting anything like close governing has proven to be the chief hindrance in the way of a more general utilization of the many splendid water powers that have long been available in this and other countries. Many attempts have been made in past years at solving this problem, but with only moderate success. Still there has been a slow but certainly increasing disposition and determination manifested among engineers, capitalists and manufacturers to make the best use of a limited amount of knowledge and skill, hence the increase of factories, etc., now run by water power everywhere. Vast and useful improvements in the manner of constructing and installing turbines, have been made of late years, and it is owing to these improvements almost solely that development has been possible. With the appearance on the market of a governor that really governs, and by the aid of which perfect control of the turbines is had, an impetus is being given to the work of utilizing waterfalls the like of which was never before seen or known. The accompanying illustrations show the details of the latest governor yet put into active service.

By referring to Figs. 1 and 2, it may be seen that the Lombard Water-Wheel Governor consists essentially of a hydraulic piston which applies its thrust in either direction to the rack, pinion and gears at the left side of the machine. These gears transmit the motion of the piston to the gate mechanism of the turbine.

The actuating force which operates the hydraulic piston is air compressed under about fifteen atmospheres (210 lbs. gauge pressure). This air is contained in the cylindrical tank under the bed plate of the governor and the pressure is maintained by a pump operated by the band wheel, shown on the rear side of the machine in Fig. 1 and on the front side of the machine in Fig. 2.

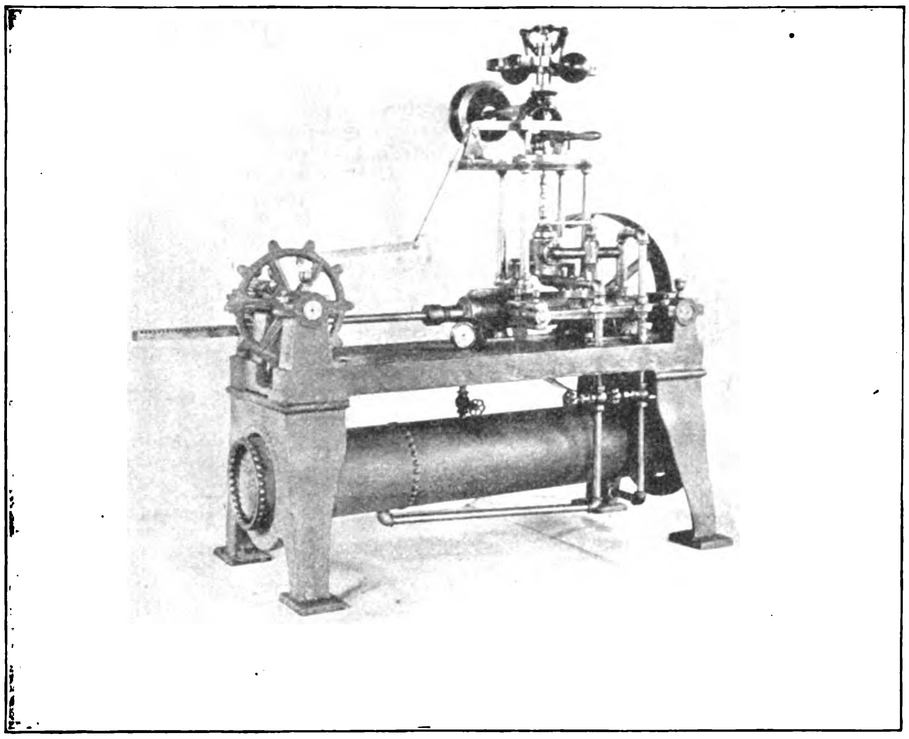

Fig. 1—Type A Governor.

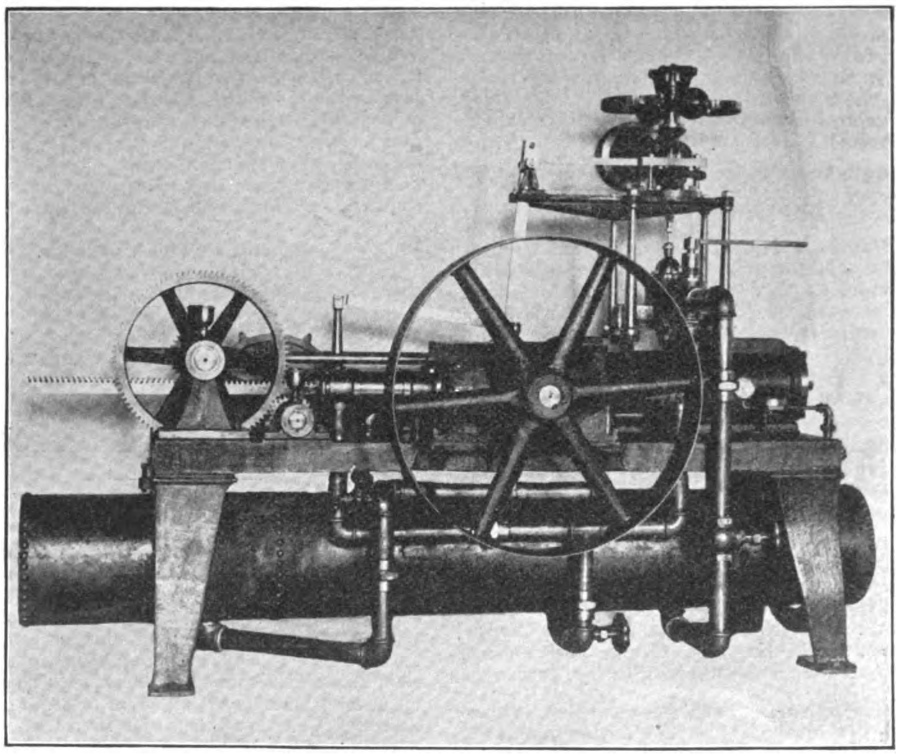

Fig. 2—Type C Governor.

The centrifugal governor balls actuate a perfectly balanced piston valve which stands in the circulating system. This valve has a lap of one-sixty-fourth of an inch, and a motion of that amount one way or the other, as the speed varies, causes the hydraulic piston and train of gears to open or close the gates of the turbine.

The mechanism of the valve motion is such that the full amount of motion due to the position of the balls is not used: in other words, the governor does not continue opening or closing the gates of the turbine until the centrifugal balls have resumed their normal position, but stops at such a position that when the various inertia forces have been absorbed the turbine gates will be in the proper position for the new load.

This peculiar motion of the valve is positive, automatic and adjustable, and gives perfect control of the turbine no matter how great the variation of load. By this it is not meant that this governor will hold a wheel to an absolutely constant speed, but it gives a speed regulation that compares favorably with the best steam engine practice and marks the beginning of a new era in the art of generating power by turbines.

The Lombard Water Wheel Governor is made in several sizes which are precisely alike in principle of action but differ in power.

Type A governor, shown in Fig. 1, is the smallest size made and is adapted to governing one wheel with easily movable gates.

Type C governor, shown in Fig. 2, is the largest size so far made.

INCORPORATIONS.

The Inland Electric Railway Company, Bucyrus, Ohio—to construct a street railroad and operate it by electric or other motive power between Bucyrus and Annapolis, Ohio. Capital stock, $50,000. Promoters: M. J. Monnett, A. J. Scott, B. Beal, Edward Volrath, E. B. Monnett.

The name of the Cuyahoga Manufacturing Company of Cleveland, Ohio, has been changed to the Jandus Electric Company, with an increase in the capital stock from $25 000 to $100,000. The president of the new company is J. Potter, the secretary Charles H. Rockwell.

Electric Construction and Supply Company, New York City. Capital stock, $12,000. Directors: Arthur A. Lawrence and Charles F. Parmly of New York City, W. S. Perry of Staten Island, and Charles E. Rocap and Frank Kinsman of Plainfield, N. J.

The Hamburg Railway Company, Buffalo, N. Y.—to build and operate a street surface road, one mile long. Capital stock, $10,000. Promoters: Wm. Elwood, S. H. Koopman, D. W. Allen, Buffalo.

The General Electric Light and Power Company, Le-Sueur, Minn.—to construct and operate an electric light plant at Le Sueur, Minn. Capital stock, $25,000. Promoters: Wm. H. Patten, Wm. A. Patten, W. H. Tomlinson, H. F. Weisx, E. H. McLeod, Le Sueur.

The Yankton Electric and Manufacturing Company, Yankton, S. D.—to own and operate an electric plant. Capital stock, $40,000. Promoters: John MacGregor, R.R. MacGregor, Otto R. Brandt, of Yankton.

The Pacific Power Company, San Francisco, Cal.—to purchase, sell and lease property; generate, manufacture and furnish electricity for lighting and other purposes. etc. Capital stock, $500,000. Promoters: W. A. Aldrich, San Francisco; G. W. Howard, San Mateo, Cal.; A. W. Bowman, Oakland, Cal.

The Peter Ballingall Company, Atlantic City, N. J.—to build, construct, enlarge or complete, or cause to be built, etc., railroads, gas works for light and heat, and electric light works for light, heat and power. Capital stock, $60,000. Promoters; Peter Ballingall, Wm. Martin, Jas. Brown, of Philadelphia.

The Mississippi Valley Harrison Telephone Company. Grand Rapids, Mich.—to engage in a general electric telephone business and sell rights to patents. Capital stock, $100,000. Promoters: J. M. Beakesly, T. Stewart White, Wm. T. Hess, of Grand Rapids.

The Wellsville Electric Light Company, Wellsville, Ohio—to manufacture, sell and furnish electric light, power and heat in Wellsville. Capital stock, $30,000. Promoters: Homer Laughlin, W. E. Wells, R. L. Andrews, Julius Goetz, H. C. Wells.

The Parkersburg Traction Company, Parkersburg, W. Va.—to build and operate a street railway in Parkersburg, with branches and extension. Capital stock, $1,000,000. Promoters: D. B. Judd, Wm. R. Hurd, Wm. C Spring, Bristol, Conn.

ELECTRICAL PATENT RECORD.

Letters Patent Issued March 19, 1895

ELECTRIC RAILROADS AND APPLIANCES.

535,936. Conduit Electric Railway. Fred P. Bergh and Charles W. Tarbox, New York, N. Y., assignors to David Calman, same place. Filed May 25, 1894.

535,971. Insulated Trolley Section and Crossover. Montraville M. Wood, Chicago, Ill., and Charles K. King, Mansfield, Ohio, assignors to the Ohio Brass Company, Mansfield, Ohio. Filed July 13, 1894.

535,993. Closed-Conduit Electric Railway. James F. McLaughlin, Philadelphia, Pa. Filed Oct. 23, 1894.

536,055. Apparatus for Automatically Limiting Speed of Electric Cars. Louis S. Wright, Philadelphia, Pa. Filed Dec. 8, 1894.

536,076. Collapsible Conduit for Electric-Railway Conductors. Harry C. Grant, New York, N. Y. Filed Sept. 17, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

535,838. Incandescent Electric Lamp. William S. Lowe, Lima, Ohio. Filed Oct. 15, 1892.

535,840. Electric-Arc Lamp. George R. MacIntyre, New York, N. Y. Filed July 5, 1894.

535,841. Electric-Arc Lamp. George R. MacIntyre, New York, N. Y. Filed July 5, 1894.

535,842. Electric-Arc Lamp. George R. MacIntyre, New York, N. Y. Filed July 10, 1894.

535,933. Street-Sign for Electric Lights. Robert S. Wright and Henry C. Bradford, Somerville, Mass. Filed Feb. 23, 1894.

536,081. Cord-Adjuster for Electric Lights, etc. Milton B. Hood, Montclair, N. J. Filed May 26, 1894.

DYNAMO ELECTRIC MACHINERY.

536,082. Alternating-Current Motor. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Societe Anonyme pour la Transmission de la Force par l'Electricite, same place. Original application filed Nov. 17, 1892. Divided and this application filed Feb. 14, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

535,810. Spring-Winding Means for Printing-Telegraph Instruments. John Burry, Long Island City, N. Y. Filed May 12, 1894.

536,100. Automatic Toll-Box for Telephones. Howard C. Root, Brooklyn, N. Y. Filed Nov. 30, 1894.

MISCELLANEOUS.

535,856. Dynamometer. Benjamin F. Perkins, Holyoke, Mass. Filed March 2, 1894.

535,865. Electric Sign-Changing Device. William Sears, Boston, Mass. Filed Feb. 19, 1894.

535,885. Accumulator-Plate. Georges R. Blot, Paris, France. Filed May 22, 1894.

535,948. Electric Program-Clock. Fred Frick, Waynesborough, Pa. Filed May 28, 1894.

536,091. Dynamometer for Mechanical Musical Instruments. Max Lochmann, Leipsic-Gohlis, Germany, assignor to Kraft Behrens, same place. Filed March 20, 1894.

536,095. Protective Device for Electrical Appliances. Joseph J. O'Connell, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed Nov. 23, 1894.

536,104. Electromagnetic Signal. Theodore Spencer, Cambridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Sept. 10, 1894.

536,153. Tip for Flexible Electric Conductors. Charles H. McEvoy, Lowell, Mass. Filed Feb. 4, 1895.

ELECTRICITY.

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EDITORIAL NOTES.

NO DEFINITE results have yet been reached in the negotiations going on between the Westinghouse and G. E. companies. The accounting departments of both companies practically finished their special work last week, having been engaged for several days, including Sundays, until late at night.

No further details are given out as to the scope of the proposed arrangement, and the opinion of one outsider is as good as that of another.

ELECTRICITY'S views are already on record. An arrangement might be made of immense benefit to every one in the trade; it might, on the other hand, result in a policy which would breed nothing but disaster.

We have reason to hope that the common sense and good management displayed by the active heads of the Westinghouse interests for the past three years will prevail, and that the visionary bankers will not precipitate their own funeral.

The annual reports of the two companies will be out in a few weeks, when the common stockholders will presumably be advised as to the entire plan.

* * *

The Tesla Oscillator. It seemed an exceedingly bold step for Mr. Tesla to take in departing from the rotary type of generator to the reciprocating, at least when we consider the step from the standpoint of efficiency and economy. It has been rather accepted as axiomatic by the steam engineering profession, that the reciprocating feature of the steam engine was a weakness which it was very desirable to overcome, but that the difficulties encountered in all attempts to depart from these established types were greater than any advantages which were practically attained by the rotary type. So strong had this conviction become that all attempts to produce a rotary steam engine were looked upon with suspicion, and we remember a recent engine which was advertised somewhat extensively at the time as not being a reciprocating engine and yet not a rotary one, it evidently being considered inadvisable to burden the machine with the disfavor which so generally attaches to the rotary engine.

With the electric motor most of the early attempts were of the reciprocating type, if we except a few of those such as Barlow's wheel, and others evincing but little power, but with the development of the modern rotating armature a great advance was realized and the tractive effort exerted by the modern electric motor as applied to street railways was soon noticed to so far exceed that from a reciprocating type as to lead many to endeavor to account for it on the ground of a magnetic relation between wheel and track—to incipient welding between the two, etc., etc. So far superior for most purposes was the rotary type regarded that the announcement was received with no little surprise that Tesla had deliberately discarded it. But when we consider that the electrical part of this combination is not the motor part, but the generator, and that the currents desired are of the reciprocating kind, it does not seem illogical that the efficiency should be greater than could be expected from the ordinary method, which involves a reciprocating engine whose motion is converted first into a rotary one and that this again is practically converted back into reciprocating. It seemed a bold step, however, and it is safe to say that it was only the great confidence which the engineering profession had learned to have in anything which Mr. Tesla was willing to stand sponsor for that prevented hostile criticism from being general. As it was, the public and the profession tacitly agreed to withhold criticism until Mr. Tesla had completed his work, and now that the immediate fulfilment of his desire to give to public gaze his completed machine has been delayed by the unfortunate catastrophe, public attention has been again aroused in this new machine. Mr. Tesla has never once lost faith or confidence in the outcome of this his latest undertaking, and it was not long since that in conversation with the writer he expressed the opinion that this, the oscillator, was the most important work of his life. Just at this time, therefore, Mr. Martin's article in the April *Century Magazine* on "Tesla's Oscillator and other Inventions," from which we are enabled by the courtesy of both the publisher and the author to reproduce the latest photograph of the completed machine, comes with great appropriateness, and will attract wide and deserved attention.

In regard to the oscillator, Mr. Martin says:

"Mr. Tesla, to begin with, has stripped the engine of all this governing mechanism. By giving also to the coils in which the current is created, as they cut the lines of force of the magnets, a to-and-fro or reciprocating motion, so that the influence on them is equal in every direction, he has overcome the loss of the idle part of the wire experienced in rotating armatures; and moreover, greatest achievement of all, he has made the currents regulate the mechanical motions. . . In the Tesla oscillator . . . the vibrations of the current are absolutely steady and uniform. . . Back of the tendencies to irregularity in the old-fashioned electrical apparatus were the equal or greater tendencies in the steam engine, and over and above all were the frightful losses due to the inefficient conversion in both of the power released from the fuel under the boiler generating the steam. . . We note immediately the absence of all the governing appliances of the ordinary engine. They are non-existent. The steam chest *is* the engine. . . Moreover, for the same pressure and the same piston speed, the engine has about one-thirtieth or one-fortieth of the usual weight. . . This diminution of bulk and area is equally true of the electrical part. . . What we are dealing with here is a dual, interacting machine, half mechanical, half electrical, of smallest bulk, extremely simple, utilizing steam under conditions unquestionably of the highest efficiency, its vibrations independent of load and pressure, delivering currents of the greatest regularity ever known for practical work or research. That such a combination should produce electricity for half the consumption of steam previously necessary with familiar apparatus in equivalent results need not surprise us."

* * *

A Return to Reason. Since Electricity was the first journal in America to promulgate the correct view of the possibilities of the Niagara transmission scheme, it is with a certain sense of satisfaction that we notice the reaction which has set in against the wave of popular fallacies which swept over the country two years ago in regard to this scheme. The ridiculous estimates of Messrs. Houston and Kennelly, given weight by their publication in the *Electrical Engineer*, were sufficient to prevent the ordinary daily paper editor from doing any thinking on his own account.

Now, however, there has been so much discussion that many of the latter are using their own horse-sense, which is sometimes more valuable than theoretical technical knowledge. The fact that the Niagara Falls Power Company has so far been unable to offer any inducement to the city of Buffalo in the shape of guarantees as to the cost of the current distributed there, is also becoming known, and it does not require much knowledge to know what this means.

Among the particular examples of newspapers who are returning to a common sense view may be mentioned the New York *Tribune*, the Philadelphia *Press* and the Rochester *Democrat and Chronicle*.

The Niagara Company has opportunities for a successful commercial venture in the sale of current at its very doors, and has already made some money out of its land speculations. When it goes beyond its proper field it will meet with disaster.

But we suppose, like many other electrical enterprises, the backers of the Niagara scheme had to misrepresent and multiply its possibilities in order to sell stock. If enough could be sold the backers would come out even, and the public would once more be taken in.

* * *

A Trolley Decision. A decision rendered by the Supreme Court of Pennsylvania last week will, if held to be good law in other States, seriously retard the work of many interurban lines now projected, and put a damper upon that entire branch of the business until the Legislatures shall have passed a special law to cover the rights and privileges of the trolley companies. The decision holds that the private property of every landholder abutting on the country highway covers the highway itself except for the purposes of passage in the regular use of the road. This makes it incompetent for an electric road to lay its tracks on country roads "*except by contract with every owner of property along the roads they wish to occupy.*"

A company proposing to build a line between two towns or villages must halt until it has obtained the consent of every owner of property abutting on the roads it wishes to traverse. This is, of course, a practical impossibility for a line running for any distance through the country.

Electric lines already built in the country can not be disturbed, as the Court holds that the property owners have the remedy of a suit at law for damages.

There have so far been few objections from the farmers themselves to having an electric line built on the roads fronting their property. But the law is now laid down, and will doubtless be found to apply in many other States.

What is needed is new legislation. This will, of course, encounter the organized opposition of the steam railway interests, which interests have been in control at Harrisburg for a generation.

The trolley, however, has won a popular victory everywhere except in New York City. In country districts it has added to the comforts of life, has promoted trade, and provided the mechanic and the artisan with a way to reach a clean home, relieving him from the necessity of living close to his workshop. It has given millions of people of moderate means an opportunity of breathing the fresh air which they could get in no other way so well.

The extension of a system which has been so universally received with favor cannot be stopped though it has been delayed.

* * *

The controversy now going on between the steam and electric road interests in Connecticut must eventually be settled upon the principle of the greatest good to the greatest number. Meantime, New York capitalists closely allied to the management of the N. Y., N. H. and H. Railroad are buying up local parallel electric lines, with a view to controlling as far as possible both sides of the case where their line is concerned.

The Carbon Business. That the National Carbon Company of Cleveland, which recently built the largest carbon factory in the world, are desirous of obtaining an exclusive monopoly in the manufacture of electric light carbons goes without saying. Such desire is natural, and in a business or moral sense beyond criticism. It should, of course, be a good thing for the stockholders of that company.

Whether it would be equally desirable for the consumers of carbons is an entirely different question, and we think admits of but one answer. Human nature is very much the same throughout the commercial world. Ambition to make profits as large as possible is ever-controlling. While this company are now selling their product in some places at reasonable prices, it does not follow that they would do so if they had the field to themselves. It would certainly seem to be to the interest of large consumers to patronize independent companies whenever possible, price and quality considered, and in the latter respect some of the independent companies are far in the lead—especially is this the case in the matter of cored carbons.

The management of the National Company has been and is shrewd—if that is the proper term. Through various ways and by various methods they have got what may be called a pull with many large plants. The consequence is that the largest consumers are in many cases paying more for their carbons than those using a very small quantity. A mild form of humbug, common with all trusts we believe, is practised in continuing to offer the brands of the various amalgamated companies after the latter have gone out of existence. Thus if a purchaser prefers T.-H. carbons over Standard, or vice versa, his taste can be suited, although the two brands are perhaps made in the same molds, by the same men and from the same material.

Not long ago they tried to corral the supply of coke, but found that they were no match for Mr. James Humbird in a game of this nature.

Sentiment often plays an important part in business, and it should have some consideration even in so prosy a one as the carbon business. In addition to this, however, there is the main question of self-interest to be considered by the purchaser. Do the central-station men of the country want their supply of carbons to be in the hands of an air-tight monopoly?

Electricity recommends that for many months to come these purchasers refrain from making long-time contracts. They will conserve their own interests by doing so, in that they will be in position to take advantage of changes in price, and will be able to know every week just what the price is.

* * *

The *Street Railway and Electrical News* for January is just at hand. The most interesting features are a report of the meeting of the Northwestern Association, held that month at Milwaukee, and a full page advertisement of the Great Western Manufacturing Company, which died last year.

Under the Searchlight.

Views and Opinions on Timely Topics.

UNANSWERABLE ARGUMENT.

One day in 1889 there was an important gathering of the leading clergymen of the Congregational faith in Plymouth Church, Brooklyn.

The day following General Pinto, a philosopher who is well known downtown in New York, was in the office of the Hon. Franklin Edson, and the following dialogue occurred :

Mr. Edson—General Pinto, what did you think of the deliberations of those clergymen in Plymouth Church yesterday ?

General Pinto—Oh, those fellows are off their base; they don't know what they are talking about.

Mr. Edson—General, how do you tell when a man is off his base ?

General Pinto—When he don't agree with me, of course.

Respectfully referred to Mr. Herbert Lloyd.

* * *

WELLINGTON ADAMS OUTDONE.

An Electric Road from Sea to Sea.

The Interocean Electric Railway Company has been incorporated by some breezy Chicago gentlemen. The capital stock is only $200,000,000. They will build (at once, of course,) an elevated freight line from New York to Chicago, extending it to San Francisco in the near future.

One of the promoters says :

> This road is a decided step in advance of the electrical roads operated at present. Electricity is cheaper as a motive power than steam and renders a much higher rate of speed possible. By elevating our road we expect to do away with the necessity of buying a right of way, and all delays incident to surface traffic will be avoided. At present it takes six days for freight to travel from Chicago to New York. On the new road the trip will take one. The road will have its own telephone and telegraph lines.
>
> A number of American and several foreign capitalists are interested in the road and building operations will begin soon. New inventions in electrical transportation will be used by the road, but I am not at liberty to disclose their nature. The capital, while large, is not out of proportion to the business we expect to do, but I cannot at present give the names of any of the persons interested.

Petty swindlers will now step aside and make room for the greatest fake of the century.

ELECTRICITY advises the " capitalists " who are in this scheme to get out at once, and those who are solicited to come in should kick the promoters out of their offices without ceremony.

It would be unnecessary to take this matter seriously if such papers as the New York *Sun*, with many others, had not done so, giving it one-third of a column in regular news matter and helping thus far in the gigantic swindling game—for it is nothing else.

* * *

WE WERE wont to look upon the Boston *Traveler* as a journal of the highest repute, using more than ordinary discretion as to what was admitted to both its reading matter and advertising columns. We now see that the *Traveler* has fallen from grace, putting itself on a par with the N. Y. *World* or the Cincinnati *Enquirer*. On Saturday, March 30, it carried a half-page advertisement of the Pennock swindle, which is not new, but has been denounced in every reputable electrical paper in America.

* * *

Intelligent Criticism.

(From the Lockport Sun.)

OFF ITS TROLLEY.

ELECTRICITY, a journal published in New York, estimates that Niagara power will cost $51 per horse-power delivered in Buffalo. The Buffalo *News* comforts itself with the reflection that the electricity used to propel the street cars there is transmitted and distributed over 125 miles of wire, and therefore ELECTRICITY is off its " trolley."

Truth Well Told.

(From the Pittsburgh Dispatch).

Notwithstanding the Pickwickian denials of the reported combination of the great electric companies a week or two ago, the arrangements were officially announced yesterday. The combination outlined in our news columns includes an adjudication as to ownership of existing patents, the mutual payment of royalties, a division of territory and a schedule of prices to be in force all over the country.

This indicates a set determination on the part of the great corporations to prevent the reduction of prices that would naturally follow the recent Supreme Court decisions. But while the agreement may be effective on that part of electrical manufacturing still controlled by patents, the fact that a great portion of the trade is thrown open to general competition will defeat any attempt to sustain excessive prices. Agreements to pay royalties can be enforced by law, but contracts to divide territory and hold prices at an arbitrary scale have been proved by experience to be little better than a bruised reed, unless there is back of them some power to smother new competition.

It is well, therefore, to wait and see what the combination will amount to in actual practice. It does not seem likely to defeat the salutary rule that the business concern which gives the public the most for its money will get the largest share of the business.

* * *

Keep on Looking.

The Leads are There.

(From " Electricity," London.)

In connection with the Cleveland Electric Lighting Convention, ELECTRICITY of New York has blossomed forth with a special and marvelous wrapper. A young lady, who does not look very comfortable, is lying with her back on a footstool and her legs in the air (perhaps I had better mention that she is wearing tights). One foot supports a gigantic arc lamp, but for the life of me I have been unable to discover the leads.

* * *

A YANKEE WIZARD.

The Amperes Are Safe in His Apparatus.

(From the St. Louis Globe-Democrat. March 27.)

VALUABLE ELECTRICAL APPARATUS.

NEW HAVEN, CONN., March 26.—J. J. Morgan, employed in the Mechanical Department of Yale Scientific School, has invented an apparatus by means of which the use of the motor dynamo invented by Edison is obvious. The amperes reduce the voltage of a current without lessening the apparatus. A test made to-day reduced an electric light current of 100 volts four amperes to seven volts, without affecting the amperes.

* * *

Is This Authentic?

(From the Wall Street Daily News.)

That a better understanding between the companies would be of great value to each goes without saying, but efforts heretofore made to bring this about have always encountered the bitter opposition of Mr. George Westinghouse, who swore "I will have nothing to do with the General Electric concern as long as that man Coffin has anything to do with it."

Mr. Westinghouse does not swear.

* * *

THE New York Edison Company (Licensees) announce that hereafter they will have nothing whatever to do with the sale of apparatus in their territory, nor with construction work. They have returned these privileges to the G. E. Company. We suppose the consideration was the consent of the latter company to the $15,000,000 bond issue, which is forbidden under the licensee contract.

* * *

THE Western Electric dynamos in the Detroit city plant are to be started this week. The initial experiments with Engineer Dow's entire system will be of considerable interest.

* * *

The New Bear Argument.

(From the Financial News.)

Take it all in all, the new bear argument on the stock exchange may be ELECTRICITY.

* * *

The Same Old Lie.

(From the " Times-Union," Jacksonville.)

ELECTRICITY is still in its infancy.

A Valuable Opinion.

(Interview with Mr. Samuel Insull in a Chicago paper.

I heard nothing of the proposed Trust while I was in New York and am inclined to think there is little, if any, truth in the reports telegraphed here. I was in the offices of the General Electric Company as late as 8 o'clock on Tuesday afternoon.

In 1892, when Mr. Insull was closer to headquarters than at present, he had not heard of the G. E. combination until it was closed.

* * *

THE formation of the G. E. Company was an effort to upset all the laws of business which men have been taught. The continuation of the company is simply prolonging the dying agonies of that effort. *It can not win.*

* * *

PUDD'NHEAD'S PHILOSOPHY.

Bate Case only a Bunco Game.

F. P. Fish and Leonard E. Curtis were the *Steerers* we Suppose.

(From the Electrical World, March 30.)

Owing to the vast amount of misinformation contained in the newspaper interpretations of the recent decision of the United States Supreme Court in the Bate Refrigerating case, and, in scarcely a less degree, to the editorial remarks of some of our electrical contemporaries on the same subject, a very considerable misunderstanding exists in electrical circles in regard to the real significance of the decision. It is somewhat singular how the importance of this case has been magnified, and the unwarranted conclusions that have been based upon its final settlement. The Bate case, in short, may be considered as little more than a "bunco" game played upon credulous clients by their legal advisers, and THE DECISION OF THE COURT HAS HAD ABSOLUTELY NO EFFECT UPON ANY PATENT WHATEVER, EITHER IN THE PAST, PRESENT OR FUTURE. Section 4,887 of the Revised Statutes declares that a domestic patent expires with a foreign patent on the same invention if the date of the latter is prior to the date of issue of the domestic patent, and the attempt to substitute *application* for *issue* was SO DEVOID OF REASON that it never had an iota of chance of favorable consideration by the Supreme Court. . . . A statement, therefore, of the effect of the Bate case is that it affected nothing whatever—the decision merely registering the failure of an attempt to change existing law. The Edison telephone patents and the Edison lamp patent, for example, which expired in 1892 and 1894 respectively, were no less null before the decision than after it.

Now we know what's what, and the next time James C. Carter, J. J. Storrow, C. E. Mitchell, Wheeler H. Peckham, B. F. Bristow and Edmund Wetmore, and the United States Supreme Court want to know just what the law is they will please report at once to Pudd'nhead in his sanctum.

The Bate case was finally argued in Washington during the week ending November 17 last. It was decided on Monday, March 4. Between those two dates, *for nearly three months*, the business of a dozen lamp companies was suspended and several eminent United States Circuit Court Judges had refused to raise injunctions.

Yet according to our perspicacious contemporary the decision *affected nothing whatever*.

The most eminent counsel in the United States were employed for months on the case at an expense all told of over $50,000, and yet the contention was *devoid of reason*.

Oh, Pudd'nhead, O'Johnston.

Personal.

Mr. Wm. Lemont, one of the leading and most enterprising citizens of Fredericton, N. B., paid us a visit last week. He states that electrical interests are making steady progress in the Canadian provinces of New Brunswick and Nova Scotia.

Mr. Godfrey G. Luthy, of the Royal Electric Company, Peoria, who has been in the city for several days, has returned to the West.

THE TESLA OSCILLATOR.

In view of the recent destruction by fire of Mr. Nikola Tesla's laboratory, with all the apparatus therein contained, some of the mechanism most nearly completed and perfected that has gone has been given an additional interest. There is probably no device of Mr. Tesla's of recent date around which more interest has centered than the electrical oscillator, which he first exhibited before a select audience at the World's Fair during the occasion of the Electrical Congress.

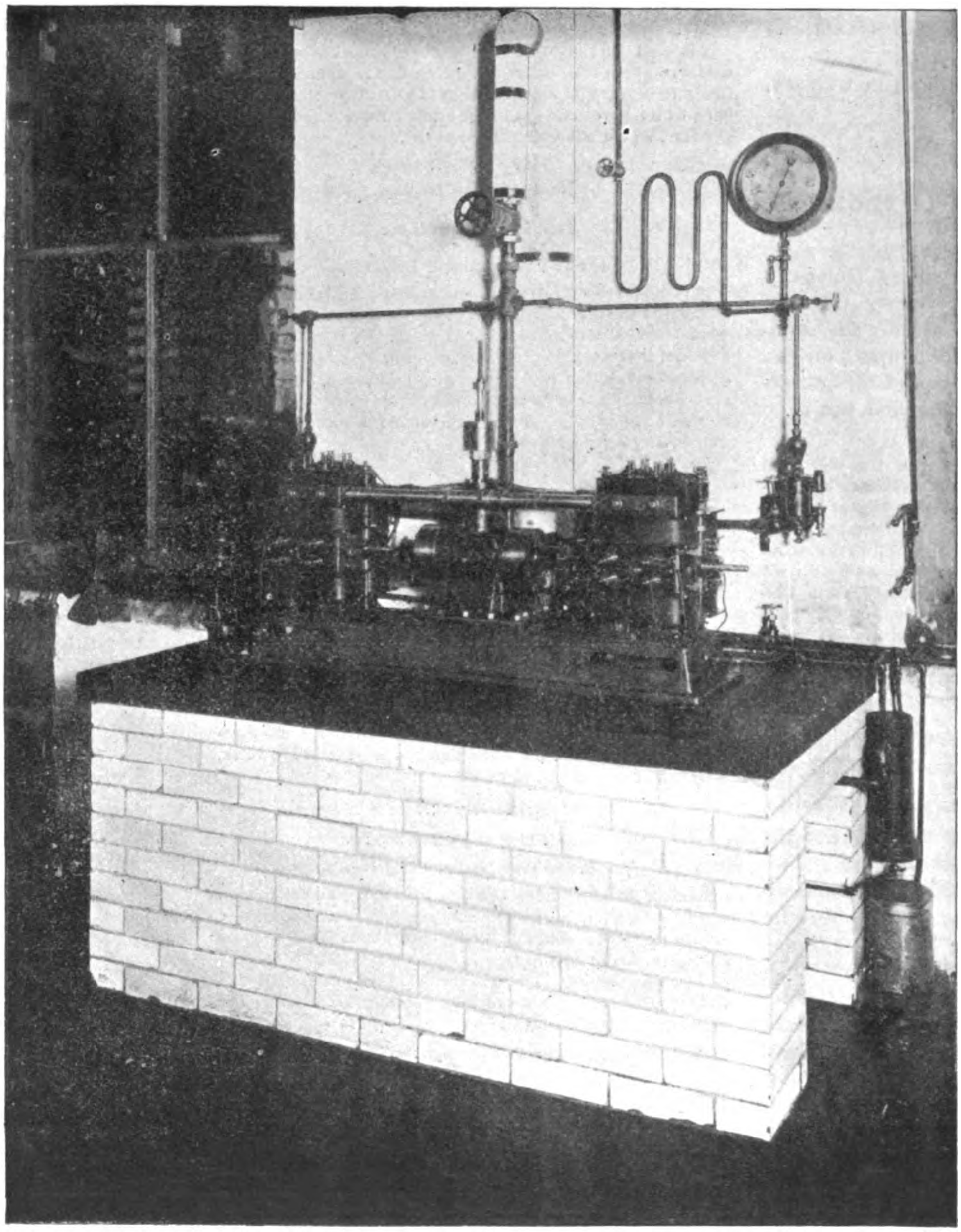
Since those instruments were exhibited the mechanism has undergone a considerable change, not in principle but in detail, which has tended to make it more compact, more efficient and in every way better adapted to the peculiar requirements of experimentation in which Mr. Tesla has been engaged as well as to the everyday requirements of the commercial machine. To such an extent had his work been carried in this line that Mr. Tesla was about ready to put the apparatus on the market, and did in fact for some time previous to the fire have his oscillator in practical service in his laboratory.

Through the courtesy of the *Century Magazine* we are enabled to reproduce here an engraving of the latest type of this machine, made from the last photograph taken of it, which, now that the machine itself has been destroyed, will have additional interest for our readers. This picture was made to accompany an exceedingly well written article by Mr. T. C. Martin which appears in the April number of the *Century*, to which our readers are referred. Mr. Martin, as is well known, is Mr. Tesla's historian, and any statements coming from him in regard to Tesla's work are therefore authoritative.

The Tesla oscillator is a steam mechanism, but the "engine" part may be said to have disappeared, so far as that word implies an aggregation of fly wheel, governors, etc. On the one base were mounted two dynamos, or electro-magnetic generating systems, and a small steam chest. There were two pistons, which were vibrated by the steam 80 to 100 times a second. Each of the pistons carried an armature which was plunged reciprocally into the field of the magnets. Normally the engine was run with the two pistons in opposite phase, but they could be set by an independent device in any phase. Above the chest was mounted an independent little oscillator, which in some experiments controlled the steam admission, and made the vibration of the engine quite independent of the load.

This oscillator was operated with steam at 350 pounds pressure, when it needed no packing, as there was no leakage. It was also used at pressures down to the ordinary 80 or 100 pounds. It was used to light up a bank of 50 or more incandescent lamps, some arc lamps, and to run various motors, while it also furnished current for a variety of most interesting and novel experiments, all of them suggestive of new departures in the electrical arts, including phosphorescent lighting, the transmission of intelligence long distances without wires, the utilization of the earth's electrical charge, etc.

Lent by THE CENTURY CO.



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THE TESLA OSCILLATOR.

For a $15,000,000 Mortgage.

In a circular asking the stockholders of the Edison Illuminating Company of New York for authority to create a mortgage of $15,000,000, figures are given indicating the larger growth of the company's business and earnings in comparison with the increase in capital invested.

The increase in net earnings in five years is claimed to be 537 per cent., while the capital was increased only 308 per cent. The mortgage proposed will authorize the retention of $8,500,000 bonds in the treasury for future use for new construction and acquisition, but they may not be issued to an extent exceeding $1,000,000 in any one year and the first issue shall not be made before January 1, 1896. Only $1,686,000 new bonds are to be issued immediately, to reimburse the company for final payments on its Harlem and Manhattan companies' purchase and to provide funds for the construction requirements of the present year. The stockholders will meet on May 1.

SOCIETY NEWS.

Prof. Crocker's Second Lecture at Columbia College.

The second of Prof. Francis B. Crocker's popular lectures on "How Electricity is Now Being Utilized" was delivered at Columbia College on Thursday evening last. The subject was "Alternating Currents" and was handled in a concise and comprehensive manner. Beginning with the fundamental principles, Prof. Crocker gave an elucidation of his subject that was quite clear even to laymen. The peculiar phenomena of alternating currents were demonstrated by a series of interesting experiments which were made more striking by contrast with direct current phenomena. Notwithstanding Prof. Crocker's well known predilection for the direct current, he did not hesitate to say that "the alternating current is of special importance, for it is certain to be the current of the future, if it is not already the current of the present." This endorsement was made with the qualification that, inasmuch as the future will witness the application of many electro-chemical processes, the utilization of the alternating current in these operations will be prohibited by the fact that the direct current is the only one by which chemical changes can be produced.

Mr. Freedman at the A. I. E. E.

At the rooms of the American Institute on West 38th street on Friday evening W. H. Freedman, E.E., president of the Electrical Section, in conjunction with the Henry Electrical Club, gave a very instructive talk on "Electric Railways." He traced the history and development of the art from the days of Davenport down to the present, illustrating his remarks by the use of lantern slides.

The next meeting of the Section will be held April 12, at which Prof. L. H. Laudy, first vice-president, will discuss the subject of "Meters."

The Walker Company Won.

The Union Depot Railway Company of St. Louis, through its general manager, Harry Scullin, has signed a contract for a 1,500 kilowatt generator with the Walker Manufacturing Company of Cleveland, Ohio. There were three bidders, the Westinghouse, General Electric and Walker companies.

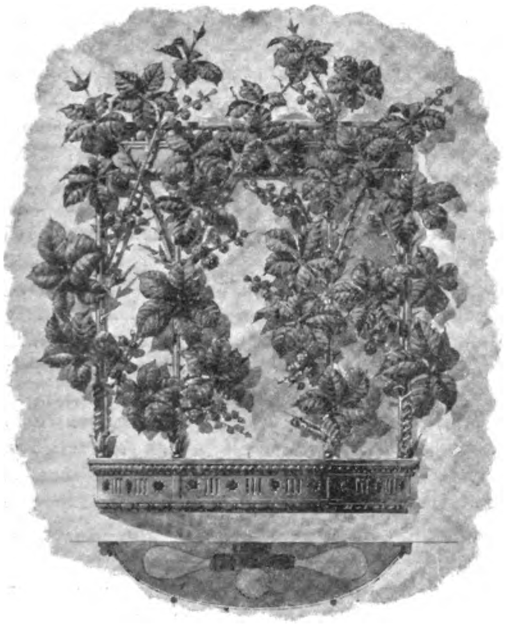
The Union Depot Railway Company have nearly 75 miles of single track. Their two power-houses are entirely equipped with G. E. apparatus and the 400 cars are all of G. E. equipment. They have lately bought 45 car equipments of the Walker type.

DECORATIVE LIGHTING.

A Fertile Field for Architects and Designers.

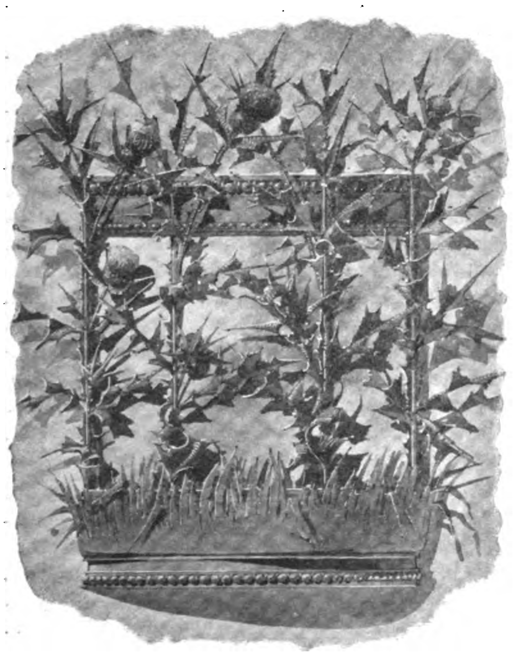
B. E. G.

The publication of Mr. Bernard's admirable article on "Church Illumination" in ELECTRICITY suggested a field of effort for fixture makers and others which has been so far scarcely cultivated at all. There are scores of large and richly designed places of worship in the country which could be rendered four-fold more attractive, without detracting in the least from the sacred character of the edifices themselves, by properly placed electric lights with artistic fittings, and by various effects from concealed lights. While the Catholic and Episcopalian forms of worship render the interiors of the churches of these denominations more distinctly available for the embellishment suggested, there is no valid reason why Protestant churches should not fall into line and adopt the means at hand for making the interiors of their houses of worship more attractive in being more beautiful.



1.—WALL ELECTROLIER.
Wrought Iron, Hammered Leaf.

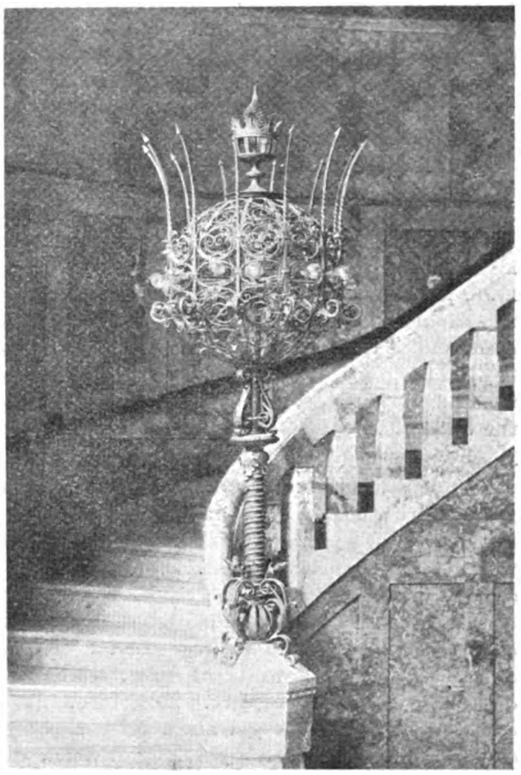
This is a field, however, particularly reserved for the genuine artist, and which amateurs would do better not to enter.



2.—WALL ELECTROLIER.
Wrought Iron, Hammered Leaf.

In the accompanying illustrations we are enabled to present for the consideration of architects and engineers suggestions as to what may be accomplished in the way of decoration for large public buildings or for private residences.

How few of the magnificent office buildings erected during the last few years have had the benefit of any taste or skill whatever in this line. Yet the difference in cost between an artistic plan of lighting and the suspension of ordinary arc lamps in large areas is not great. It is not the added cost, we think, which has stood in the way of further development in this direction, but the fact that the architects and engineers have paid little attention to it, and that the builders themselves rely on the former for suggestions of this nature.



3.—ELECTROLIER AND NEWEL.
Wrought Iron, Hammered Leaf, Bower-Barffed.

Of course the ornamental arc lamps of the period are a great improvement over the ugly original devices which were tolerated so long, but for really artistic effects the incandescent lamp must be chiefly relied on.

Fixture makers, we are sure, can extend their work in this direction to the enhancement of their own profits and to the public good, as everything which tends to make the surroundings of our daily life more beautiful, more artistic, is to the public good, raising us to a higher plane of civilization and culture.

The illustrations presented are taken by permission from *Ornamental Iron*, published by the Winslow Bros. Co., Chicago.

Good Chance for a New Plant.

At the annual election of officers of the Newburg, N. Y., Edison Company last week, the local element was completely frozen out of the directorate, and Mr. C. T. Hughes was chosen president, Henry W. Darling vice-president, H. M. Francis secretary, and W. H. Clark treasurer. The president comes from New York. The vice-president, secretary and treasurer hail from Schenectady. The fifth director resides in Canada, where he looks after the interests of the General Electric Company.

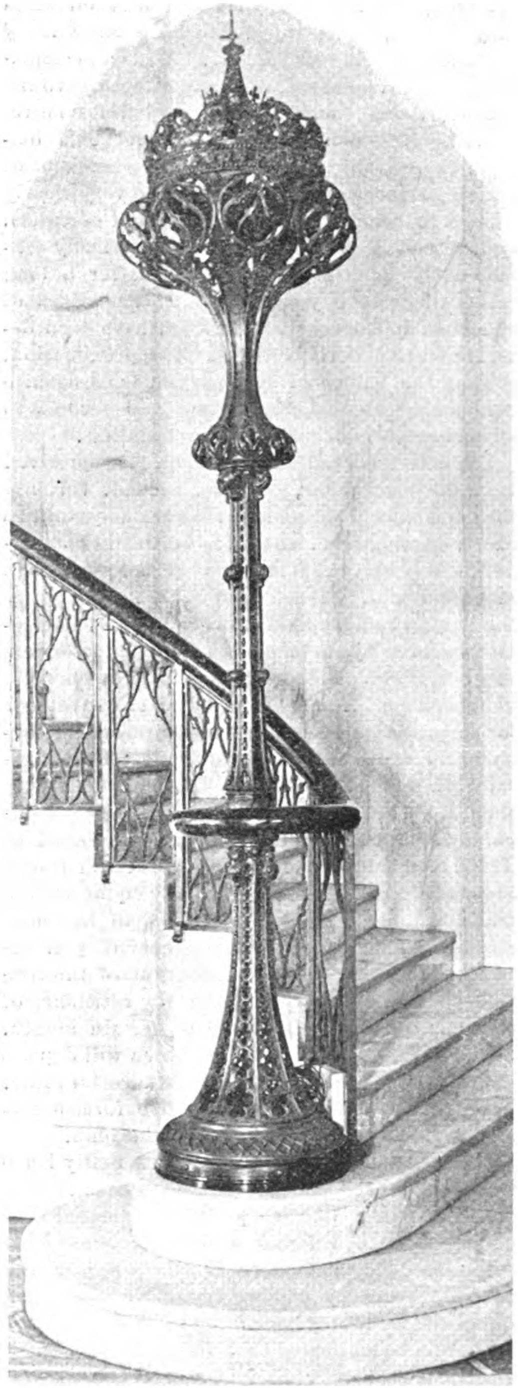
The arbitrary action of the G. E. people has aroused a storm of popular indignation. The newspapers of course are on the side of the local holders, many of whom are leading capitalists of the town. The plant was originally sold by Mr. Hughes several years ago.

It looks as though Newburg was ripe for the establishment of a new plant.

The Scientific Foundations of Electrical Engineering.*

BY F. G. BAILY, M.A.

There is probably no branch of engineering which is more intimately connected with purely scientific knowledge, and which has received more attention from scientific men than electrical engineering. The novel character of the forces which it employs, their intangibility and mysterious nature, appeal strongly to the imaginations of the uninitiated, and seem to set apart everything connected with electricity as a class of phenomena about which very little is known or understood. On the other hand, a certain amount of familiarity with the more usual phenomena, and the acquisition of several formulæ has produced in some minds a profound conviction of the truth of electrical theories, with an implicit faith in the accuracy of electrical measurements and the potency of calculation. While leaving the former attitude of mind to the gradual effect of familiarity, I wish to mention in this paper some of the limits to which we are



Decorative Lighting.
4.—ELECTROLIER AND NEWEL.
Statuary Bronze.

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*Paper read before the Northern Society of Electrical Engineers, 11th March, 1895.

still subject, and some of the errors to which we are specially liable.

The most powerful aid to improvement, and the greatest source of confidence in engineering practice, is undoubtedly by accuracy of measurement of effects and quantities in units which are common to all branches of physical knowledge. It is, therefore, useful sometimes to examine our foundations and realize what they mean.

In accordance with its close connection with pure science, the units employed in electrical engineering have been based on the so-called "absolute" system of units—that in which the centimeter, gramme and second form the fundamental quantities, the definitions of which depend on the physical properties of certain portions of the universe. Physical science refers all its measurements to these three fundamental units, and recognizes no others. As these units are independent, all calculations based on them may be accepted as rigidly accurate and strictly comparable with one another. Abstract calculations are not, however, of much direct use to the engineer, and something more definite is required. Now the electromotive force of a battery, the current in a lamp, or the resistance of a piece of wire does not appear to be very closely related to grammes, centimeters and seconds, and, in fact, they can only be numerically estimated by indirect experiment. After a long series of extremely careful work, the values of electrical and magnetic quantities have been determined to a certain degree of approximation, so that the values of any particular resistance can be expressed in centimeters and seconds to an accuracy of ·01 per cent., or even less.

The electrical and magnetic units are derived from the centimeter, gramme, second, through the mechanical forces which the various quantities exert, starting from the force between two magnetic poles and the force on a magnetic pole in a magnetic field. Hence current is measured by the strength of the field it produces, and electromotive force by the motion of a conductor in a magnetic field. Resistance is defined as the ratio of these two. This system, however convenient for scientific purposes, does not lend itself readily to the reproduction of the units. In practical work it is important that the standard values should be readily reproduced and easily compared to others. On this account the Board of Trade have laid down that the practical standards, while being made as closely equal to the true absolute values as possible, shall be independent of them and independent of possible future more accurate determinations of the true values. The ohm is defined as the resistance of a certain quantity of mercury of certain length, and the ampere as a current which will deposit silver out of a certain solution at a certain rate. The volt is then the electromotive force necessary to drive one ampere through one ohm.

In accepting these definitions we really leave the centimeter-gramme-second system, and found another one very closely related but arranged on a different and more convenient principle. To what extent is this accurate, and to what accuracy can we compare electrical quantities on this system ?

It must be confessed that the measurement of electrical quantities has not the same accuracy as the measurement of the fundamental mechanical quantities, and the laws upon which they depend are not to be depended on to the same extent. The laws of motion laid down by Newton have an accuracy which may almost be regarded as absolute. We have no reason for doubting them. The standards of length and mass may conceivably alter in the course of ages, but there is no evidence of such a change having taken place. But the electrical units are not so firmly established. The electrical resistance of standard ohm coils has been found to vary to a small extent, but this unit is the most satisfactory one, and comparisons between it and others can be made with considerable accuracy, one part in 10,000 being easily obtainable. The standard current depends on Faraday's law of electrolytic action, and though this may be theoretically very approximately true, its actual truth is marred by secondary actions, which prevent an accuracy greater than one part in 1,000. The volt depends on this, and therefore no measurement of current or of electromotive force can be relied on beyond one part in 1,000.

This question of the limit of accuracy of measurement of the actual and relative values of quantities is one which is frequently ignored. There is no such thing as the knowledge of the absolute value of any quantity. We can only know its value to a certain approximation, and this should be definitely expressed by the figures used, and it is useless to try to push this limit beyond the limit of the standards. Sometimes this standard is very imperfectly known, e. g., the value of the unit of heat is not reliable beyond one part in 400 at the most.

Frequently, however, the number of figures intended to denote a value are not justified by the degree of accuracy of the experiments by which it has been determined. The accuracy of a result is the accuracy of the weakest part, like the strength of a chain. The determination of other values involved to a much greater degree of accuracy is mere waste of time, while the quoting of them is deceptive. How often does one see a reading on a galvanometer consisting of two figures expanded by a long division or by the use of seven figure logarithm tables into a result of some five figures. The last three figures are purely gratuitous, and are quite unreliable.

The same fictitious accuracy is often seen in the design of measuring instruments. It is not infrequently the custom to design voltmeters with an expanded scale over a short range, and to advertise accuracy of scale reading to $\frac{1}{10}$ volt at 100 volts, that is, an accuracy of one part in 1,000. This is merely the seven figure logarithm over again, it being useless to magnify the scale beyond the size where the errors due to friction and the effects of temperature and residual magnetism become appreciable distances on the scale.

Under this head I feel compelled to mention an instrument for which I have a great admiration, and which has recently been eulogized before another society. I refer to the potentiometer. The delicacy is very great, almost comparable with that of the Carey-Foster method of comparing resistances, the Whitworth measurement of length, and the measurement of mass by the chemical balance, and for comparative values taken at short intervals of time it is unrivalled in its own line. But for actual values it is like using a delicate balance with a set of letter weights, or a Whitworth machine with a common foot rule as standard. A delicate method of comparison is useless beyond the point of reliability of the standard, which in this case is one part in 1,000. Even this is by no means easy to attain. Such an accuracy on the silver voltmeter requires great practice and very careful work, while the Clarke cell requires just as careful handling. It is not an immutable thing like a gramme weight of platinum, crystal, or gilt brass, but it is generally used with as little regard for its peculiarities. Notwithstanding its large temperature variation, the worker ignores its previous condition, and with a light heart applies a thermometer and a table of corrections, as if the E. M. F. had some direct connection with the mercury in the thermometer instead of being related only by the very indirect and slow-acting conditions of solution or deposition of sulphate of zinc.

The essence of applied science is emphatically the power of measurement for the purpose of checking the accuracy of previously calculated or estimated designs and for investigating the properties of materials used, in order to obtain data for future work. We may divide experimental research into three classes. 1st, qualitative observation of the occurrence or non-occurrence of some phenomenon; 2d, comparative quantitative observation of the variations of a phenomenon with change of conditions; 3d, absolute quantitative determination of the value of a phenomenon. The first two classes include the bulk of scientific research, for the absolute value is frequently of minor importance and depends on the particular piece of matter used, while the changes in value are common to a large class of bodies and indicate physical laws. The determination of the absolute value of an important physical quantity to a high degree of accuracy is a matter of great difficulty and forms the object of some of the most laborious investigations. To a large extent, however, the engineer can only deal in absolute values, because he immediately wishes to compare the result with that given by some other arrangement of his machinery. With him the all-important question is by what method a certain result can be most economically obtained, using the word "economy" in its widest meaning. For instance, a physicist or chemist may be interested in the various processes in the production of mechanical energy by the consumption of coal. The effect of varying the supply of air to the fuel, the wetness of the steam, the result of altering the initial pressure, the expansion and condenser pressure, the surface condensation under different conditions and many other points are all problems of scientific interest and may be dealt with separately. But the engineer must take all of these points into consideration at once, make the best compromise that he can between conflicting requirements, and sternly require of each improvement that the resulting increase in efficiency shall not be swallowed up by the increase in cost of plant and labor. Finally he must compare the total result with that given by some other means of obtaining mechanical energy in order to make a final decision.

For this reason, therefore, the method of investigating engineering problems must to a certain extent differ from the purely scientific treatment. The scientist narrows the conditions of his problem and simplifies the phenomena until the result, though highly artificial, illustrates the action of a single law. For the engineer, on the other hand, it often seems difficult to avoid the combination of all the variables, and in consequence he hardly differentiates their individual effects, and does not always discern which of them are essential and where the point of weakness lies. That truly English panacea, a substantial factor of safety, is made to take the place of more precise knowledge, the additions being occasionally put in quite unnecessary places.

On the other hand, much time and energy are expended, especially by mathematicians, in elaborating hypothetical problems, the conditions being chosen to suit their method of analysis, and the desirability and even the possibility of realizing those conditions being disregarded. This has been especially the case with alternating current problems. It seems a field so evidently made for mathematical treatment of an interesting nature, and so impossible to attack by any less rigid method of reasoning, that one almost feels called upon to give up the use of such an unreasonable material as soft iron, and even to abjure the use of most dielectrics, in order to rest in the security of an analytical demonstration.

It is necessary therefore to beware of the spurious accuracy of the page full of mathematics just as much as the seven figure logarithms. It has been pointed out, but the caution is frequently ignored, that mathematics is like a flour mill. The quality of the flour turned out is not better than that of the corn put in, and if not ground with due care and precaution may be a good deal worse. If the data are unreliable, or if the proportion dealt with cannot be expressed as a mathematical function, the results can have but a very limited application. Examples of this are often met with in calculations of cost and efficiency, where wonderful coefficients and constants stand for interest, depreciation, labor, superintendence, load factors, commercial efficiencies, plant efficiencies and other quantities and values, which are familiar enough to the engineer, but of which the laws are only imperfectly known.

It must not be thought, however, that I wish to disparage scientific principles and methods in electrical or in any other branch of engineering. There is no other safe foundation, especially in electrical work. The agents and phenomena are so intangible and unusual that the old-time faculty of experienced intuition, by the light of which an engineer was supposed largely to work, is exceedingly difficult to cultivate and frequently leads the possessor startlingly astray. What we want is more appreciation of actual working conditions in our mathematics and a more scientific direction and greater breadth of applicability in our engineering experiments. This latter need is the weakest part of all engineering science and the most important. An isolated case of a machine which works well contributes little to knowledge. A similar case of one which works badly gives not much more information. But it is perhaps unreasonable to expect manufacturers to build a series of experimental machines, each differing slightly in one particular, to settle the absolutely best conditions, or if this is done, as has been sometimes the case, the world at large can hardly expect to have the benefit of the work presented to it. Moreover, workshops are not the best places for research, nor is engineering experimental work a pastime at which untrained players can get results of any value. It is easy to obtain some sort of result in experimental work; it is so difficult to attribute it to its true cause and to eliminate all side issues. From the nature of the case secondary actions crowd around the main point and but few men can have both time and ability for elucidating them. Much good work has been done in the factory, but, as stated above, it is generally of an unobtrusive nature. Much has also been done in physical and technical laboratories, and I venture to think that manufacturers, central station and consulting engineers will find that a greater amount of sympathy with these institutions and mutual assistance and collaboration with them will result in true economy to themselves and will greatly help to establish a firm scientific foundation for electrical engineering.

The value of a light attached to a buoy flung into the sea to save a life, says an English magazine, has been well proved by the Holmes chemical torch, which ignites when the water reaches the composition. A German electrician has recently brought out a new buoy lighted by an electric lamp of sixteen candle-power enclosed in bullseye lenses and protected by a cage of wire. The current is supplied by an accumulator of the "solid" or celluloid type forming part of the buoy and charged so as to maintain the light for no fewer than six hours. As the light can be seen for 2,000 yards in any direction, the buoy will be a useful aid at sea.

NOTES ON RECENT ELECTRICAL ENGINEERING DEVELOPMENTS IN FRANCE AND ENGLAND[*]—III.

DISCUSSION.—(*Continued.*)

Mr. M. N. Forney—There are some things contained in this paper in relation to the Heilmann locomotive which interest me very much. I might say in the beginning that I know very little about electricity, but I know perhaps something about locomotives. There are several statements in this paper which are urged in favor of the locomotive and which could hardly go entirely to the credit of the electric locomotive. For example, it is said that the Heilmann locomotive rests upon sixteen wheels, and on page 144 that Mr. Heilmann "is able to carry a larger boiler and hence does not have to crowd it to such a wasteful point." Now it is not quite clear to me why you are not able on an ordinary locomotive to carry as large a boiler on sixteen wheels as on an electric locomotive. An ordinary locomotive and tender is always carried on sixteen wheels although the weights are not exactly the same, the Heilmann locomotive being heavier. The electric locomotive must, in addition to the engine and boiler and other appliances, carry its electric machinery besides. So that it appears that the old steam locomotive has something to say for its side.

There is another statement on page 144 in which it is said that "probably at least one-third of the cost of maintenance of the roadbed and the locomotives for high speed service could be traced directly to this destructive hammer blow and side thrust." Now it would be interesting to know on what sort of evidence that statement is based. I confess that after being a student of railroad matters for a good while I have never heard that so large a proportion of the repairs of roadbed can be assigned to any such cause as that. It is very true that experiments have been made showing that some very destructive action occurs in locomotives in which there is an excessive amount of counterbalance. A good many cases have been quoted in which, it is said, that rails have been bent, and the experiments made at Purdue University also show that at very high speeds, with excessive counterbalance, the wheels raised up entirely clear of the rails. But it is also shown by the same experiments that there are substantially no injurious results when the locomotive is counterbalanced in a reasonable way.

On page 146 it is said that the cost of the Heilmann locomotive is $30,000. Now an ordinary passenger locomotive of the largest size can be obtained for about $10,000 to $12,000 at the present time. There would therefore be a difference of about $18,000 to $20,000 in favor of the present steam locomotive. I think hardly any prudent business man would venture to make an investment of that kind without allowing 10 per cent. on the extra cost to cover the interest and cost of replacing it. That would give you an excess of interest account for the Heilmann locomotive of $1,800 to $2,000. You may take it as a rough statement that a locomotive will burn per year about $2,500 worth of coal. I am taking a rough average through the country. As you have $1,800 to $2,000 excess of interest for the Heilmann locomotive, you would have to do the same amount of work with $500 to $700 worth of coal with the Heilmann locomotive that we are now doing with $2,500 worth on the steam locomotive.

I am entirely ignorant of the appliances used on the Heilmann locomotive, and there may be features there which would give a very great advantage in locomotive practice. But from the showing that is presented here it seems to me that there is a good deal still to be said in favor of the steam locomotive.

Dr. Cary T. Hutchinson—It may be interesting to give some information about a large electric locomotive which has just been finished by the Baldwin Locomotive Works. This locomotive has eight drivers connected rigidly by side bars, making a wheel base of 16 feet, the length over all being about 30 feet. The weight is 133,000 pounds uniformly distributed on the eight drivers, giving 16,700 pounds to each driver. There are four motors, one on each axle, the motors being built directly on the axle without springs of any kind between the armature and the axles.

The machine has a capacity, on a four hour test, of 1,000 H.P. at a speed of 35 miles per hour. The regulation is the series parallel. The motor being: 1st, all in series; 2d, two series by two in parallel; 3d, all four in parallel. There is also a resistance intended for use on first position in starting. The lowest speed, without resistance, is about seven miles per hour.

A test recently made at the Baldwin Locomotive Works showed an efficiency of more than 92 per cent. when operating 1,000 H. P.

The motors are designed so that they will work without sparking with full current in the armature at one half normal field strength. That is to say, they will operate at any speed from 35 miles per hour up to about 65 miles per hour at the same power, the drawbar pull varying inversely as the speed. At speeds below 35 miles per hour the drawbar pull is constant, the power, therefore, being directly proportional to the speed.

The smoothness and absence of vibration was very noticeable in the test referred to. The entire machine was supported on four jacks without bracings; when running with full torque there was scarcely any shaking.

Mr. W. L. Bliss—On page 144 Mr. Leonard says: "But regardless of an abundant supply of steam from the boiler, we find ourselves greatly limited in power for steam locomotive practice at high speed, because of the wire drawing of the steam and difficulty of properly exhausting when we run our locomotive at its highest speed."

On page 145 he states further: "The engine in practice," which I suppose is the engine driving the dynamo, "is varied in speed from 60 to 500 revolutions, and the strength of the generator field from zero to its maximum strength." I have made a rough estimate here as to what that speed represented. In the first place, on page 144, Mr. Leonard complains that the high speed of the steam locomotive causes wire-drawing of and difficulty in exhausting the steam, whereas these troubles are obviated in the Heilmann locomotive. He assumes, however, that in the Heilmann locomotive the prime mover runs up as high as 500 revolutions. I have made a little calculation on the margin. I remember that the Empire State locomotive No. 999 has 86 inch driving wheels. That would be a circumference of 22.2 feet. At 60 miles per hour the drivers would make 236 revs. per minute, which is less than one-half as fast as the Heilmann locomotive would be going to make the same speed on the assumption that the latter makes 60 miles per hour at 500 revolutions. If we go to 120 miles per hour (or 112 per hour, which is the record of the Empire State locomotive), we should not be running the same quite as fast as the Heilmann prime mover, so that I should think there would be no more difficulty with high piston speed and wire drawing in the Empire State than in the Heilmann locomotive, for the engines are evidently operating at nearly the same speed.

Mr. Richard Fleming—In connection with the cost per kilowatt of the European dynamos, I would like to ask Mr. Leonard why the cost of the dynamos is higher there than here. Are they more liberally proportioned, or is the workmanship so much superior to ours that they have to charge more for them? Why is it? I would also like to state in connection with the use of the three-wire system on alternating lines that in the winter of 1890-91 I built a small plant in the far West, in Washington, where I transformed from 1,000 volts in the primary to 208 volts in the secondary, using the Edison three-wire system. They were compelled to change from the regular continuous current three-wire system to the alternating and used the same wire. We used the standard Thomson-Houston transformer with primary windings in multiple and secondary windings in series.

Mr. Joseph Sachs—The remarks made by the previous speaker bring to my mind a similar instance of a small plant installed in 1889 in this city in the Lenox Lyceum, which was wired to be operated by the Edison three-wire system. Afterwards a small alternating plant was installed at the station of the New York Steam Company adjacent and two Westinghouse machines were put in, operated at 1,000 volts and the secondaries of the transformers operated at 50, were so employed as to operate all the three-wire Edison system in exactly the ordinary three-wire fashion. This was quite an original feature at the time, as not very much of this kind of work had been done at that date. I would also like to make a note of the line on page 135: "What is needed is a generator of electricity directly driven by, or preferably constituting a part of the revolving disk, and here is food for considerable thought." I wish to say that several friends of mine at the present time are at work on such a device, and it has often seemed to me that it would be feasible to devise some form of unipolar or very simple commutating machine which could be coupled to the shaft of a very high speed turbine, and although the element of friction, which is really the principal thing to be overcome in a case of that kind, is very severe, I believe that such a device can be operated. A self-contained dynamo and engine of that kind would certainly be the acme of simplicity and cheapness. Prof. Crocker may perhaps be able to give us some figures in regard to the coupling of unipolar dynamos at these speeds to turbines.

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[*] H. Ward Leonard's paper read at a meeting of the A. I. E. E., February 27.

Prof. Crocker--I hardly think a subject of that magnitude can be considered a proper part of the discussion of a general paper of this kind, but I believe that some such device as you suggest can be made practicable. But it is such a large subject that it would require an evening for itself.

The President—Before calling on Mr. Leonard to close the discussion I wish to voice what I am sure are the sentiments of this meeting, by saying how much we have enjoyed this able paper, and how the value of the paper is evidenced by the very general discussion it has called forth.

I would like to say on my own part that I do not share Mr. Leonard's fear as to the evil effects of gigantic corporations, although I do not desire to be regarded as speaking unqualifiedly in favor of them. I do not think, however, that the statement made, that the practical development of engineering improvements is opposed by the gigantic corporations in the electric field is warranted by the facts. On the contrary, if I have read aright the history of progress of electrical engineering science in this country, it has not been in spite of the gigantic corporations but by reason of such corporations that such progress has been made. If here and there an inventor does not succeed in getting his particular system adopted by a corporation, he may, perhaps, naturally feel that such corporation stands in the way of its introduction. But we should not lose sight of the fact that these corporations are in the field for business and will be apt to buy anything that has real commercial value. It might be true, if all the corporations were represented by a single body, that such gigantic monopoly might absolutely discard anything of value. But when we remember that there are several, perhaps three or four or half a dozen, it is evident that a live company or corporation cannot fail to see the advantage of anything which possesses true merit.

I have shared the general surprise of probably some of you here in learning that the Heilmann locomotive, a locomotive that probably carries a central station with it, can show such favorable figures as it appears to regarding economy. It is a matter of great surprise to me, and I am rather disposed to think that a great deal of the supposed advantages possessed by the Heilmann locomotive will, in fact, be found to consist in an improvement of mechanical locomotive practice. If, however, it be true, what we have claimed for the great flexibility of electricity as a means of long distance transmission of power, will, it seems to me, to a very great extent be lost. It is a very interesting question, however, and I shall look to the solution of it with considerable interest. Of course, I recognize the question of speed as being in favor of the electric locomotive.

I will only say, in conclusion, as to Mr. Leonard's fear lest all able consulting engineers should be controlled by these gigantic monopolies, that he affords a notable instance of an able one who, I believe, has not yet been so controlled.

(To be continued.)

The Hogan Boiler Company.

On Tuesday, April 9, there will be a public exhibition of the Hogan boiler at the works of the company in Middletown, N. Y.

Trains leave foot of Chambers street at 9:15 and 10:30 A. M., returning to New York early in the evening.

The Trolley's Onward March.

It is announced that the New York Central Railway Company will equip the branch from Buffalo to Niagara Falls with the trolley system and that many of the contracts therefor will be signed this week.

This move is probably due to the fact that another company has planned for a new electric line between those points.

London Notes.

(From our London Correspondent.)

Transmission of Power by Electricity.

At the ordinary meeting of the Institution of Civil Engineers on March 5 two papers, dealing with the transmission of power by electricity, were read.

The first, on "Electrical Haulage at Earnock Colliery," by Mr. Robert Robertson, B. Sc., M. Inst. C. E., opened with an account of the general features of the colliery and of those of its seams into which electrical haulage had been introduced. The arrangements of the shafts and the capacities of the cage and coal-hutches were such that the daily output amounted to 1,200 tons. Details were given of the lengths and gradients of the main haulage roads in the Ell and Main coal seams and of the two steam hauling engines operating those roads on the main and tail and endless rope systems respectively. Electrical hauling engines had been introduced to drive endless ropes and to replace horse traction between the main haulage roads and the working faces.

The electrical generating plant comprised a dynamo for supplying power to the electrical hauling engines, capable at a speed of 620 revolutions per minute of an output of 100 amperes at 490 volts. It was driven from a shaft coupled direct to two single-acting Westinghouse engines, having cylinders 13½ inches in diameter, with a length of stroke of 12 inches, and developing together, when running at their normal speed of 350 revolutions per minute, 122 H. P. with a steam pressure of 50 lbs. per square inch. The electrical circuits were metallic throughout and the conductors were highly insulated, being sheathed also in iron pipes in the shaft and supported upon insulators in the workings.

The two electrical hauling engines, of which the main features were similar, were next described and illustrated. The motor of the engine in the Ell coal seam, when running at a speed of 770 revolutions per minute, developed 35 H. P. with a current of 76 amperes at a pressure of 400 volts. It was geared, through an intermediate shaft, to two pulleys with Hurd clips, each provided with a friction clutch and brake, by which the cables were driven at a speed of three miles per hour. The two cables were of stranded steel wire ¾ inch in diameter, and after passing over balance wheels placed in recesses near the engines operated circuits of 2,160 yards and 1,020 yards in length respectively. The cables were supported at intervals of about 30 feet along the roads by rollers 4½ inches in diameter, and at the corners were passed over wheels 5 feet in diameter, mounted upon vertical axes below the level of the rails. The gradients were so arranged at the corners that the trains of trucks could there travel without aid from the ropes. In the main coal seam a cable operated similarly a circuit 1,580 yards in length. The cables were driven continuously at a uniform speed, and the coal-hutches were attached to or detached from them by a Smallman clip.

The efficiency of the plant as compared with the horse traction which it had replaced was then considered. The electrical haulage system in the Ell coal seam was capable of a daily output of 400 tons. The daily output by horse traction had been 180 tons, and to increase this to 400 tons thirty or forty horses would have been required, a number which could not have been employed in the available space without confusion. The daily output of the electrical haulage system in the Main coal seam, which was not yet working at its full capacity, was between 150 and 200 tons.

The yearly working expenses of the two systems were compared, upon the results of one and a half years' working, and was found to be £4,180 and £1,990 by horse traction and by electrical haulage respectively, showing that an annual saving of £2,140 had been effected by the latter. The total cost of the electrical installation had been £3,500.

In the second paper—"Water Power Applied by Electricity to Gold Dredging"—by Robert Hay, M. Inst. C. E., an account was given of a plant which had been erected in New Zealand to utilize water power for generating electricity to be transmitted to motors operating a dredge in different portions of a distant river. The author pointed out that the transmission of water power by electricity, in well watered countries like New Zealand, rendered available deposits of gold in districts in which the scarcity of fuel would not permit of their being worked by other means. The plant described had been constructed for gold dredging in the River Shotover, the course of which was for the most part in rocky gorges through rugged country, accessible only by tracks cut down the leading spurs and gullies.

The source of the water power and the method of its application were then described and illustrated by a longitudinal section of the pipe line. The water was obtained at a creek one and a half miles distant from the dredging ground, and was brought by a race cut in the side of the hill, or, in places where the ground was not suitable, in a timber flume to a pressure tank at a level of 524 feet above the pipes at the generator house. From this tank to the Pelton wheel the water was carried in rolled steel pipes constructed in lengths of 19 feet 6 inches, bolted together by wrought-iron flanges riveted to the pipes.

The prime mover of the generating plant was a 4-foot Pelton reaction water wheel, upon the buckets of which the water, from a nozzle 1⅜ inches in diameter, impinged at a pressure of 228 lbs. per square inch. This wheel drove two series wound dynamos working at a normal speed of 700 revolutions per minute, each developing a current of 40 amperes at an electromotive force of 650 volts, or together nearly 70 H. P. The dynamos were coupled in series, and to guard against damage from abnormal increase of current a regulator was so arranged as to throw into the circuit an artificial load in case of the current becoming from any cause 3 amperes greater or less than its normal amount. The conductors, of a length of two miles, were of No. 4 S. W. G. bare copper wire, and were supported upon insulators carried by cross-arms upon old 40-lb. rails.

The current was conducted to two motors in the dredge, one for driving a centrifugal pump and the other for operating the buckets, winches and revolving cylinder. These two machines were duplicates of the dynamos and were coupled in series so that when the bucket motor was switched off the pump motor absorbed the surplus power by increasing the speed of the pump and causing it to throw more water.

The dredge was constructed for the most part of steel and was capable, when operating at a depth of 20 feet, of an output of 90 cubic yards per hour. The dredgings were delivered, through a revolving screen for separating the stones and coarser material, upon baize tables set at an inclination of 1 in 12. Two 10 ampere arc lamps lighted the dredge at night and were joined in multiple series with the motors, with suitable arrangements for their control. A table of particulars of the efficiencies of various parts of the plant was given. The cost of the installation and the weekly working expenses, £7,000 and £35 respectively, were also tabulated.

Cards are out for a reception and exhibition at the station of the Brooklyn Edison Company tonight (April 3).

A Move in the Right Direction.

The first steps have been taken to put feed water heaters upon a definite rating, and it is to be hoped that these steps will lead to reforms which every steam user knows are much needed. Feed water heaters, like boilers, have been rated in terms of horse-power, which for apparatus of this kind, as every one knows, have absolutely no meaning unless further data are specified. For instance, a boiler of a given size may with equal propriety be rated as 20 H. P., or 40 or 10, and unless the conditions under which it is operated are specified, none of these ratings means anything, simply from the fact that the boiler does not do any work at all and therefore the term as applied to it is fallacious. So with feed water heaters. If, however, in describing a boiler the grate area and heating area are given, the data are at hand for calculating the performance under any given conditions, and boilers are thus now so designated. The same method of rating of feed water heaters would seem to commend itself, and we are glad that the subject has been taken up by such responsible people as indicated by the following :

Astor House, New York, Jan. 26, 1895.

We, certain manufacturers of closed feed water heaters, in convention assembled, declaring—

That a better understanding among ourselves and also between each of us and our customers in the matter of rating of feed water heaters is much to be desired, do hereby resolve

That we believe that the only proper rating for feed water heaters is one which is based upon the square feet of heating surface contained in the heater. For the purpose of giving practical shape to this belief we do further resolve

That we hereby agree that for the future we will in each and every case in which we are called upon to make prices upon heaters, state the exact number of square feet of surface which we are offering : to give further effect to this action we resolve

That we will in each and every case state without reservation, both in our printed catalogues and in our specifications, the diameter of the tubes, the number of the tubes, the number of lineal feet thereof and the total square feet of heating surface in each heater offered.

Resolved further, that the secretary be requested to transmit a copy of these resolutions to every manufacturer of closed heaters in the United States.

And we hereby agree to live up to the spirit and the letter of the foregoing and to bind ourselves so to do by our signatures affixed below.

Resolved finally that the secretary be requested to invite all closed heater manufacturers of the United States to join this Association and to subscribe to the foregoing resolutions.

(Signed) The Taunton Locomotive Mfg. Company (makers of the Wainwright Feed Water Heater), Benj. F. Kelley & Son (makers of the Berryman Feed Water Heater), Wm. Baragwanath & Son (makers of the Baragwanath Feed Water Heater), The Goubert Mfg. Company (makers of the Goubert Feed Water Heater), The National Pipe Bending Company (makers of the National Feed Water Heater), Robt. Wetherill & Co. (makers of the Wetherill Feed Water Heater), Keystone Engine and Machine Works (makers of the Keystone Feed Water Heater).

FRANK A. THAYER, Secretary.
14 Church street, New York.

The Cincinnati and Dayton Electric Line.

The project of building an electric line from Cincinnati to Dayton via Middletown and Hamilton appears to be on a sound footing. The directors of the company are: L. C. Weir, president Adams Express Company; S. M. Felton, president Cincinnati Southern Railroad; W. A. Goodman, president National Lafayette Bank; A. Hickenlooper, president Cincinnati Gas Light and Coke Company; H. H. Hoffman, president Cincinnati Tobacco Company; O. C. Barber, president Diamond Match Company; George B. Cox, president Hauss Bro. Manufacturing Company; O. B. Brown, attorney-at-law, and H. B. Morehead, financial agent.

Mr. Hickenlooper says:

Our company will build a double track between Avondale and Dayton, going due north to Glendale, and from there northwest to Hamilton, and thence on to Dayton. Next week we will probably fix the date for beginning the work of construction. I do not know whether we will operate with a single or double trolley system. Can we compete with the railroads? Well, I rather think so. The line is so near straight that we will have an advantage in the matter of miles, and expect to make very nearly as good time as the railroads. But it is in the fare that we will be able to do most. We will carry people for about one-third the fare charged by the railroads.

BOOK REVIEW.

PROCEEDINGS OF THE INTERNATIONAL ELECTRICAL CONGRESS HELD IN THE CITY OF CHICAGO, AUGUST 21st TO 25th, 1893. Cloth. 8vo, 488 pp. $3.00. Published by the American Institute of Electrical Engineers, New York.

This book is the official record of the proceedings of the Congress and will be valued by all who wish to preserve in convenient form the many valuable and interesting papers presented at that time, as well as the decisions of the Chamber of Deputies which settled, for the time being at least, so many of the points at issue up to that time. Aside from its value as a work of reference, a book of this kind loses much of its value by such a long delay in issue, but in this case at least the delay seems to have been unavoidable by reason of the widely scattered residences of those whose co-operation was essential to its success. It were far better, however, that the publication should be late and *accurate* than that it should be earlier and inaccurate, and we believe that the delay has been warranted, in a measure at least, by the apparent extreme care and fidelity with which everything connected with the Congress has been collected.

There has been one very regretable omission, however, viz., that of Prof. Ayrton's elaborate paper on the Arc Lamp. The manuscript of this, through a most inexcusable and unfortunate piece of carelessness, was destroyed, and we are ashamed to say that the carelessness was that of an American.

While the present price of the book is $3.00, we are notified that this is subject to advance, doubtless in anticipation of libel suits on the part of some of the members of the Chamber of Deputies whose pictures are given in the frontispiece. This latter is simply awful. What will Mascart's descendants say when they see his picture? Rowland is all right if he wants to look that way, but we fancy that even Prof. Forbes would not be so unkind as to send him a valentine like this. Hospitalier looks as though he was saying "Oh mamma, see me now," and Carhart's picture reminds one of the picture entitled "Who Said Rats?" Preece resembles a Methodist clergyman of the Pike County type, or the Rev. Stiggins about to weep over the cruel jibes of Weller, Sr. Elihu Thomson—well the story is told of a good old Harvard professor who in his absent-mindedness was walking with one foot in the gutter and the other on the curbstone, and wondered what made him so lame. Thomson looks as though he were doing the same thing, but with his hand upon his heart was devoutly hoping he wouldn't be that way always. Mendenhall has a pose and expression recalling Ajax defying the lightning as he stands there with bared breast looking off into space of n dimensions. We fancy Ajax never assumed such a tantalizing pose, however—either this or the lightning was unusually good-natured. Leduc looks like Weaver of the *Electrical World*, but that is the fault of the camera, and he is not to blame. We remember seeing a picture once entitled "A Black Cat in a Dark Cellar." It was a nocturne in which the cat was invisible by reason of its surroundings. Voit's picture reminds us of this—he is invisible by reason of his surroundings.

LEGAL NOTES.

N. Y. Insulated Wire Co. vs. Westinghouse Electric Co.

Suit was brought last week in the Supreme Court by the New York Insulated Wire Company against the Westinghouse Electric Manufacturing Company to recover $35,411.51 alleged to be due as a balance for the wiring work on the World's Fair Building, and an attachment was secured against the property of the latter company in this State.

Later the attachment was set aside by Justice Beekman upon the claim of the Westinghouse officials that they have a defence to the action, and that the procuring of an attachment against the property was a spiteful attempt on the part of the Insulated Wire Company to do the Westinghouse Company an injury.

In the suit of the Citizens' Electric Light Company against the city of Jacksonville, Fla., involving the question of commercial lighting, Judge Call decided that the city had a legal right to put in an electric light plant and to furnish commercial lights to its inhabitants.

The Montgomery County (Pa.) Railway Company, operating a trolley line, sued the Pennsylvania Railroad Company to secure the right of way at crossings along the route of its railway and gained a favorable decision in the lower court. The case was appealed and the Pennsylvania Supreme Court has reversed that decision, holding that the Street Railway Act gave no right of eminent domain, and that as the trolley lines are incorporated under that act they have no power to construct their roads where the taking of property is incident or necessary to it without the consent of the property owners. The decision injuriously affects $50,000,000 of capital invested in trolley lines over the State, and many of the long distance projected lines will have to be abandoned or compelled to confine themselves to highways until relief is secured from the Legislature.

Judge Green, of the U. S. Court at Trenton, N. J., has refused to grant the injunction sought by the American Graphophone Company restraining the Edison Phonograph Company from operating under the Edison patents. Similar suits were brought in New York, Ohio and other States. The decision of the United States Court at Trenton will, it is thought, govern the decisions in the other States.

Judge Wheeler has ordered Receiver C. S. Mersick, of the Ansonia Electric Company, of Ansonia, Conn., to use part of the money paid for the concern by Franklin Farrel for a 10 per cent. dividend for the creditors, the rest to go to the receiver. An additional 15 per cent. will be paid later.

Electric Snow.

The story of a most remarkable snow storm is told by Lieut. John P. Finley, one of the best-informed meteorologists in the United States, who encountered the storm in making an ascent of Pike's Peak. He says the storm could best be described as a "shower of cold fire." In reality it was so charged with electricity as to present a scene more easily imagined than described. At first the flakes only discharged their tiny lights on coming in contact with the hair of the mule on which the lieutenant was mounted. Presently they began coming thicker and faster, each flake emitting its spark as it sank into drifts of the snow or settled on the clothing of the lieutenant or the hair of the mule. As the storm increased in fury and the flakes became smaller each of the icy particles appeared as a trailing blaze of ghostly white light, and the noise produced by the constant electric explosions conveyed an impression of nature's power which Lieut. Finley will never forget. When the storm was at its height and each flake of snow was like a drop of fire, electric sparks were shaken in streams from the lieutenant's finger tips, as well as from his ears, beard and nose, and a wave of his arms was like the sweep of flaming sword blades through the air, every point of snow touched giving out its little snap and flash of light.—*New York Tribune.*

General News.

What is Going on in the Electrical World.

Monroe, Mich.—The council has passed an ordinance revoking the franchise of the Toledo, Monroe and Detroit Electric Railway Company.

Flushing, Mich.—At the late election it was voted by a large majority to bond the village in $20,000 for a waterworks and electric light plant.

Warsaw, Ill.—Wilcox & Son, of Oskaloosa, have bought the local electric light plant from E. B. Hillman & Co., of Peoria, who established the plant.

Bloomfield, N. J.—The 10 per cent. reduction in wages which took place at the Sprague Electric Elevator Works last fall has been restored to the men.

Pittsburg, Pa.—The contract for the construction of an electric railway from Pittsburg to Johnstown has been let by the Second Avenue Traction Company.

Trenton, N. J.—The bill authorizing cities of over 50,000 population to construct and maintain electric light plants has passed the House and is now before the Senate.

Mauston, Wis.—The Mauston Improvement Company, of which J. T. Heath is president, intends to put in electric lights and a telephone system here at an early day.

St. Paul, Minn.—Thomas Lowry, owner of the Selby Avenue cable line has decided to change that line to an electric and extend it to Minneapolis over the Marshall avenue bridge.

Oregon, Ill.—The officials of the Rock River Electric Railway have decided to go to work at once on the new road.—There is talk of building an electric road from Oregon to Amboy.

Gloversville. N. Y.—The route for the proposed trolley railroad from Gloversville to Broadalbin has been surveyed, and as sufficient funds have been raised there is no doubt of the road being built.

Fort Wayne, Ind.—Murray Hartnett has been appointed receiver for the Orr Bros.' Electric Manufacturing Company. The company was incorporated about a year ago with $10,000 capital.

Lancaster, Wis.—The Lancaster city council has granted to Edward Pollock an exclusive franchise for an electric light and power plant upon condition that it shall be in operation within six months.

Chatham, N. Y.—Bids will be received at the office of the city clerk until noon on the 8th day of April for lighting the streets of this village. Eighty-five incandescent lights or more, of 25 candle power, are required.

Guthrie, O. T.—The local electric light plant is now in the hands of J. Sam Brown, who has paid off the mortgages on the plant and will make improvements in the way of new machinery and give an all night service.

Herkimer, N. Y.—The application of the Mohawk, Herkimer and Ilion Railroad Company for a change of motive power from horses to electric trolley on their street line has been granted by the State Railroad Commissioners.

Peoria, Ill.—The Peoria General Electric Company has applied to the city council for permission to erect poles and string wires for the purpose of furnishing light, heat and power to the city and its inhabitants.

London, Ont.—The street railway company have secured permission to change the motive power of their road from horses to electricity. Henry A. Everett and E. W. Moore, of Cleveland, O., are the principal owners of the road

Stoughton, Mass.—The capital stock, $12,000, of the company that proposes to build an electric railway between Stoughton and Canton has been subscribed, a board of directors elected, and work on the line will begin as soon as practicable.

Medford, Wis.—Prominent business men and taxpayers have petitioned the council to order an election to get the public vote on the question of bonding the city in the sum of $5,000 for the purchase of an electric light plant to be owned and operated by the city.

Lockport, N. Y.—The council has granted a franchise for an electric street railroad in this city to C. A. Johnson, of New York. The city discontinues none of the pending actions against the old company until Johnson either fails to perform or complete his contract,

Oshkosh, Wis.—J. K. Tillotson of the Wisconsin Interurban Railway Company states that contracts have been let for twenty-six miles of rails to build the interurban line from Oshkosh to Kaukauna, besides fifteen miles of road to be built in the city of Oshkosh.

Wilmington, Del.—It is reported that all the funds needed for the West Chester and Wilmington Electric Railway are arranged for. The route is via Talleyville. As soon as the Legislature grants the charter there is nothing to prevent the commencement of work at each end.

Winona, Minn.—Receiver S. B. Livermore, of the Winona General Electric Company, has filed with the clerk of the United States Court a statement showing the financial standing of the company. The assets are $147,607.15 and the liabilities $504,610.42, which includes $270,000 of bonded indebtedness.

Frankton, Ind.—The town council has granted to Congressman elect Charles L. Henry a ninety-nine-year franchise of the streets for electric street railway purposes. Mr. Henry proposes to put in a line from Anderson to Elwood, passing through Frankton, and connecting at Anderson with the Indianapolis-Marion line.

Niagara Falls, N.Y.—The first great dynamo is set up in the power-house of the Cataract Company and is ready for operation, only awaiting the completion of the switchboard. The second dynamo is completed and after undergoing the requisite tests at the works of the Westinghouse Company at Pittsburg will be taken apart and shipped to the Falls.

Warren, O.—Col. D. M. Yeomans, of Kinsman, says there are prospects that the projectors of the electric road to connect that village with Chagrin Falls will consolidate with the Cleveland Suburban Electric road, which contemplates constructing lines to many northern Ohio towns, among them Chagrin Falls. The Kinsman-Chagrin Falls road will run through Bloomfield and Burton.

Milwaukee, Wis.—The *Sentinel* states that the number of men engaged in electrical pursuits in this city reaches into the thousands, that electricity is a factor in nearly every branch of business, and that millions of dollars are invested in electrical enterprises here. Over 50,000 incandescent lights and a proportionate number of arc lights enable the inhabitants to get around and see all there is to be seen after nightfall.

Athens, Ga.—The charter of the Tallesee Shoals Electric Company is being prepared. The capital stock of the company will be $50,000, with the privilege of increasing it largely. The enterprise will develop fully 1,200 H. P., which will be furnished cheaply to the manufacturing interests here. The Tallesee shoals are eight miles from Athens, and are one of the best water powers in the State.

Atlantic, City, N. J.—It is reported here that a syndicate of New York and Atlantic City capitalists have formed a company, which is capitalized at $4.000,000, to build an electric railway from New York to this city. If the scheme proposed goes through, the road will be in operation next summer. It is understood to be the same company which is building electric roads in and about Baltimore and Washington, and is now extending them northward to Philadelphia.

Seneca Falls, N. Y.—The Seneca Falls and Cayuga Lake Railroad, including the roadway from Ovid street to Cayuga Lake park, and all the property and rights of way of the company, will be sold here by the sheriff on the 18th inst. —It is understood that the electric railroad companies between Geneva and Seneca Falls have been consolidated under the name of the Geneva, Waterloo, Seneca Falls and Cayuga Lake Traction Company.

Chattanooga, Tenn.—Henry S. Ewing, special commissioner, has filed a deed of the property and franchises of the Chattanooga Electric Light Company to the Chattanooga Light and Power Company, the consideration being $250,000; the latter company has filed a deed of trust to the Old Colony Trust Company as trustee to secure an issue of $300,000 in bonds of denominations of $1,000 each, payable in gold coin in thirty years, and bearing 6 per cent. interest per annum.

Rochester, N. Y.—The Rochester. Charlotte and Manitou Railroad Company is the name of the company organized to take the place of the Grand View Beach Railroad Company, which went into the hands of a receiver last fall. The capital stock of the new company is $100,000. The directors of the company are: Michael Doyle. Louis Werfield, Charles W. Briggs, Valentine Fleckenstein, Otis H. Robinson, Emmett H. Craig, Martin Beatties, George L. Brown and Jacob Odenbach.

Logansport, Ind.—The Logansport city council has revoked the right of the Jenney Electric Light Company and the Logansport Electric Light and Power Company to furnish electricity to private consumers. The former has operated here for ten years under a contract which recently expired, while the latter exists under a special ordinance which the Supreme Court is said to have declared illegal. Both companies are ordered to remove all poles and wires from the streets within ninety days.

Sedalia, Mo.—A convention of superintendents of water, gas and electric light plants in Missouri was held here recently to perfect a permanent organization in the interest of the three branches of business. Nearly all of the plants in the State were represented. The organization, to be known as the Missouri Water, Gas and Electric Association, was perfected by the election of the following officers: President, W. E. Walton, Butler; vice-president, James A. Montgomery, Sedalia; secretary, C. F. Strohm, Nevada; treasurer, R. D. Wirt, Independence.

Lake Charles, La.—The town council recently referred the application of the embryonic Electric Railway, Heating and Telephone Company for a charter to a committee which is noted for hostility to new enterprises. When this action became known there was a general feeling of disappointment, and one irate citizen was heard to remark: "The people want improved methods of light, heat, communication and travel, and the fear that the electric cars may frighten a grass-fed pony or startle some cow into swallowing her cud will not deter them from demanding it."

Brooklyn, N. Y.—Electric lights are now in successful operation on the Bridge cars. Current is supplied by means of an ordinary trolley pole which is automatically reversed at either terminus. There are ten 16 C P. incandescent lights to each car, or 480 in all, 48 cars being the maximum number used at present.—An ordinance limiting the speed of trolley cars in the city streets to eight miles an hour has been adopted by the board of aldermen.—The specifications for the new lighting contract were published in the city papers of the 26th ult.

Louisville, Ky.—The Pennsylvania Railroad Company will soon test electricity as a motive power on the local accommodation trains running on their road between Louisville and New Albany. If the test proves successful electricity will likely be introduced for running accommodation trains on other parts of the system.—The Louisville Railway Company is transforming its cars on the Sixth street line into motor cars and trailers. Mules have heretofore furnished the motive power. Other lines in Louisville not yet electrically operated are to be changed in the near future.

Sacramento, Cal.—The *Bee* states that W. W. Felts, of this city, "has succeeded in developing a continuous electric light from a primary battery. He claims also that his battery is a perfect electrolyte and polarizer combined. Mr. Felts says that a continuous electric light from a battery has been heretofore considered almost impossible. Bunsen's system of primary battery is only certain for three hours at a time, whereas he claims that his battery will run for one month without cleaning or replenishing. He refuses to allow anybody to inspect his battery."

Buffalo, N. Y.—The New York Central Railroad Company intends to introduce the trolley system on its road between Buffalo and Niagara Falls as soon as the plans are ready. The power to operate the trains will be supplied by the Niagara Falls Power Company. Special cars of the observation pattern will be put on the road so as to give passengers a clear view of the scenery at the Falls. Sufficient power will be applied to give the cars the same rate of speed as at present, the fares will be reduced, and the comfort of passengers increased by the absence of cinders, smoke and other inconveniences of a steam road.

Atlanta, Ga.—The finance committee of the Exposition has approved Mr. H. M. Atkinson's plans for supplying electric lights and power. "The plans," says the *Constitution*, "contemplate the lighting of the Exposition grounds in the most brilliant manner. At night the park and buildings will be as bright as day. The Electrical Building and the flower garden, which are to be located inside the enclosure now used as a race track, will be particularly bright with lights. The Electrical Building will be a perfect blaze of glory and will shine to heaven."—The franchise for the electric line of the Atlanta Electric Railway Company in this city has been approved by the mayor, and the company has now the right to go ahead and build its line.

Detroit, Mich.—The Rapid Railway Company, the proposed electric line to run between Detroit and Mt. Clemens, has filed with the city clerk a chattel mortgage for $300,000 running to the Finance Company of Philadelphia. The company will hold the mortgage in trust for the holders of an issue of $300,000 worth of bonds. The mortgage covers the right of way in Hamtramck and Grosse Pointe townships, in Wayne County, and in the townships of Warren, Erin and Clinton, in Macomb County, franchises in Mt. Clemens and a traffic arrangement with the Detroit and Erin Plank Road Company on Gratiot avenue and the Citizens' Street Railway Company of Detroit. The bonds of the company are to run for twenty years at 5 per cent. Ex-Judge C. J. Reilly, as president, and Charles M. Swift, as secretary of the new company, signed the mortgage. Similar mortgages will be filed with the township treasurers of the several townships crossed.

Albany, N. Y.—Among the bills recently introduced in the Assembly was one appropriating $50,000 to establish a State board of gas and electric light commissioners, to be appointed by the Governor, the commissioners to have the right to annually inspect the business of gas and electric lighting companies.—A bill has been reported favorably from the Assembly Cities Committee which provides that at the next general election held in this State there shall be submitted to a vote of the duly qualified electors of each city of the first class the question of the ownership by such city of the franchises within its boundaries of all street railroads, whether operated on or below the surface of the street, and including also elevated railroads, and irrespective of the motive power which may be used on such railroads.—The bill authorizing the Canandaigua Electric Light Company to operate throughout the towns and villages in Ontario and Wayne counties has passed both branches of the Legislature and become a law.—The Senate committee on judiciary is giving consideration to a bill which is designed to convey in fee simple a mortgage on a good slice of the State to a company denominated the Maritime Canal Company of North America, which desires to be legally empowered to construct a $200,000,000 canal to unite the St. Lawrence and Hudson Rivers. The company, among other privileges too numerous to mention, desires to have a telephone and telegraph monopoly, the right to operate vessels of every sort and engage in a general real estate and transportation business. The most prominent men named in the bill are Henry G. Burleigh, Smith M. Weed, of New York State; "Sam" Allerton, the millionaire wheat manipulator of Chicago, and D. H Burnham, the builder of the World's Fair.

Telephone and Telegraph.

C. L. Downey has been authorized by an ordinance of council to maintain a system of telephones in Carbondale, Ill. It is understood that connection will be made with an exchange in Murphysboro.

The Harrison Telephone Construction Company for Kentucky and Tennessee has filed articles of incorporation at Louisville. The capital stock of the company is placed at $100,000. The business of the corporation is the construction and operation of telephones, and the principal office is to be in Louisville.

State control of telephone companies is the object of a bill now before the Massachusetts Legislature, and the Committee on Mercantile Affairs has given hearings to the advocates for and against the measure. The telephone companies are strongly opposed to it.

The trustees of Edgewater, S. I., have given the Automatic Telephone Company a franchise to establish its system in Edgewater.

A telephone company has been organized at La Crosse with local capital. The rates they propose are $30 a year for business telephones and $18 for residences.

The Wolf River Telephone Company of Orihula, Wis., recently incorporated, will put in a local exchange and construct a line from Orihula to Weyauwega via Fremont. The officers of the company are: Clemens Schmidt, president; Joseph Vogt, secretary, and A. L. Hutchinson, treasurer.

The citizens of Carbondale, Pa., are about to organize a company for the establishment of a telephone exchange. Parties who are prepared to furnish a complete and reliable system can obtain further information upon application to A. P. Trautwein, secretary of the Board of Trade.

The town of Calhoun, Ky., is now connected by metallic circuit with Evansville, Ind., and Nashville, Tenn., and will likely be in line with New York City the coming summer.

The Phœnix Telephone Company and the American Telephone and Telegraph Company have asked the council of Bayonne, N. J., for franchises to put in their telephone systems in that town. The company now operating through Bayonne is meeting much opposition because of its high rates.

The East Tennessee Telephone Company is making preparations to extend its lines from Chattanooga to Jasper, South Pittsburg and Bridgeport, and will shortly make connections by which Chattanooga will be able to communicate by the long-distance system with Knoxville and with Atlanta, Ga.

E. B. Monroe has applied for a franchise for a local telephone service at Warsaw, N. Y.

As a result of the telephone war at Frankfort, Ind., between the Central Union, the Strowger system and the Stethephone, the rates have been cut to a low figure. The Central Union makes the latest cut, and, besides, proposes to replace the old wire with the best quality of copper for long distance between Frankfort and Indianapolis and between Indianapolis and Lafayette.

A dispatch from Laporte, Ind., states that "the Elkhart Telephone Company, which will be a competitor of the Bell corporation, has been organized under the laws of Indiana. The board of directors includes R. B. Campbell, general manager Baltimore and Ohio Railroad Company, Baltimore, Md.; H. E. Bucklen, president Elkhart and Western Railroad Company, Chicago, Ill.; Charles Selden, superintendent of telegraph Baltimore and Ohio Railway, Baltimore; O. N. Lumert, Elkhart, Ind.; Joseph Claybaugh, Indianapolis, Ind.; W. F. Ranfiel, Frankfort, Ind. The company claims to have unlimited capital at its command."

The Indiana Harrison Telephone Company promises to begin the work of construction for its new system at Terre Haute in a few weeks. It expects to start into business with 600 subscribers.

The following statistics derived from the Bell Telephone Company's annual report are interesting. The report contains very full statistics of the business done for the ten years (1884-94). Instruments in the hands of licensees December 20, 1894, were 582,500 against 325,574 in 1884 and 566,491 in 1893; a gain for the past year of 16,015. This is a gain in increase of 2,244 over the increase of 1893, but 24,298 less than the gain in 1892, which was the banner year of the whole ten years. The year 1894 shows an increase less than any year since 1884 with the exception of 1893, the lowest previous record of increase being 23,478 in 1886. Miles of wire on poles increased the past year 17,332, and underground 27,610. Total miles of wire increased 43,194. The longest increases in miles underground have been: Boston, 2,841; Cleveland, 2,801; Detroit, 1,080; Jersey City, 1,720; Louisville, 2,080; Newark, N. J., 2,348; New York, 7,728; Washington, D. C., 1,083. The estimated number of exchange connections daily in the United States, made up from actual count in most of the exchanges, is 2,088,152, or a total per year of about 670,000,000. Not including the cost of current repairs and renewals, the companies operating under Bell licenses have expended during 1894, upon extensions of lines and apparatus, $4,138,000, and for buildings to accommodate their exchanges $411,000, making, with the amount reported last year, a total of investment in telephone property in the United States of $77,500,000.

The German Department of Telegraphs has been carrying on an investigation with a view to determining what effect the telephone wires in cities have on atmospheric electricity; i. e., whether the danger from lightning is increased or decreased by the presence of the miles of wires now necessary in cities in which the telephone is extensively used. The result of the investigation has been to show that the wires tend to weaken the severity of thunderstorms and to decrease the danger from lightning. From information received from 340 cities with telephone wires, and from 560 without them, it appears that the danger of damage by lightning in the two classes is as 1 to 4.6.

The Cumberland Telephone Company is extending its lines so as to connect Columbia, Tenn., with Lewisburg, Mooresville, Petersburg, Hampshire, Lipscomb and Frierson.

The Central Union Company has reduced its rates at Indianapolis to $60 a year and up for business houses within a mile radius and $42 for residences within that radius.

A charter has been granted by the Hustings Court at Staunton, Va., to the Mutual Telephone Company. The officers are R. S. Tuik, president; W. L. Oliver, vice president; Edgar M. Furkhouser, secretary and treasurer.

H. J. Edwards and associates have petitioned the common council of San Jose, Cal., for permission to establish a telephone system in that city. The company is composed of local capitalists.

The Bell Telephone Company, beset by competitors or competing projects in almost every town and city in the country, is rapidly reducing its rates, generally to a figure about two thirds of former rates, but when rivalry is pressing fifty per cent. or more is struck off.

At St. Joseph, Mich., the Gilliland Telephone Company of Chicago secured a franchise by offering to charge only $24 a year for the use of telephones in business houses. The Bell Company, which for years has been charging $48 a year, now announces a reduction to $18 for the same service.

The Strowger Automatic Telephone Company is making arrangements to establish its service in Milwaukee. The company has erected telephones in the Hotel Pfister and made connection with a 'phone in the Federal Building. The service does away with the necessity of operators or "hello-girls," the switchboard working automatically.

At Lockport, N. Y., the Bell Telephone Company has reduced its scheduled prices about ten per cent., and it is said this reduction will apply to all places in Western New York with the exception of Buffalo and Rochester.

The Laclede Electrical Company has 200 patrons pledged at Kokoma, Ind., and promises cheaper rates than the Bell Company, which has just reduced its charges 50 per cent.

The common council of Ithaca, Mich., has granted the Gratiot County Telephone Company a franchise to erect poles and string wires.

At a meeting of the projectors of the Home Telephone Company at Mobile, Ala., a few days ago, the capital of the company was fixed at $40,000, and the entire amount was subscribed. James K. Glennon, A. S. Lyons, P. J. Lyons, D. R. Burgess, A. H. Spira, W. H. Fitzpatrick, Henry Piser, Adam Glass and A. S. Benn were elected directors.

The ordinance granting a franchise to construct a telephone system in Philadelphia to the Drawbaugh Telephone Company failed of passage in the common council.

The Union Telephone Company, of Union, S. C., has been granted a charter. The president and treasurer is W. D. Arthur. Directors: G. H. Oetzel, W. E. Thompson, W. W. Nicholson and W. D. Arthur.

A telephone exchange is to be established at Tampa, Fla., by a new company. The present service there is unsatisfactory. Ocala, Fla., will have a complete telephone system in operation in a few days.

A home telephone company having been arranged for at Emporia, Kan., a few days ago, the Missouri and Kansas Company as soon as it heard the news made a cut of 25 per cent in its rates; nevertheless the organization of the new company was determined on and it guarantees a still lower rate.

Rome and Americus, Ga., will shortly be linked to Atlanta by telephone. The building of the line to Rome is the first step toward telephone connection with Chattanooga, and that means a step toward connecting Atlanta with Knoxville, Memphis, Cincinnati and ultimately Chicago and the Northwest.

The Wisconsin Telephone Company (Bell) has determined to immediately reduce its rates about 25 per cent. throughout the whole State, with the exception of Milwaukee.

A telephone company composed of business men has been organized in Sacramento

Cal., to compete with the Bell Company. Arrangements have been made with the California Telephone and Construction Company for the use of the Columbia instruments and system, of which that company is owner of the rights on the Pacific Coast.

The Direct Cable Company announces a reduction in its rates to South Africa, but those of our readers who have dealings with the Dark Continent will still be obliged to use greatly condensed phraseology in their dispatches if they wish to leave any bequests for the promotion of civilization among the heathen at that end of the line. The new rates per word are appended: Cape Colony and Griqualand West, Cape Town, $1.48; British South Africa, $1.58; Natal Durban, $1 48; all other offices, $1.52; Orange Free State, $1.52; South African Republic (Transvaal), $1.52; British Bechuanaland, $1 52; Bagamoyo, $1.52; Dar Es Salaam, $1 52; Mombassa, $1.48; Imperial British East Africa Company's offices, $1.58; Zanzibar, $1 48.

COMMERCIAL PARAGRAPHS.

The Metropolitan Electric Co. are finding very ready sales for their new Carbon Open Circuit Battery that they recently put on the market.

The Electrical Installation Company.

The Electrical Installation Company, Chicago, of which Mr. L. E. Myers is president, announce the removal of their offices to Suite A, 1116 Monadnock Building, where they have largely increased facilities.

Phœnix Rubber Insulating Paint.

Messrs. Morris & MacCurdy of Indianapolis report an encouraging demand from all parts of the country for their new Phœnix Insulating Paint, and that those who have used it so far are emphatic in their praises. The company have erected a large warehouse and are now prepared to fill orders in any quantity at once.

Agencies are being established in every trade center.

The Mather Electric Company's Sales.

The Mather Electric Company of Manchester, Conn., report the sale through Messrs. H. B. Coho & Company, their New York contractors, of one 30 K. W. and two 50 K. W. direct-connected generators of their new type for Grace Chapel, Fourteenth street, New York City. Armington & Sims engines will be used.

The Walker Company is Coming to the Front.

The Walker Manufacturing Company, Cleveland, Ohio, closed the following contracts between March 1 and March 22, 1895:

Burhorn & Granger, 136 Liberty street, New York City, two 25 K. W. direct-coupled lighting generators.

Union Depot Railroad Company, St. Louis, Mo., forty-one double car equipments, eighty-two 30 H. P. steel motors.

Pittsburg Traction Company, Pittsburg, Pa., one double car equipment, two 30 H. P. steel motors.

Pittsburg, Crafton and Mansfield Passenger Railway Company, Pittsburg, Pa., one double car equipment, two 50 H. P. steel motors.

Federal Street and Pleasant Valley Passenger Railway Company, Pittsburg, Pa., two double car equipments, four 30 H. P. steel motors.

Suburban Rapid Transit Street Railway Company, Pittsburg, Pa., one double car equipment, two 25 H. P. steel motors.

Schuylkill Electric Railway Company, Pottsville, Pa., four double car equipments, eight 25 H. P. steel motors.

Chicago City Railway Company, Chicago, Ill., forty-nine double car equipments, ninety-eight 25 H. P. steel motors.

F. E. Snow, receiver Adrian City Electric Belt Railway Company, Adrian, Mich., one 60 kilowatt belted generator, three single car equipments, 25 H. P. steel motors.

Premier Motors and Batteries.

The following extracts from a personal letter recently received from Mr. M. R. Rodrigues, 19 Whipple street, Brooklyn, show an encouraging condition of the business in his line and are interesting:

"Trade has picked up wonderfully in the past month, and I have several orders for large quantities of our No. 2 Battery. Several outfits of motors and batteries have been shipped South (South America) through my export agents with whom I have written contracts. One special outfit went out to-day to Iquique, Peru, and also our No. 2 Cells to operate a kinetoscope. The Pacific Coast and Southern business hold about the same, and just now we have many inquiries regarding Fan Motors from there.

"Our leaflet, 'Where the Profit Comes In,' is ready for the trade only. This sheet gives our prices and also our cast-iron terms.

"This week we have put in a machine to turn out work that heretofore had to be contracted for, and before long I hope to make many improvements in the construction of the Premier Motors and the Premier Batteries.

' . . . I am pleased to see in your paper occasional notices of the Brooklyn Electrical Society. At present I have not much time to devote to it, but it is a good thing and deserves some credit. We have many earnest workers in it, and there may be something of interest coming from it when the laboratory is in working order. Two of the members have wired the place and the Edison Company of Brooklyn will turn on the 'juice' at an early day."

RECENT COMPANY ELECTIONS.

Consolidated Traction Company, Jersey City, N. J. Directors: Edward F. C. Young, John D. Crimmins, Peter A. B. Widener, Alexander J. Cassatt, Clement A. Griscom, Frank Thomson, Michael R. Shanley, Jeremiah O'Rourke, Thomas F. Ryan, George F. Perkins, Abram Q. Garretson, William L. Elkins, Elisha B. Gaddis, Thomas Dolan and Joseph B. Sandford.

Stoughton, Canton and Sharon Electric Railway Company, Stoughton, Mass. President, Hon. Elisha C. Monk: treasurer, Henry W Britton. Directors: Alfred Upham, Henry L. Johnson, Charles Tenny, Melvin Upham, George Mantle, A. M. Bridgeman, F. C. Monk.

INCORPORATIONS.

The Binghamton General Electric Company has filed a certificate of reduction of its capital stock from $400,000 to $280,000. The certificate is signed by Edmund O'Connor, Geo. W. Dunn, Geo. F. O'Neil, Geo. C. Bayless, Geo. W. Davenport and J. H. Roberts.

Ayer Electric Typewriter Company, Concord, N. H.—to manufacture electric and other typewriters; sell, buy, lease patents and machinery. Capital stock, $300,000. Promoters: Chester M. Sprague, Claremont, N. H.; Chas. A. Herbert, Concord; Henry E. Adams, Boston, Mass.

The Capitol Electric Engineering Company, Lansing, Mich.—to manufacture and sell electrical supplies, etc. Capital stock, $5,000. Promoters: A. Robinson, Geo. L. Robinson, E. P. Kinney, all of Detroit, Mich.

Chicago Western Coal and Mining Company, Chicago, Ill.—to manage, operate and conduct the business of mining and selling coal and other minerals; construct, maintain and operate plants, power houses and all the necessary appliances for producing electricity for light, heat and power. Capital stock, $500,000 Promoters: Edw. W Russell, Frank H. Russell, Lawrence Browne.

The Harrisburg and Cumberland Railway Company, Harrisburg, Pa.—to build and operate an electric railway from New Cumberland to Riverton, Whitehill and Shumanstown, Pa., with a branch to Newmarket. Capital stock, $36,000. Directors: Joseph J. Baughman, New Cumberland, president; S. M. Hertzler, Eberly's Mills; Joseph Kaufmann, New Cumberland; W. L. Gorgas, S. J. McCarrell, Frank R. Leib, Levi Brandt, F. P. Snodgrass, S. W. Flemming, Harrisburg.

The Multiphase Motor Company, New York City—to manufacture electric motors, machinery and appliances. Capital stock, $200,000. Directors: Alfred S. Brown and Watson D. Schram, of New York City, and G. W. Gardenier, of Nyack, N. Y.

The Automatic Telephone Company of Wisconsin, Chicago. Capital stock, $500,000. Incorporators: J. Harry Theobald, William T. Whipple and Maurice Rosenfeld.

The Snyder Electrical Company, Cleveland, Ohio—to manufacture and deal in chemicals, electrical and plating machinery and supplies; specialties of every kind; machinery and tools. Capital stock, $5,000. Promoters: Edward Snyder, Chas. E. Watson, M. M. Zellers, Geo. A Bunke, A. V Cannon.

The Enbalm Conduit Trolley Company (incorporated in W. Va.), New York, N. Y.—to acquire, manufacture, own and sell all sorts of machinery and inventions and construct and equip steam and electric railways, etc. Capital stock, $5,000,000. Promoters: Glenn S. Smith, Brooklyn, N. Y.; Oscar A. Enbalm, Clarence E. Sherin, New York City.

The Dover Electric Light and Power Company, Dover Plains, N. Y.—to carry on the business of lighting cities, towns and villages by electricity, and sell electricity for heat and power. Capital stock, $10 000. Promoters: Adolph Reimer, Catharine Reimer, Dover Plains; J. C. Muick, Brooklyn, N. Y.

The Providence Electric Thermostat Company, Kittery Maine—to manufacture and deal in heat and damper regulators. Capital stock, $100,000. Promoters: Lorin M. Cook, Frank M. Burrough, Providence, R. I.; Burton S. Cowles, Meriden, Conn.

The Kelsey Electric Railway Specialty Company, New Haven, Conn.—to manufacture electrical supplies and specialties and car supplies, hardware and machinery. Capital stock, $20,000. Promoters: Frank N. Kelsey, Chas. L. Wright, Wm. W. Miner, New Haven.

The Morage Valley Railroad Company, San Francisco, Cal.—to build and operate railroads in Contra Costa County by steam, electricity or other motive power; lease purchase and sell railroads. Capital stock, $500,000. Promoters: Angus A. Grant, Albuquerque, N. M.: Archibald J. McDonald, San Francisco: John T. Williams, Oakland, Cal.

The Lock Haven Traction Company, Lock Haven, Pa.—to operate passenger railways by cable, electrical or other means. Capital stock, $10,000. Promoters: Chas. A. Bragg, H. M. Mitchell, Geo. Breed, Philadelphia.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

APRIL, 1895.

Day of Mo.	Light.	Day of Mo.	Extinguish.	No. of Hours.
	H M.		H.M.	H.M.
1	P. M. 11.20			5.20
2		2	A. M. 4.40	
3	A. M. 1.20	3	" 4.40	3.20
4	" 2.00	4	" 4.40	2.40
5	" 2.40	5	" 4.40	2.00
6	" 3.00	6	" 4.40	1.40
7	No light.	7	No light.	
8	No light.	8	No light.	
9	No light.	9	No light.	
10	P. M. 7.00	10	P. M. 9.20	2.20
11	" 7.00	11	" 10 30	3 30
12	" 7.00	12	" 11.40	4.40
13	" 7.00	14	A. M. 1.00	6 00
14	" 7.10	15	" 1.40	6 30
15	" 7.10	16	" 2 30	7.20
16	" 7.10	17	" 3.00	7.50
17	" 7.10	18	" 3.30	8.20
18	" 7.10	19	" 4.00	8 50
19	" 7.10	20	" 4.20	10.10
20	" 7 10	21	" 4.20	10.10
21	" 7.10	22	" 4.10	10.00
22	" 7.20	23	" 4.10	9.50
23	" 7.20	24	" 4.10	9.50
24	" 7.20	25	" 4.10	9.50
25	" 7.20	26	" 4.10	9 50
26	" 8.00	27	" 4.00	8.00
27	" 9.10	28	" 4.00	6.50
28	" 10.20	29	" 4.00	5.40
29	" 11.00	30	" 4.00	5.00
30	" 11.20	May 1.	" 4.00	4.40
Total				170.10

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MARCH 26, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

536.250. Adjustable Switch for Trolley Systems. Montraville M. Wood, Chicago, Ill. Filed July 14, 1894.

536,256. Electric Railway-Switch. Rollin A. Baldwin, South Norwalk, Conn., assignor to the Fitch-Excelsior Switch Company, of New Jersey. Filed Oct. 24, 1893.

536,275. Supply System for Electric Railways. Charles E. Emery, Brooklyn, N. Y. Filed March 15, 1894.

536,374. Conduit Electric Railway. Frederick S. Davenport, Jerseyville, Ill. Filed Jan. 28, 1895.

DYNAMO ELECTRIC MACHINERY.

536,226. Magnetic Separator. James D. McKinnon, Portland, Oreg. Filed Aug. 7, 1894.

536,438. Electric Mining-Machine. Edmund C. Morgan, Chicago, Ill. Filed July 18, 1894.

536,439. Armature for Electric Machines. Edmund C. Morgan, Chicago, Ill. Filed July 18, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

536,233. Telephone System. John I. Sabin and William Hampton, San Francisco, Cal. Filed Nov. 9, 1894.

536,382. Telephone Exchange System. Silas W. Holman, Boston, Mass. Filed March 24, 1894.

536,420. Telegraphy. Patrick B. Delany, South Orange, N. J. Filed Nov. 19, 1894.

536,481. Telephone. Jonathan D. Price, Chicago, Ill. Filed July 30, 1894.

536,559. Relay. Cyprien R. J. Willot, Paris, France. Filed Nov. 24, 1893.

SIGNALS AND SIGNALING APPARATUS.

536.210. Electrical Signaling Apparatus. William E. M. Jackson, San Francisco, Cal. Filed June 8, 1893.

536,271. Electrical-Signal and Switch-Operating Apparatus. Justin Dutrey, New Orleans, La. Filed July 19, 1894.

536,467. Electric Signal System. Webster Gillette, New York, and Alexander S. Williams, Long Island City, N. Y.: said Gillette, assignor to said Williams. Filed Oct. 30, 1894.

536,547. System of Electrical Signaling for Railways. Charles Seiden, Baltimore, Md. Filed Dec. 26, 1894.

MISCELLANEOUS.

536,184. Method of Applying Insulation. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed June 21, 1894.

536,221. Electric Switch. Charles J. Miller, Philadelphia, Pa. Filed Jan. 19, 1895.

536,266. Electric Switch. Cummings C. Chesney, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Jan. 17, 1895.

536,311. Fusible Cut-Out. James J. Wood, Fort Wayne, Ind. Filed Dec. 27, 1894.

536,319. Method of Insulating High-Tension Coils of Transformers. August Schneller, Aalanderveen-Alfen, and Willem J. Wisse, Haarlem, assignors to Henry Tindal, Amsterdam, Netherlands. Filed Dec. 27, 1894.

536,411. Velocipede Provided with Electrical Communicating Apparatus. Raphael H. Wolff, New York, N. Y. Filed Aug. 18, 1894.

536,478. Combination Electrical Meter. Herschel C. Parker, Brooklyn, N. Y. Filed Jan. 9, 1895.

536.530. Electric-Current Regulator. Charles M. Jordan, Washington, D. C. Filed Feb. 13, 1895.

536,535. Electric Brake. Edward D. Lewis, Savona, N. Y. Filed Nov. 12, 1894.

RE-ISSUE.

11,481. Closed-Conduit Electric Railway. William Lawrence, New York, N. Y., assignor to the Lawrence Electric Company, same place. Filed March 26, 1894. Original No. 516,631, dated March 14, 1894.

ELECTRICITY.

VOL. VIII. NEW YORK, APRIL 10, 1895. No. 13

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EDITORIAL NOTES.

ELECTRICITY *states upon authority that up to the hour of going to press no agreement of any nature has been made between the Westinghouse and G. E. companies. That any agreement can be made is growing more and more improbable.*

* * *

Storage Battery Possibilities. The mail box of the newspaper which has achieved prominence along with a reputation for sturdy truth-telling and good judgment contains many interesting inquiries. Most of them are perhaps best answered by private correspondence. Occasionally a constituent asks something the answer to which is of public interest. We believe this to be the case with the following:

To the Editor of ELECTRICITY.

Dear Sir: Having recently been solicited to purchase some stock in a storage battery concern, and knowing that you are unusually well posted on the commercial possibilities of such undertakings, I would esteem it a favor if you will advise me what your opinion is. Is there sufficient demand for the product to make success possible?

Yours truly,

New York, April 8. INVESTOR.

Answering the last question first, yes. We suppose there might be a gross business of $250,000 a year for a well-managed concern in this line to be built up within two or three years. It might reach $1,000,000 in five years. At present the first figure is much above the value of the total output in this country. A company, therefore, going into business on the square, without a ballooned capitalization, ought to make a reasonable success.

So far the experience of the capitalist in storage battery ventures has been disastrous because he has been led to expect impossibilities. The storage battery promoter in years back has been a species all to himself. He has claimed that with *his improved* system the laws of nature were turned over, and that any kind of work possible for a steam engine direct could be better done by the storage battery as an intermediary agent. Hence the road has been strewn with wrecks, large amounts of money lost, hopes blasted, and investors disgusted. Whereas if the promoter had told the truth for the past ten years, as would have been to his best interests, the application of storage batteries, in *proper* places, would have been ten times what it is to-day.

It has now come to a point where the entire notion is in dispute almost everywhere, and all this hostile feeling has got to be overcome. It can be beaten down only by the frankest truth-telling. Continued deception will but further retard legitimate development.

Of course, however, continued deception, if practised in an artistic manner, may sell stock.

* * *

The Religious Press and Electro-Medical Frauds. It has become an axiom among promoters of questionable projects that the religious press of all class publications is the most easily satisfied to accept for pay the advertisement of their wares. Humbugs and frauds which even the daily press rejects as unfit for its columns are often greedily sought after by the editors of religious papers of easy conscience simply because of the financial returns which they bring. Many of the papers of this class seem to draw the line only at such advertisements as greengoods, lotteries and assignations, and then only because these have already been officially declared illegal and their insertion would subject them to the penalty of the law and a forfeiture of mail privileges. These papers by their conduct hold religion up to ridicule and should be disavowed by the Church which they pose as representing. Fortunately not *all* of the religious papers are of this class, and there are a few whose names we have mentioned from time to time that conscientiously endeavor to keep their advertising pages as pure as the gospel they preach. Such papers are an honor to the press and the cause which they espouse and have done much to remove the ill-repute into which their confreres as a class have fallen.

The occasion for these remarks is the announcement in the New York *Evening Post* of last week that "The Rev. Dr. William H. DePuy, assistant editor of the *Christian Advocate*, will retire the first of May, to devote himself to a literary work in which he is interested."

It will be remembered that Dr. De Puy has figured as one of the most blatant indorsers of the Electropoise, and that wherever his name has been used in that connection it has also been used in connection with his assistant editorship of the *Christian Advocate*—thus virtually implicating that paper in his endorsement. Our attention was called to the fact that Dr. De Puy's endorsement was that of the individual and not of the paper with which he was officially connected, and it was argued that so long as the individual performed his editorial duties satisfactorily to the editor-in-chief it mattered not what his private beliefs were.

We replied that while that might be strictly true in some cases, it certainly should be a matter of concern to the editor-in-chief when those private beliefs were of such a nature and published in such a way as to involve the good name of his employers. We are glad, therefore, that our view has been accepted as the correct one, and congratulate the paper for having decided to relieve itself of an incubus that not even so strong and correct a journal as the *Christian Advocate* can carry without contamination. The religious paper, like Cæsar's wife, should be beyond suspicion, and now that Dr. De Puy has withdrawn to literary pursuits he may pursue his puffing of the Electropoise unhampered, and at the same time without dragging down into dishonor with himself a publication which is and ought to be the repository only of the good and true. The Electropoise killed Dr. De Puy.

* * *

Patents and Combinations. If the electrical combination which has been talked of as an offensive and defensive alliance on patents needs any further discussion, a study of the full text of Judge Baker's recent decision at Indianapolis furnishes food for thought.

The National Harrow Company had brought suit for infringements of their patents against an independent manufacturer and asked for an injunction, which was refused. An abstract of the decision appears on another page. It will be noticed that infringement was not denied by the defendants. They rested their whole case upon the contention that the plaintiffs were a combination to control prices and hence had no standing entitling them to the assistance of the Court in enforcing their claims. This was the view taken by the Court, and the words of the decision are clear and emphatic.

Judge Baker is a man of high standing in his profession, whose decisions are looked upon with great respect by the judges in other circuits. It is fair to suppose that his opinion will be sustained by the higher courts.

While the intention of the framers of our patent laws was unquestionably to confer a monopolistic privilege upon the inventor, it is equally certain that they did not comprehend the possibilities for evil of the trade combinations which have come into being in the last twenty years. The monopoly of an individual patent-holder in his property is necessary and operates for the public good. The monopoly intended in trade combinations like the National Harrow Company, and the General Electric Company is not for the public good but for the public injury. Such combinations are rarely if ever of benefit to the inventor himself. They are hindrances in the way of development, barring all progress to whatever extent they can. They are created for the purposes of oppression and operate to prevent the man of small capital from enjoying his natural rights. They create a dangerous weapon in the hands of unscrupulous promoters and schemers which it is impossible to suppose was intended by the founders of our Government to bestow when giving protection to the actual inventor or to his legitimate backers.

It is to be hoped that our constituents will read Judge Baker's decision carefully, that they will study closely the status of electrical patents, and ask themselves what would be the chances for winning on any possible plan for patent litigation by a combination of any character against the smaller concerns.

They should moreover read Electricity thoroughly each week. They will here find many incontrovertible truths laid before them and before the public in clear and intelligible language.

In the harrow case, *infringement* was not denied; the validity of the patent was not questioned.

What electrical patent would come into court with half as good a showing? The *validity* of any electrical patent of importance is open to serious question, and an unjust campaign of litigation against the smaller concerns would be stubbornly fought at every point.

Notwithstanding Judge Lacombe's remarks in the Sawyer-Man case, when the Westinghouse contention that the G. E. Company was a trust and attempting an abuse of its patent privileges was laid before him, it might now be found that even he has got additional light by this time upon the fundamental principles of common law.

* * *

The Tesla Motor in the Machine Shop. In this issue we give the first paper by Mr. Perry on the new Westinghouse Electric and Manufacturing Company's shops, fitted throughout with Tesla two-phased motors, which cannot fail to interest our readers. Since it has been announced in the papers that a preliminary test of one of the great Niagara generators was made last week, the subject of the utilization of the two-phased currents which are to be generated assumes new interest, and Mr. Perry's article is therefore most timely. Those who are contemplating the erection of factories at Niagara have questioned the ability of this system to adapt itself to all the varied requirements of their demands. The Westinghouse plant answers these questions in a most positive manner, for with the single exception of electrolytic work almost every conceivable class of work is already being done successfully without the rectification of the current, and with this rectification, which is also exemplified in these same works, even electrolytic work is rendered entirely feasible. At East Pittsburg the generators are of the same general type as those at Niagara, viz., they produce two-phase alternating currents of exactly the same frequency as do the latter. The Westinghouse shops might therefore be hitched directly on to the Niagara circuit and continue in operation as now without the change of a pulley, a motor or a tool. They will therefore serve as a most important object lesson, not only to those contemplating removal to Niagara, but to other users of power having two-phased currents at their disposal. Aside from all this, these new works undoubtedly constitute the most complete electrical shops in the world of any kind, and the only ones using the two-phase currents for all operations.

In the first paper Mr. Perry confines himself to a general description of the plant. In the second he will describe its operation.

Our review of what is being done at Pittsburg has exceptional interest at this time from the fact, and it is a fact, that in the discussions of a patent agreement between the Westinghouse and G. E. interests, the latter have admitted that the Westinghouse Company has an undoubted legal right to actual proprietorship in these methods of alternating current transmission. It is admitted that the monocyclic system exploited by the G. E. Company is directly an infringement of the Tesla patents owned by the Westinghouse Company.

In the disappointment of Mr. Tesla at the delay in placing some of his later work before the public in commercial form, there must be a measure of satisfaction in realizing that his earlier work is proving all that he claimed for it practically and that the world recognizes that he is entitled to the credit.

In obtaining control of this system, the Westinghouse Company exercised exquisite foresight, and they are entitled to the full measure of practical benefit.

Under the Searchlight.

Views and Opinions on Timely Topics.

In view of the report that Mr. F. P. Fish has retired from his salaried connection with the G. E. Company, is it too much to expect that he will come forward and tell what he knows as to the purchase of the charter of the G. E. Company in this State. What day was it that a G. E. employé, now in Europe (?), went over to New Jersey to pay out the money? How much did he pay? Was Mr. Fish an active or a passive agent in this matter? The money being paid in New Jersey, where was the crime committed? Is the charter of the company, which can be proved to have been obtained by criminal methods, still valid?

Mr. Fish has contemplated a libel suit against Electricity. Now that he is again a free man, why don't he bring it?

* * *

And why does not Mr. Coffin himself defend his reputation? Is he waiting for an exposé of Northwest G. E.?

* * *

Taking time by the forelock, many of the independent manufacturers have already come together for consideration, and a strong combination for the defence of patent suits brought by the G. E. or any other combination is a foregone conclusion.

* * *

The Fort Clark, Ill., Railway, in which the

G. E. Company holds $177,000 of stock, has been allowed ten days in which to pay a claim of $297,583.36. In default, a decree of sale will be issued.

* * *

GENERAL ELECTRIC.

Preparing the Public for Another False Statement.

(From the Boston News Bureau.)

A great deal has been heard about the patent account of the General Electric Company. As a matter of fact the so-called patent account is the item of "patents and franchises $8,159,264," which has been unchanged since the organization of the General Electric Company, and its value at the present time has not been so seriously impaired as the records of the patent department and law courts might lead one to believe, as the licenses and franchises from that account still pay the company about 5 per cent., or $400,000, on its total capitalization, and in some years about $500,000 has been received.

The last annual report of the General Electric Company showed a book value of $59 per share, including this patent and franchise account, whose valuation amounted to $26 per share. Therefore at $27 per share (lowest price March 4 at 25⅝) General Electric was sold for $6 per share less than its book valuation with the entire patent and franchise account eliminated. This book value a year ago of $59 per share was after the revaluation which wiped off the company's books $14,600,000.

The foregoing is so peculiarly Coffinesque in its tone that its authorship is unquestioned.

It may be accepted as official notification that the $8,000,000 patent account is not to be scaled down in the forthcoming report.

The statement that the item of $8,159,264 "has been unchanged since the organization of the G. E. Company" is not entirely correct.

The statement filed at the Stock Exchange May 31, 1892, when the G. E. Company was organized, showed this account to be as follows :

T.-H. patents	$338,354.29
T.-H. Int. Company patents	286,110.99
Edison Company patents	332,551.22
*Stock of Edison Electric Light Company	3,826,099.25
*Stock of Sprague Electric Company	680,000.00
Total	$5,463,115.75

*The only value claimed for this stock was in the patents owned by the companies.

Eight months later, when every effort was considered necessary to make a false showing in order to avert a collapse, this account had been marked up as follows for the first annual report:

Edison patents	$4,239,168.32
T.-H. patents	3,389,352.07
T.-H. Int. patents	530,743.63
Total	$8,159,264.02

Thus, although these patents were decreasing in value rapidly, they have been marked up since the organization of the company just $2,696,148.27.

Since the issue of the last report the company has been beaten on two of its most valuable patents—the feeder and main and Thomson regulator—and the lamp patent has expired by limitation.

Perhaps the *News Bureau* does not know what the "royalties" are. We would suggest that, in order to prove Mr. Coffin's case for him, our contemporary should call upon him for information showing how many Edison licensees are still handing over any proportion of their additional issues of stock, and how the total for the year 1894 compared with the year 1893 or 1892.

These increases of stock of Edison licensees are the only royalties worth considering in fixing the value of the patent account.

* * *

The Best System Will Win.

(From the New York Sun.)

In the rivalry between the electric and the steam railroads in Connecticut, the Legislature of the State ought to refrain from interference. If the electric lines are injuring the business of the steam lines it must be because they enjoy economic advantages not possessed by the other. The cheaper and more serviceable of the two powers will surely win in the end, whatever be the legislation enacted in regard to it.

A TALE WITH A MORAL.

A few years ago two sturdy young farmers drove into the town of Eau Claire, Wis., to go to the circus. As usual the town was full—also most of the people. By afternoon, John and Bill had acquired two distinct varieties of jags. The former was quarrelsome, the latter happy as a king. Several times Bill interfered to save his friend when he was about to get into a fight. Finally there was trouble in earnest, and John was in it. Bill rushed in, grabbed his partner by the collar, and yanked him out. Then John struck Bill, and all was different. Bill landed with his right and left simultaneously, and John fell to the floor with Bill sitting on his wishbone, saying, as he finished the job : "Strike me, will ye—biff-biff. I'm your friend, —— ——ye (biff-biff)—the best friend ye ever had (biff)."

As Jack Bunsby would say, the bearings of this observation lie in the application of it.

* * *

THE Federal courts at Little Rock, Ark., are still busy with street railway litigation, and Mr. H. G. Allis is on deck to make it uncomfortable for his enemies.

* * *

WHERE, oh, where, is Mossback Westover? Has he been playing woodchuck during this long and dreary winter ?

* * *

A DIRECTOR of the G. E. Company who never has taken kindly to the methods adopted to get his name into the list, nor to the "green goods" game which has been played on the public, has promised to ELECTRICITY a statement of his views just as soon as his official connection with the concern is ended. It is not a long time to wait, and we think we are safe in assuring our readers that we will present a clearer story of the enterprise, with critical estimates of the men interested, than has yet appeared. It will be authentic, discriminative and just.

* * *

WE all know that rats desert a sinking ship, and ELECTRICITY knows that several gentlemen holding good positions in the G. E. Company are making other business arrangements.

* * *

BEFORE the reform administration in Brooklyn complete their labors of purification they ought to call some of the G. E. hustlers in to tell what they know about railroad matters in that town. Of course some of them are in Europe—or elsewhere—but they can't stay away forever. We wonder if there is any connection between their being in Europe and the matters referred to ?

* * *

THE St. Johnland lighting plant would be another nice job to investigate. Curtis & Dean might, under proper pressure, tell what they know of this.

* * *

WE suppose that in the late negotiations between the Westinghouse and G. E. companies the astute and brainy secretary of the latter company has exercised a commanding influence.

* * *

IT is not too much to suppose that Mr. H. M. Byllesby, who knows a good deal about the wrecking of the Northwest G. E., and who might be inclined to tell his story some day, will soon hold a high position in the G. E. Company.

* * *

MR. CHARLES W. PRICE of the *Electrical Review* has been in the South for two weeks recuperating after a severe attack of the grip.

* * *

THE last number of the *Electrical Review* was the most interesting which our contemporary has issued in several months.

THE G. E. Company now propose to accomplish by slaughtering prices what they failed to accomplish by years of litigation—clear the lamp field of all competitors. They will lose their money and their fight the same as before.

* * *

Was the Canadian Delegate There?

The following clipping from the *Canadian Electrical News* for March will be read with some amusement by those who really attended the Cleveland Convention :

> There was a larger Canadian representation than usual at the National Electric Light Association Convention held in Cleveland on the 19th, 20th and 21st of February. Among those who attended from Canada were Messrs. John Langton, Frederic Nicholls and J. K. Kammerer, of Toronto ; J. W. Taylor, Peterboro'; Frank Badger, Montmorency, Que., and J. A. Corriveau, of Montreal. The total attendance at the Convention numbered about 800. "It was the first of the American Conventions that I had attended," said one of the Canadian delegates, "and I was so disappointed that I am not in the least anxious to attend another. I had polished up my mental apparatus to the greatest possible degree, in anticipation of coming in contact with the brightest intellects of the continent. Judge of my surprise to find the discussions of the tamest character, and largely monopolized by sales agents of the various manufacturing companies for advertising purposes. One whole day was taken up with the discussion of the monocyclic system. I was surprised that the President of the Association made no effort to limit the discussion so as to allow time for the consideration of other subjects of general interest to the electrical fraternity. Mr. Nicholls' paper on 'The Lighting of Large Cities,' for example, received no discussion whatever. I consider that our Canadian Electrical Association can give the National Association pointers as to how to manage a successful Convention. The Canadian Association is noticeably superior in point of the ability of its members to present intelligibly their views upon the subjects up for discussion, and in their knowledge and observance of parliamentary practice."

We are sorry that the Canadian delegate was disappointed in the caliber of the intellects with which he came in contact, and also in the character of the discussions, which were not wild enough to meet his views. What did he expect—war paint, tomahawks, revolvers and bowie knives? But as to facts: he is so far astray as to lead to the supposition that he mistook the basement of the Hollenden for the Convention hall. As matters of fact, the discussions were *not* monopolized by sales-agents; one whole day was *not* taken up in the discussion of the monocyclic system, unless from 3 to 5:30 P. M. is called a whole day by Canadians, and Mr. Nicholls did *not* have a paper on "Lighting of Large Cities"—that was merely a topic for discussion. Unfortunately, the discussion did not amount to much, but just wait until the Canadian Association meets. We can then get pointers as to how to conduct such things, and perhaps do better ourselves in the future.

FIRE AT THE CROCKER-WHEELER FACTORY.

The Crocker-Wheeler Electric Company works, near Ampere station, at East Orange, N. J., were partly destroyed by fire on Sunday last. Over $100,000 worth of motors and dynamos, which were stored in the main building, were ruined, together with about $50,000 worth of machinery. The total loss will amount to about $250,000. The company is insured.

It was feared that the flames would spread to the office building, and all the books, drawings, etc., were removed.

Two hundred men are thrown out of employment by the fire. The company will rebuild at once, and the stoppage in the business will be of brief duration.

Correction.

We were incorrect in reporting last week that Judge Beekman had set aside the attachment obtained by the New York Insulated Wire Company against the Westinghouse Company's property in this State in the action brought for balance claimed to be due on the World's Fair contract. Messrs. Brayton Ives and Marcellus Hartley gave bond for $40,000 to secure the claim, pending final settlement.

RECEPTION AT THE BROOKLYN EDISON STATION.

That a central lighting station may be made a beneficent agency in other ways than that for which it was avowedly constructed has nowhere found a happier illustration than in the Brooklyn Edison station under the able management of Superintendent W. S. Barstow, President Ethan Allen Doty, and Secretary Royal C. Peabody.

From the very start these gentlemen have realized the potentiality for good which their station has placed in their hands, and they have been foremost in enlightening the minds of the community as they have been in illuminating its buildings. In them the cause of education has found a ready friend.

When the enlargement of their establishment was decided on, the plans included a very unusual feature, viz., a large lecture room where experimental demonstrations of electrical phenomena could be given from time to time as occasion offered. While this feature was primarily intended for the benefit of their employees, experience has shown that it has by no means been limited in its accommodations to them.

When the electrical section of the Brooklyn Institute was temporarily without a home, this lecture room with all the varied facilities of the great station was placed at its disposal. When, later, the Brooklyn Electrical Society was organized, composed of earnest young men, who met around from house to house for the purpose of improving their electrical education, these gentlemen saw the germ of a good thing and encouraged it in every way in their power. They took them in and gave them a home in this same lecture room until the society became strong enough to make a home for itself, and when the new quarters were procured gave many evidences of their continued interest in the shape of equipment of their new laboratory.

Last week the Edison Company inaugurated a new step in the educational scheme by which its benefits were extended more directly to the general public than had previously been possible. The new step consisted in affording to the public an opportunity of seeing not only one of the very finest electrical stations in the land, but also the manifold and varied applications of the electric current to the uses and comfort of man.

To the average layman the interior of an electric light station is a *terra incognita;* it is the abode of mystery through whose portals he may not pass. There is usually no *open sesame* to these portals, but last week this was afforded by handsomely engraved invitation cards sent for Wednesday evening by the officers of the company to their friends and patrons, and for Thursday evening by the employees to their circle of immediate friends and admirers. On the first occasion the officers as hosts were ably assisted by their employees, and on the second the employees as hosts were as ably assisted by the officers.

The mere opportunity to visit the station would have been sufficient to call out a large attendance, but on this occasion it had been announced that among the specialties on exhibition there would be the following: Electric piano, electric ice-making, electric cooking, electric motors, electric pumps, electric dumb-waiter, electric medical apparatus, electric forge, illustrations of the street lighting system; and from before 8 P. M. until 11 the throng of ladies and gentlemen continued almost undiminished in numbers.

The Otis electric elevator carried the expectant visitors to the third floor, where the operating offices of the company, brilliantly lighted, were open for inspection. In some of these the various testing and measuring instruments used by the electrician were exhibited and their mysteries explained by untiring young gentlemen. In another room the endeavor was made to make clear to the customer the beauty and infallibility of the electric meter by which his bills are rendered monthly, and the delicacy of the chemical balance by which the deposited zinc was weighed was illustrated by a charming young lady to the crowds that gathered around her.

In the passageway leading to the lecture room had been erected a narrow platform upon which were shown electrical curling-irons for the ladies, radiators and cooking utensils, goose-irons, glue-pots, etc., etc., illustrating the adaptation of electricity to the domestic arts of heating and cooking, electric motors of the Lundell, Crocker-Wheeler and C & C types, illustrative of the application of the current to power; and in this connection was shown a Quimby electric elevator pump, which consisted of a combined electric motor and rotary pump, forcing water into a small glass tank near the ceiling. The complete apparatus, including automatic switching apparatus and all, just as it is installed in connection with the ordinary hydraulic elevator, was shown in miniature in operation.

Above these exhibits, along the wall, were shown a profusion of the latest designs of incandescent lamps and shades, in colors, frosted and clear, illustrating the artistic adaptation of the electric light.

Passing into the lecture room, the first exhibit to meet the eye was the mechanism of a full-size electric elevator of the well-known A. B. See Manufacturing Company's type. This, having all its working parts exposed to view, proved perhaps more interesting to the electrical engineer than to the layman, but the extreme ease with which its every motion was controlled by the attendant could not fail to attract the attention of even the layman, and its great simplicity and economy were manifest to all.

Next in order were two extensive exhibits of electro-therapeutical appliances showing the benign applications of the electrical current to the healing art. These exhibits were made by the Monarch Company and Messrs. J. C. Vetter & Company.

Electric cooking was practically illustrated along the south wall of the room, where Mrs. Lempke showed the roasting of meats and the baking of cakes to a most appreciative audience.

In another corner of the room was the electric piano, whose keys, touched by unseen hands, gave forth classical as well as popular strains to the admiration of all present. We noticed among the most attentive listeners around this piano an unusually large proportion of young ladies—doubtless from the Packer Institute. Probably these were thinking how beneficent the mission of electricity would be if only electrical pianos could be made to do their "practising" for them at the Institute.

Passing down a narrow iron stairway, the visitors were ushered upon the regulating gallery of the power room. Here a birdseye view was had of the great engines and dynamos and other mechanisms that are essential to the production of the electrical current, and to many this was the most marvelous sight of the evening. In the gallery itself was the long, silent distributing switchboard, by which the currents in all parts of the city are controlled, with its accessories, the rheostats and indicating instruments. Below—so far down that it almost made one dizzy to look at them—were the two great engines of 1,500 H. P. each, with their dynamos, nearly as silent as the switchboard itself yet sending out thrills over miles and miles of wire into every precinct of Brooklyn as well as providing current for the wonderful applications just witnessed.

And yet one more thing was best seen from this gallery—the great 15-ton electric traveling crane, erected by the Morgan Engineering Company of Alliance, Ohio.

This spanning the great power hall, nearly 65 feet in length, traveled the whole length of 100 feet, and on its own surface bore a carriage or buggy which traversed it longitudinally. Suspended from the center of this great span, in a little cab hanging in mid air, 30 or 40 feet from the floor, stood the motor man, who by pulling this lever or that directed this mighty mechanism so that the hoisting apparatus could be brought over any piece of machinery on the floor. It was by means of this great crane that the enormous engines and dynamos were lifted as a mother does a child and placed in their present position. It is by means of this crane that they will be taken apart should they at any time require repair, and it will be by means of this same mechanism that other great engines and dynamos will be installed when the rapidly increasing demands for current render them necessary.

Descending from the gallery to the ground floor, the visitors passed by the great dynamos and engines, and thence to the open space not yet required by the demands on the station. Here was viewed a small refrigerating apparatus erected by the De La Vergne Refrigerating Machine Company—this, too, operated by an electric motor; hence indirectly they saw the process of manufacturing ice by electricity. As if to add contrast to the uses of electricity, side by side with the ice machine was exhibited the waterpail forge, fully described some months ago in ELECTRICITY. Here the anomalous condition was observed of raising iron bars to a welding heat by simply immersing them in a pail of water.

Nearby were shown and explained the Edison conduit system, by which all of the electrical currents from this station are distributed over Brooklyn, and also the time mechanism employed in the new ornamental arc lampposts, by which, on somewhat the same principle as the alarm clock, the lamps may be turned on or off at any predetermined hour.

From this last inspection the visitors passed out into the street if they so desired, but many returned by the electric elevator to the third floor and inspected again the interesting features which they had first seen.

This occasion was one for mutual congratulations—for congratulation among the residents of Brooklyn that they had had the opportunity of witnessing such a comprehensive display of the possibilities of electricity, among the Brooklyn Edison Company that their efforts were so highly appreciated by such an intelligent constituency.

A Hollander has invented a process of sterilizing milk by subjecting it to the passage of an alternating electric current. All micro-organisms taken up by the milk from the air, etc., are permanently destroyed by the electric current. This germ-killing quality of the electric current does not hurt the milk, but a longer experience only will teach us whether this system can be applied to large quantities with the proper result.

The Faraday medal of the Chemical Society of London has been conferred upon Lord Rayleigh in recognition of the investigation which has led to the discovery of argon. The previous recipients of the medal are Dumas, Canizzarro, Wurtz, Helmholtz and Mendelejeff.

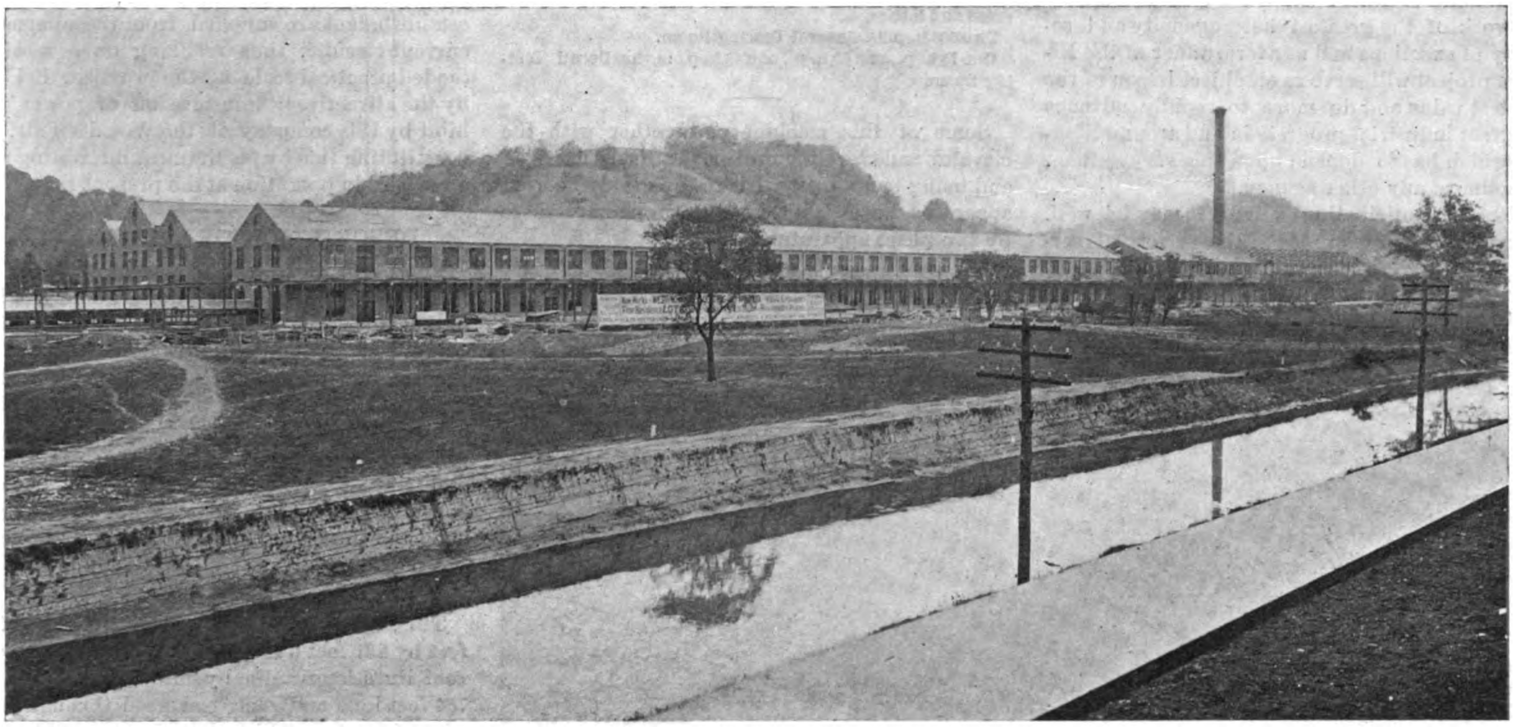


FIG. 1.—WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY'S PLANT, BRINTON, PA.

The Tesla Two-Phase System.

Extensive Use at the Westinghouse Works, Brinton.

The New Plant Fully Equipped with Alternating-Current Apparatus—The Most Important Installation Thus Far Attempted.

BY NELSON W. PERRY, E. M.

For many years it was a matter of reproach to the electrical industry that the manufacturers of electrical apparatus who zealously urged its adoption in all other industries failed to use it in their own. While recommending their wares to others they used them not themselves, except in a few isolated cases where small electrical apparatus was erected in the works to show to prospective purchasers that it would run under favorable circumstances. On the conservative business man the claims of superior economy, efficiency and convenience made for electrical methods produced rather the opposite effect to that intended when he saw in these great establishments the same methods in vogue which their proprietors were urging him to discard in his own.

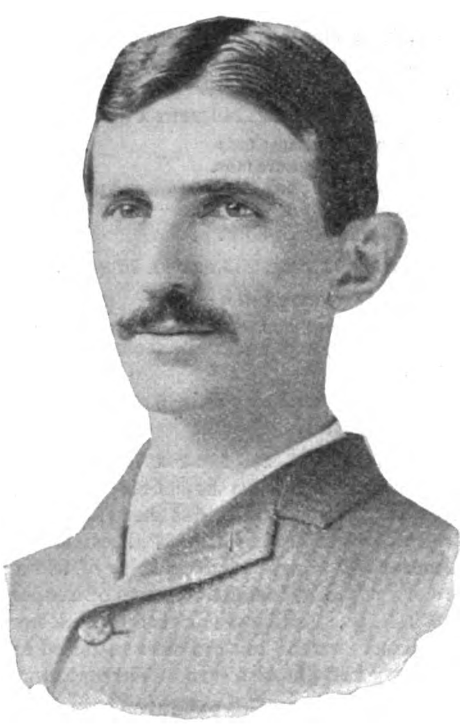
Gradually, however, things changed, and the electrical manufacturer began himself to follow the advice which he had so long been giving to others.

Direct current methods are the oldest, commercially speaking at least, and first reached a perfection leaving little to be desired; and for some years past several of our largest electrical companies have been distributing power throughout their works by electrical means instead of by long belts and shafting, and have driven almost all of their tools either directly from direct current motors or from short lines of shafting driven locally in the same way.

Next in point of time came the simple alternating current which seemed to present possibilities for the future which would relegate direct current practice to the rear. For incandescent lighting purposes and long distance transmission *per se* it seemed all-sufficient almost from the invention of Gaulard and Gibbs, but for motor service it proved inadequate to the demands. Early in the history of the art alternating current motors of good efficiency had been constructed, which, when once brought up to speed, would do good work, but from that day to this, notwithstanding the persistent efforts of the best talent, a simple alternating current motor that could be started and stopped and reversed while under load, and thus fulfil all the requirements of commercial practice, has not been built.

From time to time claims have been made that this has been accomplished, but the test has never verified the promise. Not until the invention of the polyphase motor by Nikola Tesla, in which two or more simple alternating currents differing in phase were employed, was the alternating current adapted to the demands of commercial power practice.

Although Tesla's seven earliest patents were issued on May 1, 1888, followed by four others during the same year, the value of the polyphase system was not generally realized until 1891, when the Frankfort-Lauffen experiment attracted world-wide attention to its merits. Both before and since that date, however, many modifications of Tesla's method had sprung into existence whose claims for utility were strongly urged by their respective promoters, and the history of the direct current method from the manufacturer's standpoint was repeated. Although extraordinary claims were advanced for these systems, and latterly numerous successful installations had been made, the manufacturer himself neglected them in the equipment of his own shop. With one or two exceptions, while the manufacturer of alternating current apparatus equipped his factory with electrical power apparatus, it was of the direct current type, which his own wares were professedly intended to supplant by reason of their superiority.



NIKOLA TESLA.

There were often more or less valid reasons for this seeming inconsistency, but the public knew them not, and from this circumstance, perhaps, more than any other has looked upon polyphase systems with lack of confidence, if not suspicion.

The greatest difficulty that the manufacturer has had to contend with in replacing an established system by a new one, has been to adapt the speeds of the new motors to the old pulley relations—either this had to be done or the pulley relations had to be adapted to the new motor speeds, either of which would involve an expense scarcely warranted by the results.

But when the Westinghouse Electric and Manufacturing Company began equipping their magnificent new works at East Pittsburg they were hampered by neither of these considerations, and were left entirely free to choose that system which they thought promised the best results. This company being the owners of all the Tesla polyphase patents, had for years been recommending the system to their patrons as universally applicable for general power distribution; and they have given evidence of their faith in the system by equipping their new works throughout with it.

This plant, which is now described for the first time, though not yet complete, forms the most interesting installation of polyphase apparatus thus far made, for several reasons. In the first place, the same type of apparatus, the same method of distribution and the same frequency of alternation of current (3,000 per minute) are employed as are to be used at Niagara. Its sufficiency for all the multifarious demands of these large works is therefore a demonstration of its sufficiency for all the demands that can be made upon it at Niagara. Furthermore, it is the first practical demonstration of this on a sufficiently extended scale to settle the matter beyond question. In the second place it is the first demonstration on a practical scale of the system to machinery and work of the greatest heterogeneity and severity of exactions and as a forerunner of the Niagara project will serve as an object lesson of the greatest value and do more to rapidly advance the great industrial progress in and around Niagara, which has to depend upon this very system, than almost any other agency.

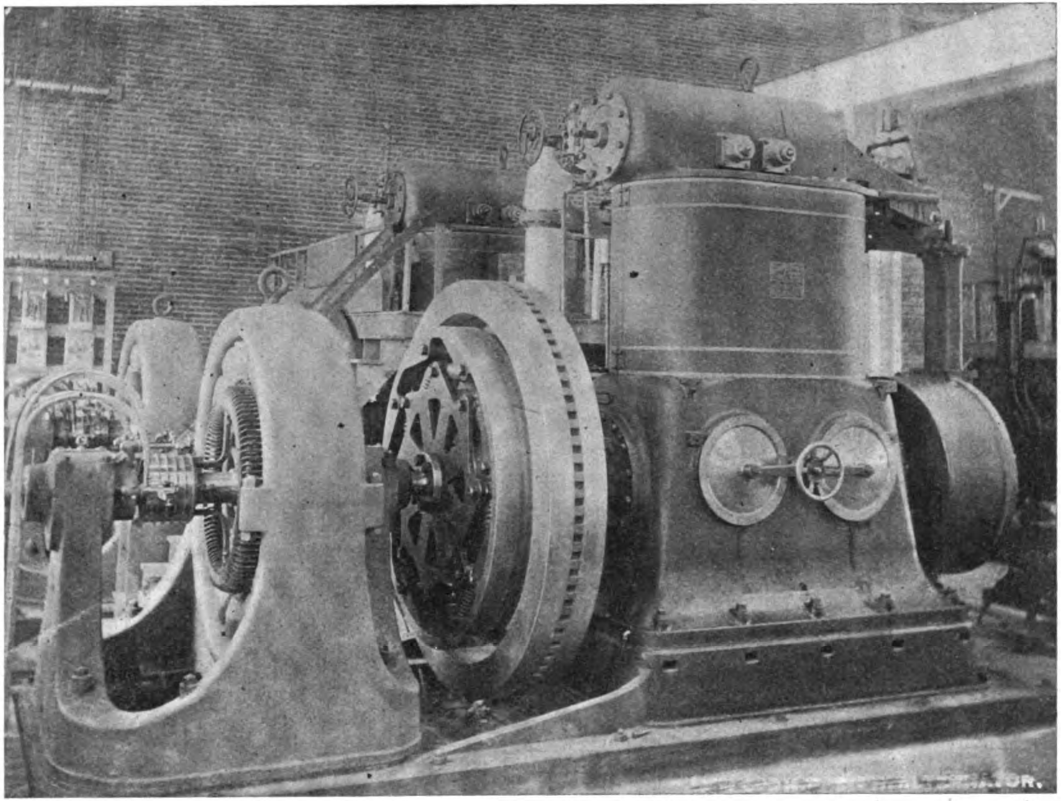


FIG. 2.—TWO-PHASE GENERATORS FURNISHING POWER AND LIGHT TO THE WESTINGHOUSE SHOPS. 500 H. P. UNITS.

Although anticipating a little, it may be well, in order to convey an idea of the variety of service that this system is supplying in the Westinghouse works, to catalogue the apparatus it is now driving.

PRESENT INSTALLATION.

Main Machinery Building, 754 feet long by 235 feet wide.

SMALL GENERATOR DEPARTMENT—MACHINES BELOW 100 H. P.

Ground Floor—

Two 40 h. p. motors each, driving planers, drill presses, lathes, etc., to the number of about 100 machines.

Galleries—

One 30 h. p., driving about 40 screw machines of various sizes.

Two 30 h. p. each driving 40 tools of various kinds in Too Department.

One 40 h. p. driving about 40 tools of various sizes in Commutator Department.

One 20 h. p. driving about 25 or 30 tools in Brush-holder Department.

One 30 h. p. driving about 60 tools in Controller Department.

One 20 h. p. driving about 15 tools in Converter Department.

One 20 h. p. driving 15 punches and various tools in Mica Department.

Four 20 h. p. driving 200 winding lathes.

Six 40 h. p. driving fans for heating.

Making 20 motors of an aggregate of 620 h. p. already installed in this building.

There still remain to be installed in this building the following motors:

One 30 h. p. to drive 3 Ingersoll milling machines.

Two 30 h. p. in Railway Motor Armature Department, each of which will drive some 40 tools, lathes, etc.

One 15 h. p. in Motor Armature Winding Department.

Two 30 h. p. in Motor Machinery Department, each driving some 30 heavy tools, boring mills, lathes, drills, etc.

One 30 h. p. to drive 3 boring mills, one 122 inch by 35 inch lathe, two 72 inch radial drills, two large planers.

One 30 h. p. to operate planers, boring mills and drill presses.

Three 20 h. p. to drive large planers, boring mills, drill press and lathes.

Two 500 h. p. in General Testing Room.

One 75 h. p., one 60 h. p., one 40 h. p. in the Detail Testing Room.

Some of this machinery, together with the elevator and traveling cranes, is already installed and being temporarily driven by direct current apparatus, but it is intended to supplant all these by two-phase apparatus.

WAREHOUSE, 76 FEET X 754 FEET.

Motors already installed—

Four 20 h. p., each driving some 40 tools.

Two 30 h. p., each driving some 45 tools.

Two 40 h. p., each driving fans for heating purposes.

Making 8 motors of 220 h. p.

CARPENTER AND CABINET SHOP, 192 FEET X 60 FEET.

100 h. p. in small units, all direct current at present, but to be replaced with two-phase motors.

BLACKSMITH SHOP, 242 FEET X 82.6 FEET.

Two 20 h. p., on exhaust fans.

Two 10 h. p., on pressure fans.

One 20 h. p., driving two large shears and punches and 5 smaller tools.

Total—5 motors of 80 h. p.

POWER HOUSE, 206 FEET X 76 FEET.

At present this contains—

Two 500 h. p. direct connected alternating current (two-phase) and two 500 h. p. direct connected direct current machines.

The full complement will be 3 units of 500 h. p. each of each kind.

PUNCH SHOP, 258 FEET X 76 FEET.

Two 30 h. p., each driving 40 odd punching machines.

Recapitulating, we find that there are at present installed and in operation 37 alternating current motors of an aggregate capacity of 980 h. p. There are yet to be installed 16 more of a capacity of 1,390 h. p., besides several hundred horsepower direct current motors now installed to be replaced by two-phase alternate current motors.

It will be seen from this catalogue that the new plant constitutes by far the largest installation of polyphase motors that has heretofore ever been attempted and that these motors are doing almost every conceivable class of service except electrolytic work. In addition to this, all of the lights, both arc and incandescent, for the whole establishment are supplied from the alternating current circuits, thus realizing on a most extended practical scale all the promises held out by the attractive "transmission of power" exhibit by this company at the World's Fair, and constituting this by far the most interesting plant anywhere in operation at the present time.

DESCRIPTION OF THE PLANT.

The site of the Westinghouse Electric & Manufacturing Company's new shops, which has been christened East Pittsburg, is 12 miles from Pittsburg, on the Pennsylvania Railroad. The buildings at present erected and occupied are seven in number, and in the order of size are the main machine shop, warehouse, punch shop, blacksmith shop, power house, carpenter shop, and temporary brass foundry. All of these are substantial brick buildings except the carpenter shop and the brass foundry, which are of corrugated iron.

THE MAIN MACHINE SHOP.

This, by far the largest, covers an area of 754 feet by 231 feet 6 inches, and is divided by the roof lines longitudinally into three aisles, each 754 feet long and each traversed throughout its whole length by railroad tracks connecting with the main line of the Pennsylvania Railroad. The main aisle is unbroken from floor to roof and traversed throughout its length by a 30-ton electric crane. Here all the heavy machine work and large generator erecting is carried on. The side aisles are both divided midway of their height by floors, under which in each case is a 10-ton electric crane with a 754-foot runway.

On the ground floor of the north aisle are located the motor armature winding, fitting, and assembling departments and storerooms, and in the south aisle are found the small generator department, small generator armature winding and assembling departments and more storerooms, and the entire eastern quarter of the three aisles as general testing rooms for the classes of work done in their respective western portions.

On the second floor of the north wing, beginning at the west and going east, are the screw department, tool and storeroom, brush-holder department and railway equipment rooms, and similarly situated in the south wing are the wire storeroom, winding and insulation department, mica department, detail testing room and converter department.

Each of these longitudinal sections of the building is traversed by line shafting divided into numerous sections, each of which is belted to an individual two-phase motor situated on the floor, and from which are belted the various tools and machines already enumerated. This plan of transmission from motor to tool is observed throughout the various buildings and need not be again referred to. It may also be stated here that with the exception of three small steam

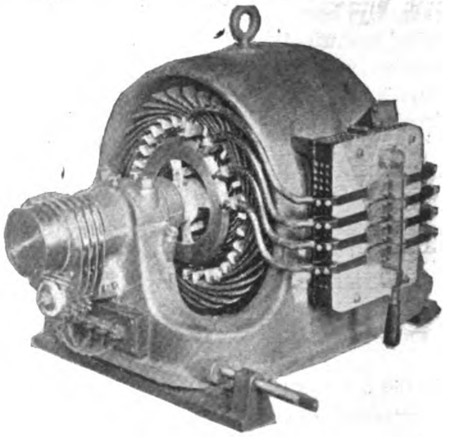


FIG. 3.—TESLA 50 H. P. TWO-PHASE MOTOR. OLD STYLE SWITCH. NEW STYLE COLLECTOR BRUSHES.

hammers for copper forging, in the blacksmith shop, every piece of machinery in the establishment is electrically driven.

THE WAREHOUSE.

Directly south of the machine shop is a building of equal length, but only 76 feet 2 inches broad, whose entire first floor is occupied as a warehouse, in which all finished and returned material is stored for further disposal. For the handling of this material there are two 10 ton electric cranes with runways extending the entire length of the building.

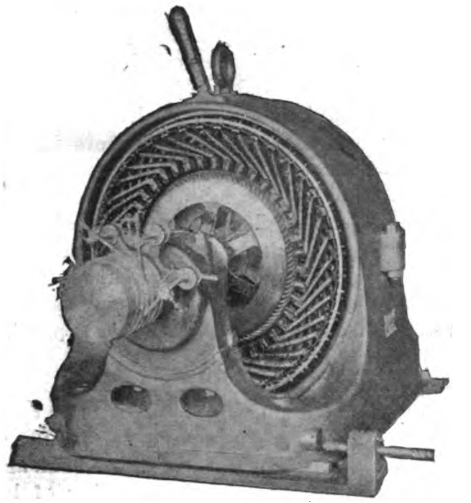


FIG. 4.—TESLA 50 H. P. TWO-PHASE MOTOR. NEW STYLE SWITCH RING. OLD STYLE COLLECTOR BRUSHES.

The second floor is connected by five bridges with the second floor of the south wing of the machine shop thus practically making the two one. The west end of this floor is devoted to the general offices of the administrative, engineering and draughting departments and the eastern end to the instrument department, including meter, arc lamp and switchboard equipments.

THE POWER HOUSE.

East of the warehouse, and separated from it by a passageway 52 feet wide, is the power house. This is 206 feet long by 76 feet 2 inches wide, and devoted in its western part to the engines and dynamos and two hand-operated overhead cranes and in its eastern part to the boilers. The latter are Pierpoint boilers of 2,500 h. p., and there is room for an equal number more. These boilers are equipped with the Roney mechanical stoker. The fuel is delivered from cars on an elevated track direct into large iron hoppers from which it descends as needed to the grates without manual handling of any sort. The present engine and dynamo equipment consists of two 500 h. p. Westinghouse compound engines directly connected by means of two standard Westinghouse flexible couplings to two 500 h. p. two-phase Tesla generators, and two similar engines connected in the same way to two 500 volt multipolar direct current generators. The foundations are all ready for one more 500 h. p. unit of each kind.

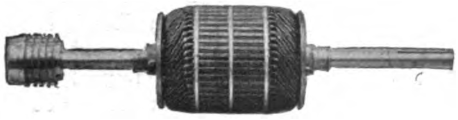


FIG. 5.—TESLA 10 H. P. MOTOR. ROTATING PRIMARY.

PUNCH SHOP.

Fifty feet to the east of the power house and on the same lines is the punch shop, 258 feet long by 76 feet 2 inches wide. Upon the ground floor are the shearing and heavy punching machines, and storage for sheet iron. In the extreme east end are the annealing ovens. The second story is devoted exclusively to the machines for punching armature disks, converter and other shapes for laminated structures.

Running along the north fronts of the warehouse, power house and punch shop is a surface railroad track connecting with the Pennsylvania Railroad's main line, and along the south walls an elevated track by which shipments to and from the second stories of the buildings are made.

TEMPORARY BRASS FOUNDRY.

Just north of the punch shop is a one-story corrugated iron building, 40 feet by 242 feet, used as a brass foundry, and north of this is the

BLACKSMITH SHOP.

This is a substantial brick building covering an area of 242 feet by 82 feet 6 inches. These last three buildings complete the extreme eastern tier of buildings, as do the machine shop and warehouse the western.

Through the center of the building runs a track for local transportation purposes. There are already erected and in operation within this building twenty-five forge fires, and there are fifteen more to be installed. The blast for these forges is supplied by two 10 h. p. two-phase motors. Over each fire is suspended a large sheet-iron hood to collect the smoke and other products of combustion, and these are connected with a system of flues in which a strong draft is created by exhaust fans operated by two 20 h. p. Tesla motors. There are also two large Allstatter combined shears and punches and some smaller tools operated by one 20 h. p. motor. Besides these there are three small steam hammers for forging copper bars of the largest size used in dynamo construction.

CARPENTER SHOP.

The carpenter shop, 60 by 192 feet, lying east of the machine shop, is a one-story corrugated iron building, fully equipped for the purpose. In the 65 feet space separating the machine shop from the warehouse is located the

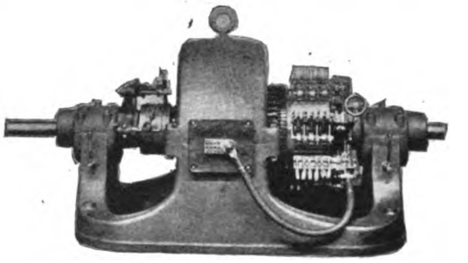


FIG. 6.—TESLA ROTARY TRANSFORMER.

COIL-BAKING AND OIL STORAGE HOUSE,

which is a small brick building, 182 feet 10 inches long by 27 feet 4 inches wide, devoted to the purposes indicated in its name. On the roof of this has been constructed a light, airy room in which the thousands of blue prints used by this great establishment are prepared.

(To be continued.)

Personal.

Mr. W. A. Stadelman, a gentleman who is pleasantly remembered by a good many people in the trade through his former connection with the Sprague Company, is now established in the Havemeyer Building as New York agent for the Elwell-Parker Company and the Brown Hoisting and Conveying Company of Cleveland. These companies have a first-class line of apparatus to offer the public, and we look for a large increase in their business through the New York office. Mr. Stadelman, it will be remembered, distinguished himself at the time of the Cape May Convention by saving from drowning a young lady who had been carried beyond the lines while in bathing.

Mr. J. H. Rhotehamel, president of the Columbia Incandescent Lamp Company, has been in the city for several days.

Mr. F. S. Terry of the Sunbeam Lamp Co., Chicago, is in New York this week.

A PIONEER IN ELECTRICITY:

Sir Francis Ronalds, F. R. S.

BY JOHN SYME.

[The following piece of history, originally published in our English contemporary, *Lightning* (September 1 and 8, 1892), has been republished in pamphlet form by Messrs. Simpkins, Marshall, Hamilton, Kent & Co., Limited, London, and will be of interest to those of our readers who have followed the articles already published in ELECTRICITY on the early history of the telegraph.—ED.]

Wheatstone and Cooke in England and Morse in the United States receive the popular honors, and in their generation received the substantial rewards due to men who first on the largest scale demonstrated to the public satisfaction the utility and practicability of the working of the electric telegraph. Their labors entitle them to honor. No material reward could ever adequately repay them for the benefits which they have conferred on humanity by their discoveries.

But many men of science, in patience, in humility, with many a vision floating before them of what was coming, had laboriously plowed and sowed in the field in which these distinguished and, as the world reckons it, more fortunate men ultimately reaped the harvest. The labors, successful experiments as well as failures, of these earlier workers are apt to be wholly forgotten; but they were none the less necessary in the evolution of the invention which long ago revolutionized modern commerce, which may be said to have created the modern newspaper, and which links together the nations of the world.

Of these pioneers, who for love of science devoted their lives to it, none more richly deserves a niche in the corner of the Temple of Fame devoted to electrical progress than the venerable man, Sir Francis Ronalds, F. R. S. Ronalds had not the practical businesslike qualities—what in common parlance is nowadays known as "push"—but a comparison of dates will clearly show that twenty years before Wheatstone and Cooke or Morse had patented their improvements in the telegraph, indeed while the first two were respectively lads of 12 and 14 years of age, Ronalds had sent messages over eight miles of overhead wire of his own construction, and had laid and worked a serviceable underground line of telegraph of sufficient length to demonstrate the practicability of communication by telegraph between long distances.

Details of the construction and working of these lines are given in an interesting and now somewhat rare little volume entitled "Descriptions of an Electrical Telegraph and of Some Other Electrical Apparatus," published in 1823—i. e., fourteen years before Wheatstone and Cooke patented the improvements with which their names are identified. Plates I and II are from the careful drawings which appear in that little volume illustrative of Ronalds's methods. The experimental line, overhead wires eight miles long, was erected in the year 1816 ("amid many scoffs and jeers and a few imputations of insanity," says Ronalds pathetically in a letter to a friend which now lies before me) in the garden of the house at Hammersmith now occupied by Mr. William Morris, the distinguished poet and well-known Socialist, the house being in 1816 occupied by Ronalds. Quite recently a plain tablet, or inscribed slab, commemorating the fact that in this garden the first message on any wire of really considerable length was successfully sent, has been placed with the consent of Mr. Morris on one of the walls of his house.

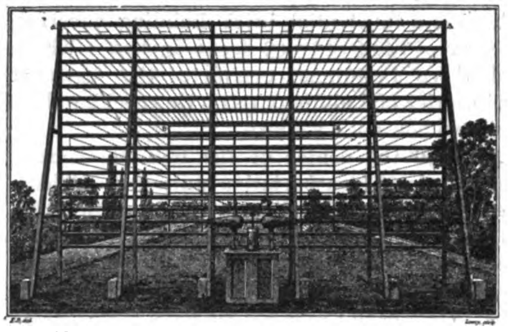
In Ronalds's essay, "Descriptions of an Electrical Telegraph," published in 1823 (and the date is important), he describes his overhead wire as follows: "Upon a lawn or grass-plot at Hammersmith I erected two strong frames of wood, A and B, Plate I, at the distance of twenty yards from each other, and each containing nineteen horizontal bars. To each bar were attached thirty-seven hooks, and to the hooks were applied as many silken cords, which supported a small iron wire (by these means well insulated), which (making its inflexions at the points of support) composed in one continuous length a distance of rather more than eight miles. When a Canton's pith ball electrometer was connected with each extremity of this wire, D and E, and it was charged by a Leyden jar, F, both electrometers appeared to diverge suddenly at the same moment; and when the wire was discharged, by being touched with the hand, both electrometers appeared to collapse as suddenly. . . . When the spark was compelled to pass through the gas pistols, C, and anyone closed his eyes, it was impossible to distinguish more than one explosion, although both pistols were discharged." He was thus able to demonstrate to three of the senses—sight, feeling and hearing—that through eight miles of wire there could be practically instantaneous transmission of electric signs. (See Plate I.)

His next step was to dig a trench in the same garden 525 feet long and 4 feet deep. "In this," again to quote his essay of 1823, "was laid a trough of wood, 2 inches square, well lined in the inside and out with pitch, and within this trough thick glass tubes were placed, through which the wire ran." Plate II, Fig. 1, shows a section of the trough, tubes and wire, from which it will be seen that the different lengths of tube did not touch each other, but that at each joint, or rather interval, other short tubes were placed, of just sufficient caliber to admit the ends of the long ones, together with a little soft wax, which effectually excluded any moisture from insinuating itself between them, and also allowed a little play or motion for the contraction and expansion which variations of temperature produced. For in the first attempts, when hard cement was used, the tubes were apt to break with changes of temperature. "The trough was then covered with pieces of wood, screwed upon it while the pitch was hot; they also were well covered with pitch, and the earth then thrown into the trench again."

His method of reciprocal communication was thus devised: "A light, circular brass plate, divided into twenty equal parts, was fixed upon the seconds-arbor of a clock which beat dead seconds. Each division was marked by a figure, a letter and a preparatory sign. The figures were divided into two series, from one to ten, and the letters were arranged alphabetically, leaving out J, Q, U, W, X and Z. Before or over this disk was fixed another brass plate . . . which had an aperture of such dimensions that, whilst the other disk was carried round by the motion of the clock, only one of the signs upon it could be seen through the aperture at the same time. In front of this pair of plates was suspended an electrometer of Canton's pith balls from a wire which was insulated, communicating with a cylindric electrical machine of only six inches diameter and with the above described buried wire." A second electrometer and clock were placed at the other end of the buried wire adjusted to go as nearly as possible synchronically with the first. "When the wire was charged by the machine at either end the electrometers at both ends diverged; when it was discharged suddenly at either station they both collapsed at the same instant; and when it was discharged at the moment when a given letter, figure and sign on the lower plate of one clock appeared in view through the aperture, the same figure, letter and sign appeared also in view at the other clock; and that by such discharges of the wire at one station, and by noting down the letters, figures or signs in view at the other, any required words could be spelt and figures transmitted."

Ronalds thereafter proceeds to suggest a code or telegraphic dictionary of great ingenuity to economize both time and discharges; and suggested sundry methods by which injury to a damaged wire could be successfully and readily located.

Much of the essay is occupied with popular objections to the introduction of the telegraph, difficulties which experience long ago has proved to be baseless. One objection in these early days frequently raised was the liability of the subterranean wires to be injured by an enemy or by mischievously disposed persons. After considering various practical methods of meeting this danger Ronalds quaintly says: "If they still succeed in breaking the communication by these means, hang them if you can catch them, damn them if you cannot, and mend it immediately in both cases."



A and B: Strong frames of wood erected in 1816 in Ronalds' garden, twenty yards apart; nineteen horizontal bars, supporting eight miles of insulated wire. C: Two air pistols. D and E: Extremities of wire. F: Leyden jar

PLATE I.

He also in this essay predicts with extraordinary foresight the immeasurable public utility to which the electric telegraph may be applied. "Why should not our kings hold councils at Brighton with their ministers in London? Why should not our Government govern at Portsmouth almost as promptly as in Downing Street? Why should our defaulters escape by default of our foggy climate? Let us have electrical conversazione offices communicating with each other all over the kingdom."

This, it must be remembered, was written when the sprawling arms of the semaphore were the swiftest messengers of news in public use, however urgent the occasion.

One of the stations of this garden line of wire (the longest, if not actually the first which up to that time had been seen in England) was situated in a room over Ronalds's stable, and the other at the end of the garden in a tool-house. The wire was buried under the gravel walk. Nearly half a century later there was dug up in the Hammersmith garden several yards of copper wire, a glass tube with the copper wire in it, and one of the joints with a short glass tube; the wooden trough and pitch had become almost as hard as drain-tile. It seems a pity that this interesting relic, which on being found was placed in the Pavilion Museum at Brighton and was later in the possession of Mr. L. Clark, M. I. C. E., along with the original dial-plates used by Ronalds, both of which were procurable, did not find a place on the stand devoted to historic relics of the progress of the science at the Electrical Exhibition at the Crystal Palace in 1892. Ronalds's wire and dial-plates were in active work, as we have said, in 1816; whereas the earliest exhibit at the Crystal Palace was Cooke and Wheatstone's needle instrument of 1837.

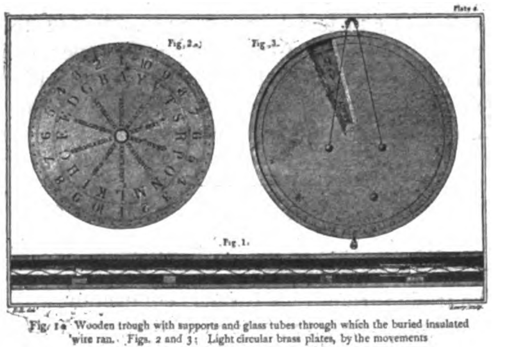


Fig. 1: Wooden trough with supports and glass tubes through which the buried insulated wire ran. Figs. 2 and 3: Light circular brass plates, by the movements of which messages were read.

PLATE II.

The most advanced ideas in science of one generation often become the commonplaces of the next. Sir F. Ronalds's methods have been, of course, greatly improved by his successors in the same field, but to him belongs the honor of being one of the most noteworthy pioneers in the science that, since his early labors, has revolutionized modern life.

His experimental eight-mile overhead wire and his underground telegraph had proved not merely the possibility but the practicability of sending messages over long distances as early as 1816; while Wheatstone and Cooke's apparatus was not patented until 1837.

It is rather a curious fact that Sir W. F. Cooke's father was a surgeon living at Brentford at the date of Ronalds's residence and experiments at Hammersmith, and that Ronalds showed him and explained minutely to him the working of his telegraph. In the controversy which sprung up between Cooke and Wheatstone in 1854 as to the invention of the electric telegraph, Wheatstone says: "Mr. Cooke's principle (the principle of reciprocal communication) was no novelty, . . . having been developed completely and effectively by Mr. Ronalds in his telegraph, the description of which was published as early as 1823." There is good evidence also that Wheatstone himself as a lad of 15 was present at some of the principal experiments in the garden at Hammersmith.

It is not, of course, here sought to assert that Cooke and Wheatstone were not men of great original ability and deserved the honor which they lived to enjoy in connection with their labors, but it is contended that Ronalds paved the way for them. His ideas were in the atmosphere. Ronalds described his invention, as we have stated, but he never took out a patent. It was not until 1837 that a patent was granted to Wheatstone and Cooke for "improvements in giving signals and for sounding alarms in distant places by means of electric currents transmitted through metallic circuits."

England's most rapid method of getting public news from distant places in the days while Ronalds was quietly at work in the Hammersmith garden, was, as I have said, by the semaphore, an arrangement at once costly and clumsy. In fogs, and at night, no communication could be sent. Mr. Frost, librarian to the Society of Telegraph Engineers, states that during three years the semaphore from the Admiralty could not be used, owing to atmospheric disturbances, on 323 days, and that the annual cost for the working of the semaphore between London and Portsmouth alone was £2,000.

Ronalds, conscious of the public importance of his invention, offered it to the Government of the day. Mr. Frost, in his short sketch of Ronalds which forms the introduction to the Ronalds Library Catalogue, publishes the correspondence. It is certainly interesting and instructive, giving a little insight, on the one hand, to the character of Ronalds, and, on the other, a glimpse of the crass dullness and incapacity of the official mind to grasp the fact that the world is moving.

Ronalds sent the following note to Lord Melville, then First Lord of the Admiralty:

> "Mr. Ronalds presents his respectful compliments to Lord Melville, and takes the liberty of soliciting his Lordship's attention to a mode of conveying telegraphic intelligence with great rapidity, accuracy and certainty, in all states of the atmosphere, either at night or in the day, and

at small expense, which has occurred to him whilst pursuing some electrical experiments. Having been at some pains to ascertain the practicability of the scheme, it appears to Mr. Ronalds and to a few gentlemen by whom it has been examined, to possess several important advantages over any species of telegraph hitherto invented, and he would be much gratified by an opportunity of demonstrating those advantages to Lord Melville by an experiment which he has no doubt would be deemed decisive, if it should be perfectly agreeable and consistent with his Lordship's engagements to honor Mr. Ronalds with a call; or he would be very happy to explain more particularly the nature of the contrivance if Lord Melville could conveniently oblige him by appointing an interview.

"Upper Mall, Hammersmith, July 11, 1816."

At first Lord Melville seemed disposed to grant an interview—indeed made an appointment; but ultimately Ronalds received the following letter from the Secretary of the Admiralty:

"Mr. Barrow presents his compliments to Mr. Ronalds, and acquaints him with reference to his note of the 3d inst. that telegraphs of any kind are now wholly unnecessary, and that no other than the one now in use will be adopted.

"Admiralty Office, 5th August, 1816."

If any individualist desires an argument to hurl at the head of a Socialist opponent here is one ready to his hand. Yet Mr. Barrow (afterwards Sir John) lived to write the article on "Telegraphs" in an edition of the "Encyclopædia Britannica."

The immediate result of the correspondence was to throw back research and experiment of electrical science in England for twenty years, and to deprive the nation of the benefits of the invention for that period. Ronalds had to endure the disappointment of most men who are twenty years ahead of their generation.

In 1842 he was appointed superintendent and director of the Kew Observatory under the auspices of the British Association. During this period he invented many important instruments which have had direct and important bearing on electro-meteorological science. His labors in this direction have their place in the Philosophical Transactions of the Royal Society and in the Reports of the British Association.

In 1844 he was elected a Fellow of the Royal Society. The following extract from his will is thoroughly characteristic of the generosity and fine sense of honor of the man:

"I bequeath to the President, Council and Fellows of the Royal Society the sum of £500, in trust, for the augmentation of the Wollaston Fund, and in recognition of the advantages I derived when Honorary Director of the Kew Observatory from grants which I received from that Fund in aid of my not unsuccessful inventions of photographic instruments for the registration of terrestrial magnetism, atmospheric electricity and other meteorological phenomena."

It was not until Ronalds had reached his 83d year, on the recommendation of Mr. Gladstone, that the tardy honor of knighthood was conferred on him "in acknowledgment," as Mr. Gladstone wrote, "of his early and remarkable labors in telegraphic investigations."

To the Society of Telegraph Engineers he bequeathed a fine library of rare, curious and valuable books, collected all over Europe during his long life, of works bearing on electricity, magnetism and the electric telegraph, and with this collection Mr. Frost tells us that among other unpublished MSS. he has left the heads of a proposed "History of Electricity," which it is to be hoped will yet see the light. His book entitled "Descriptions of an Electrical Telegraph" (1823), the first edition of which is now scarce, from which I have quoted, is particularly interesting as being, I believe, the first English book on the electric telegraph.

Ronalds was a man of great originality, whose modesty, amounting to diffidence, did much to hide his real merit from the world. Had he been a pushing, thick-skinned man of business, doubtless the public monuments and the material fortune that many men who have done less for science have attained would have been his. He was content to do his share of the world's work quietly, modestly, and with a single eye to the promotion of scientific knowledge without regard to any personal rewards. Such men deserve to be honorably remembered when the history of any great movement comes to be recorded.

ELECTRIC CURRENTS OF HIGH PRESSURE AND PERIODICITY.*

BY A. A. C. SWINTON.

The experimental effects that I propose to show this afternoon are all produced by utilizing the disruptive discharges of Leyden jars to give electrical impulses of comparatively considerable magnitude as regards energy but of exceedingly short duration as regards time.

As is well known, if a Leyden jar be discharged through a stout copper wire forming a circuit of small resistance, a surging of the electrical charge is set up, with the result that the electric current which passes through the wire is of the nature of a gradually dying-away oscillation. The action may, indeed, be compared to what occurs when a pendulum, immersed in some viscous fluid, is suddenly released from an inclined position and swings backwards and forwards with a gradually decreasing amplitude of oscillation until it comes to rest; or we may make the analogy more exact by comparing the effect to a loaded spring bent aside in a resisting medium and then let go. The pliability of the spring corresponds to the capacity of the condenser, its displacement to the electrical charge, the load or inertia to the self-induction of the circuit, and the viscosity of the fluid to the resistance of the circuit.

Thus the total duration of the discharge of a Leyden jar varies with its electrostatic capacity, being longer for large jars than for small. At the same time, both the duration of the discharge and the rate of oscillation are dependent upon the resistance and self-induction of the discharging circuit. In apparatus of the kind that we employ the conditions are exceedingly complex, and consequently calculations as to the duration of the discharge, or as to its rate of oscillation, must necessarily be only approximate. The total duration of the discharge itself can, however, be fairly accurately measured experimentally by means of a revolving mirror, and I think you may take it as tolerably correct when I tell you that the total duration of each discharge of the batteries of Leyden jars that we have here, and are going to use, is about $\frac{1}{50000}$ of a second. It has been further calculated that, with the conditions that we are working under, the rate of oscillation should be about 200,000 complete periods per second, so that apparently we get about four complete oscillations in each of our discharges.

Our jars are charged by means of an alternate-current dynamo machine, which has a frequency of approximately 100 complete alternations per second. The jars are charged and discharged at each half-period, consequently one in each $\frac{1}{200}$ of a second. The duration of the discharge is, as already mentioned, $\frac{1}{50000}$ of a second, and consequently, if we devote our attention merely to what is taking place in the discharging circuit, there are intervals between each discharge of $\frac{249}{50000}$ of a second, during which intervals there is no current passing at all.

Fig. 1 shows this from a diagrammatic point of view. Only four discharges are shown, and it has unfortunately not been possible to show the intervals between them to scale, as, if shown on the same scale as the discharges, each of which on the diagram occupies 10 inches, the intervals ought to be no less than 208 feet.

It has been usual to call oscillatory currents produced in this manner "high frequency" or "high periodicity electric currents." I am not sure with whom the term originated, but I think it was with Mr. Tesla, to whose investigations in this particular branch of electrical science we all owe so much. I am bound to say, however, that the term seems to me to be a very unfortunate one, as though the periodicity is decidedly high during each discharge, the discharges are of so very short duration, and are spaced by such comparatively long intervals, that the average frequency is really not high at all; in fact, in the experiments I am about to show you, the average frequency appears only to be about 800 a second as against 100 a second, the periodicity of the alternator supplying the original current.

Further—and what I am now going to say is, I believe, in direct contradiction to the orthodox view—it does not appear to me that any high frequency at all is necessary to explain the effects produced. All that is necessary is that the electric current should be delivered in impulses of exceedingly short duration, in which the current and voltage rise from zero to enormously high maxima, and fall again to zero with exceeding suddenness. The defects are, in fact, due to the rapid rate of change.

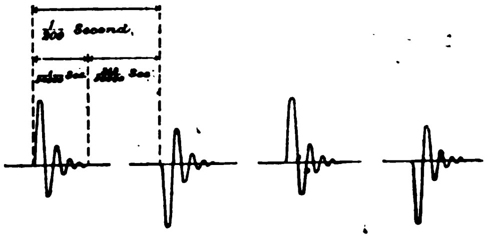


FIG. 1.

Now, oscillatory or pulsatory currents of the description that I have mentioned behave in many respects in quite a different manner from continuous or ordinary alternating currents. This is due to the fact that while with ordinary alternating currents the effects of impedence, induction and electrostatic capacity are comparatively small, unless we take special means to render them operative, with our oscillatory currents these effects are comparatively enormous, and show themselves whether we will or not.

To take first of all the case of impedence. We have here a thick copper wire bent into a U-shape, which would conduct an ordinary alternating current with practically no impedence at all. We have it connected, as shown in Fig. 2. We start with a 100-volt alternating current of the ordinary description, which passes through the primary of an induction coil. From the secondary of this coil we obtain some 20,000 to 30,000 volts. This high pressure current charges the Leyden jars at each half-period up to a point where the air resistance across the spark gap is broken down, and a disruptive oscillatory discharge takes place. In this manner we obtain an oscillatory discharge of electricity through our U-shaped piece of copper wire. In order to let you see the effect of the impedence, I will connect these incandescent lamps across from one leg to the other of the U-shaped wire. You will observe that though short-circuited by the wire, which has enormously less ohmic resistance than the lamp filaments, the latter incandesce brightly. The oscillatory current, in fact, does not take the path of least ohmic resistance, as might be expected, but the shortest path—i. e., that of least self-induction and impedence. By sliding the lamps up and down we can make them burn more or less brightly, and by choosing suitable positions we can make lamps varying in voltage from 20 to 100 volts all burn with uniform brightness.

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* Contribution to the Professional *Papers* of the Corps of Royal Engineers, Chatham, Eng.

Again, oscillatory electric currents such as those with which we are dealing have much more powerful inductive effects than ordinary alternating currents.

We have here two circles, each consisting of a single convolution of thick copper wire. One of these circles has a 20-volt 5 C. P. incandescent lamp connected to the two ends of the wire, and the other circle is connected as was the U-shaped wire in the last experiment, so that we can send oscillatory discharges through it. We will hold the two circles facing one another about 6 feet apart and turn on the current. As you see, the lamp filament is gradually becoming red hot, showing that the oscillatory current passing through the one circle is inducing an electric current in the other. If we bring the circles nearer together the light becomes brighter, and with an interval of 2 feet the lamp is fully incandesced.

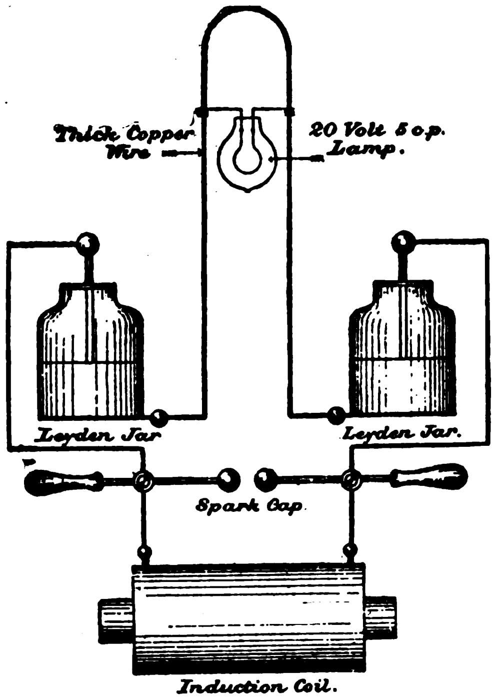

FIG. 2.

One of the most striking facts in connection with these oscillatory currents is the small physiological effect that they appear to have on the human frame. As is well known, the discharge of a good-sized Leyden jar, if taken direct, occasions a most violent shock to the system, and may, indeed, be sufficient to destroy consciousness for a time, or even to cause death. The current from a medical magneto machine, or even a small induction coil, is sufficiently unpleasant for most people, while that from an alternate current dynamo giving 1,000 to 2,000 volts is used for official electrocution in the United States of America, and has been the cause of more than one death in this country. The electric currents employed in medicine rarely exceed a few thousandths of an ampere, muscular fixation and other unpleasant results being usually produced when more than 10 to 20 milliamperes of continuous, or two to six milliamperes of alternating or interrupted, current is passed through the body.

We have here an ordinary 5 C. P. 100-volt lamp, which, with continuous or ordinary alternating current, requires about one-fifth of an ampere or 200 milliamperes to bring it to full incandescence. This is, of course a much greater strength of ordinary current than anyone could bear for a moment. We will incandesce this lamp with current conveyed through the bodies of two persons. The connections are as shown in Fig. 3, and as you will observe, there is no connection between the lamp and the other apparatus except through the arms and bodies of the two operators. As you will see, the lamp filament is brought up to full incandescence when we turn on the current.

Various theories have been propounded to account for the harmlessness of these currents. Some have supposed that the human body acts not as a conductor, but like a condenser with regard to the passage of alternate currents, forgetting that were this the case the impedence offered to oscillatory currents would be very small, and the application of high voltages, such as I have been using, would consequently be serious. Some, on the other hand, have imagined that it is all a question of the nerves, which they assume to be, as it were, tuned only to respond to alternations of comparatively low periodicity, and being unaffected by those above a certain range, as is the eye to luminous waves above the frequency of violet light.

The real facts of the case seem to be that wherever these oscillatory currents are harmless it is simply for the reason that the quantity of electricity they transmit in any given time is too small to do any injury. Leaving on one side those physiological effects from which the burning and disruptive action produced in the tissues traversed are clearly due to the internal production of considerable quantities of heat, the physiological effects of electric currents seem most probably to be due to chemical decomposition—in fact, to electrolysis. Now the amount of electrolytic effect in any given time is, of course, proportional to the quantity of electricity—that is to say, to the number of the coulombs passed in that time. What, therefore, can be more natural than that the physiological effects of electric currents should, within limits, be proportional to the coulombs of electricity passed.

It will, however, be said that in the lamp experiment I have just shown you the current in the lamp must have been one-fifth of an ampere, and that, consequently, whatever the description of the electric current—continuous, alternating, or oscillatory—one-fifth of a coulomb was passed through the arms and bodies of the operators during each second that the lamp was lighted.

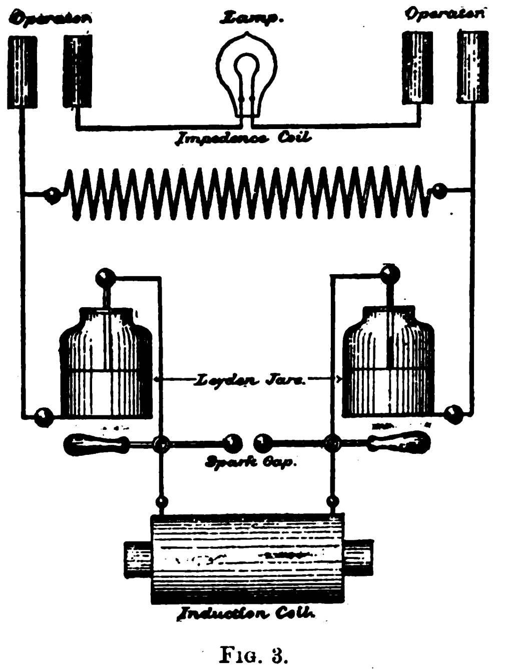

FIG. 3.

A little consideration will, however, show that this is by no means the case. In the first place, as has been shown by Lord Kelvin, oscillatory currents which rise and fall between minimum and maximum very rapidly do not flow uniformly through the section of a conductor. They tend to keep on the surface, and given sufficiently sudden fluctuations, may only be, as it were, skin deep. Applying this to the filament of our lamp the effect is to increase its resistance, since only a part of the section of the filament acts as a conductor. The filament might, in fact, be a hollow tube instead of a solid wire. We have ample sufficiency of available voltage, and though the strength of the current may be small, the resistance being high there is a sufficient expenditure of watts to raise the filament to incandescence. The lamp, in fact, ceases to be a 100-volt lamp taking one-fifth of an ampere, and becomes, may be, a 1,000-volt or even a 10,000-volt lamp, taking only a tenth or a hundredth of that amount of current.

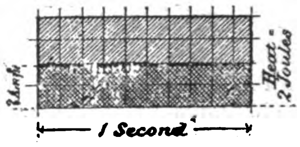

FIG. 4.

Steady Current.—Assumed resistance equals 1 ohm; assumed quantity, 2 coulombs; time equals 1 second; ∴ current equals 2 amperes; ∴ heat generated equals 2 joules.

There is also another point to be borne in mind. The current is delivered in impulses of exceedingly short duration. If we turn to Fig. 4, the double-cross shaded portion of the figure represents a current of two amperes flowing for one second of time. The area of this portion thus represents two coulombs of electricity. If we assume that this current is being passed through a resistance of one ohm, the heat generated in the resistance will clearly be equal to two joules. So much for continuous current. If we now turn to Fig. 5, we have a similar quantity of electricity—namely, two coulombs—passed through a similar resistance of one ohm; but instead of sending the current through continuously for one second, we will suppose it to be sent through in four pulsations, each lasting for one-tenth of a second, with intervening spaces of one-fifth of a second of no current at all. In order to pass our two coulombs within the second under these conditions, the average current during each pulsation will have to flow at the rate of five amperes, and the amount of heat generated, being proportionate to the square of the current, will be one and a quarter joules for each pulsation. The total heat generated during the second will, therefore, be equal to five joules, as against the two joules generated when we employ a steady current. Conversely, of course, the same quantity of heat can be generated in a given resistance and in any given time with a pulsating current with a less quantity of electricity than will generate this quantity of heat in the same

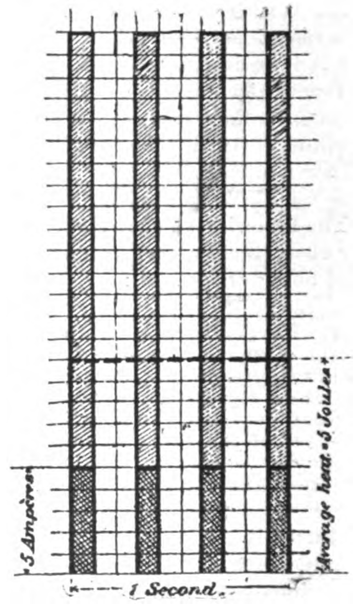

FIG. 5.

Pulsating Current.—Assumed resistance equals 1 ohm; assumed quantity equals 2 coulombs; total time equals 1 second; duration of each pulsation, one-tenth second; then average current during each pulsation equals 5 amperes, and heat generated equals 5 joules.

time with a steady current. Further, the shorter the duration of the impulses the smaller is the quantity of electricity necessary, so that when we come to impulses of such exceedingly short duration as $\frac{1}{50000}$ of a second, such as we have been using in our experiments, the quantity of electricity necessary to produce the amount of heat required to incandesce our 5 C. P. lamp must be exceedingly small indeed.

So far we have been dealing with what I may term "primary oscillatory currents"—namely currents that are derived directly from the Leyden jars without transformation. We will now try the effect of a step-up transformer which is contained in this box, and is entirely immersed in resin oil, in order to prevent sparking and the dissipation of energy by leakage either in the shape of conduction or brush discharges. The arrangement of the connections may be shown in Fig. 6.

We are now dealing with oscillatory discharges having a potential difference that may be measured in hundreds of thousands of volts, and, as you will notice when the light is put out, the brush discharge effects are very striking. If I present my hand to one of the terminals of the coil sparks shoot out to my fingers. These sparks cause a painful pricking, but if I take a piece of metal in my hand and present it to the terminal I can take a violent discharge of sparks practically without any sensation. If I take hold of one terminal of the coil with one hand, which I can do without hurt, and present the other hand to the outside of the box of oil containing the coil, streams of sparks issue from my finger tips. Again, having hold of one terminal I can draw sparks from any body having electrostatic capacity, such as another person or any metallic body, merely by bringing my free hand, or for that matter my foot or any part of my body, near to them.

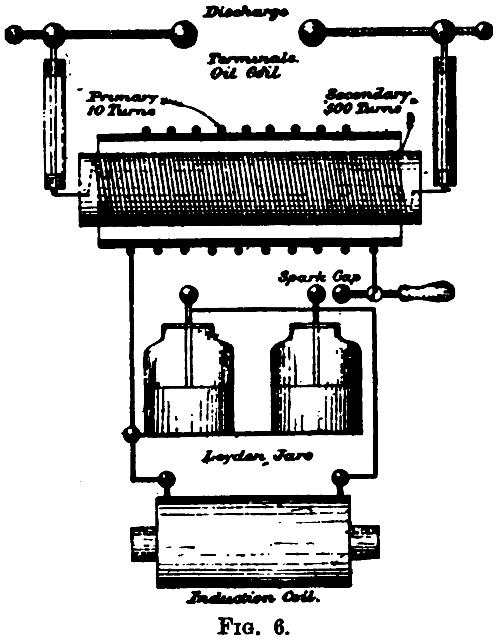

FIG. 6.

The high-tension oscillations have also marked electrostatic inductive effects. We will show this by attaching a tin-plate to each of the two terminals of the coil. We have here two other tin-plates, between which an incandescent lamp is connected. When we bring these latter plates within a foot or 6 inches of the others, the lamp incandesces brightly. We can also incandesce a lamp filament by connecting one lamp terminal to one coil terminal and merely touching the other lamp terminal with a piece of metal held in the hand. The operator can stand upon an insulated stool, it makes no difference, as the effect is due not to any circuit being established, but to the electrostatic capacity of the operator's body. The electricity in fact merely runs in and out of the operator through the lamp, and thereby incandesces the latter.

Pretty effects can be shown by passing the high-tension discharge through a piece of wood, the sparks finding their way through the substance of the material, and lighting it up with a dark red color. Or a piece of glass, one side of which is covered with tinfoil, may be placed between points connected to the terminals of the coil. As will be seen, the discharge spreads out in fiery streamers over the glass with a loud roar. By substituting a dry photographic plate for the glass we can obtain photographs of the discharge taken with its own light. I have had lantern slides made of photographs produced in this manner, and, as you will see, they give very beautiful effects. The figures produced by positive electricity are irregular, somewhat resembling the rivers on maps. Those produced by negative electricity are, on the other hand, beautifully curved, and are like feathers or palm branches. Oscillatory discharges show both positive and negative figures combined.

The oscillatory electrostatic stresses set up in the neighborhood of the coil will also produce luminosity in vacuum tubes. If I wave the tubes rapidly you will notice the discontinuity of the light, which is due to the intervals of time between the succeeding groups of oscillations. I have here a cylindrical vacuum tube, outside of which is wound a few turns of thin wire in the form of an open spiral. I connect one end of this wire to one terminal of the coil, and you see two luminous spirals twisting in and out of each other. One is the wire, which glows with a dark purple color, the other is a species of ghost produced by molecular bombardment inside the tube.

The luminosity of wires can, however, be shown on a larger scale. We have here two circles of wire, a large and a small one. We will connect them respectively to the two terminals of the coil, and place them concentrically in one plane. When we switch on the current and lower the gas you will see that both wires glow brightly, while the interval between them is filled with streamers of purple light; or we can connect these two parallel wires which reach to the other end of the lecture hall, and which become luminous throughout their entire length.

These are all the experiments I have to show to you this afternoon. These phenomena may not in themselves have any immediate useful application, but they are in many ways very instructive. In addition, the essence of science is the correlation of facts, and the further we pry into the secrets of nature the more we are likely to achieve useful results.

A Chicago inventor has devised a mail-carrying arrangement which has favorably impressed the postal authorities, and if successful will do away with the lumbering mail wagons in city streets, as mail will be carried on trolley cars running on wire cables strung over the roofs of houses. A test will be made in Chicago at an early day, the city council having granted the inventor permission to string his wires. The cost of construction is put at $250 a mile. A description of the motor and carrier by the inventor is as follows: "The whole arrangement weighs 32 pounds. The motor alone weighs 18 pounds and its strength is ¼ horse-power as proved by actual tests. It will be operated by a single wire without a return circuit. All parts of the carrier except the motors are made of aluminum. The cars are detachable from the frame, and can be taken out and changed in ten seconds. The motors will climb an incline of 20 per cent. The speed is regulated before the carrier is started on its trip by a simple attachment. It will run no faster down grade than up. It cannot jump off the wire even at a speed of 100 miles an hour. It runs on a four-inch sheave wheel with deep flanges. The wheel is furnished with ball-bearings. The power required to operate the carriers at a speed of 60 miles an hour is exactly the same as is required to run an ordinary arc light. A current of 110 volts is used. A heavier cable is used than is necessary to sustain the weight as a measure of safety."

Notes on Recent Electrical Engineering Developments in France and England*—III.

DISCUSSION.—(*Continued*).

The President—I will call now on Mr. Leonard to close this discussion.

Mr. Leonard—I have so many points to answer that I hardly know where to begin. If I inadvertently embraced far more in the scope of my paper as regards central stations abroad than I should have done, I regret it, and I can see upon reflection that there is cause for criticism if I have made remarks that are so sweeping as to involve stations which I did not see. In saying that undoubtedly we have the best three-wire central station plants in the world, I judged largely by my familiarity with those in this country by observation, and those abroad which I have not seen, by published descriptions. But one point which I wish to mention is, that I do not consider that any conclusions can be arrived at in judging the matter by the question of how many watts are delivered to the customer per pound of coal. The coal in the cost of the central station energy is less than 10 per cent.. It may possibly be that such stations abroad may show better results than ours as judged by the statistics compiled by the National Electric Light Association. But I hardly think this would necessarily be a criterion either, because we all know the care with which statistics are prepared by foreigners, and especially Germans, and we also, most of us, would be inclined to doubt whether all of the best of our United States stations had submitted full, detailed and accurate figures as to their production to the committee that published the results in question. There are a great many points concerned in what I would consider the best three wire plants which are not at all covered nor rubbed out by the question of the watts produced per pound of coal, and among them are the question of the perfection of distribution of pressure, the question of kilowatt hours produced per annum, per dollar of capitalization, and especially the question of how much earnings the station is making per dollar of investment, in which latter two points I am quite confident, although I have not the figures to back up the statement, that we are ahead of the European practice. I was very much surprised to hear one of the speakers state that the load factor of the New York Edison central station was 34 per cent., and I am almost forced to conclude that we differ as to the definition of load factor, for I had occasion personally to secure unquestionable returns in 1890 from the central stations in Chicago, Brooklyn, New York, Philadelphia and Boston, and at that time those stations averaged about 40 per cent. for the load factor and the New York station was the best of the lot, and I can only explain any such falling off as is represented by the present low factor of 34 per cent. as due to the taking on of too many of those fluctuating loads like elevators. As regards the question of the load factor again, I happened to be with the president of the Chicago Edison Company on my visit abroad, and while there he received complete statistics from Chicago in regard to the operation in December, and the load factor there during December was over 50 per cent. The speaker perhaps did not understand that my remarks were limited as regards the quotation as to the load factor in London in the month of December, in which, of course, the load factor is higher than would be ordinarily the case.

Another speaker spoke of 28 pounds per kilowatt hour not being correct relative to 15.7 pounds per indicated horse-power hour. I think these figures will bear scrutiny, and I call attention to the fact that the first one was in feed water per kilowatt hour in useful electric energy and not horse-power hour, and the second is per indicated horse-power hour.

As to the argument which has been presented by more than one, that while the Heilmann locomotive has a larger boiler there is no reason why similarly a steam locomotive should not have a larger boiler, I beg to say that while I do not profess to have any very great amount of knowledge on that subject, I have given some considerable attention to it of late, and have noticed the comments and the writings of a good many persons who claim to be very well versed, and apparently are, judging by their papers and by their standing, and the impression that I have derived is that there has been reached, very closely, a limit in the size of the steam locomotive boilers, that to make and place a larger boiler upon a locomotive to-day leads to such difficulties in many other ways as to be practically prohibitive, and I can only wonder, if they can run with a steam boiler sufficiently large, why they burn twice as much coal as we do with stationary boilers. There seems to be no question that they do burn more coal to produce a horse-power, and it is due to the fact that they do have too small a boiler and crowd it too hard. If they can, why don't they put on a bigger boiler ?

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* H. Ward Leonard's paper read at a meeting of the A. I. E. E., February 27.

As to the cost of batteries, engines, etc., relative to each other, the figure of $107 per kilowatt, I think it is quite close to the mark of present practice, and I will say that in discussing this question with one of the best posted men in England, after considerable argument and figuring on his part, he stated that the cost of batteries, such as they made, would be $175 per kilowatt. As to the cost of engines, boilers and generators, I am satisfied if any such figure as $100 per horse-power has been quoted, that it must have been intended not to cover the boiler, engine and dynamo merely, but possibly the value of the real estate and buildings, etc., which they represent also, and which I have not included in my figures, as there is no doubt but that large boilers, engines and dynamos can be procured, not only at $50, but I believe at considerably less per kilowatt.

A criticism was made as to the suggestion of placing the batteries upon the consumer's premises instead of in the station. I think the speaker has lost sight of the fact that the only argument in favor of placing the battery in the position which I suggested was to enable the customer to obviate the necessity of calling upon the central station for those large spurts of energy which he required, with its consequent high cost, due to small load factor, at the rates I named. Placing the batteries in the central station would not correct the disturbance of lights or the drop in the conductors affecting other consumers, nor could the station afford to give to the customer such a low rate when these variations in the customer's load are still in existence as he could if it was a constant current supplied to that customer for twenty-four hours per day. I must say that knowing the general views of American central station managers about storage batteries, I thought it would be rather in consonance with their ideas if they could get a customer to buy the batteries and maintain them.

As to the $300 per kilowatt, that $300 per kilowatt represents not, of course, merely the boilers, engines and dynamos, but it represents the underground system which is very expensive per kilowatt, also the real estate and buildings, and possibly the usual percentage for the franchise, patents, etc.

I had no intention of impressing my hearers with the idea that the European practice was ahead of ours at the present moment. In fact, my opening clause stated that I was in doubt as regards the matter. But I did point out that they were making more progress than we were in this country in trying new methods, new apparatus and new combinations, diverging from the old beaten paths; and I consider that practice due to the fact that there are so many concerns over there which are considered first class and are almost always in any competition which arises. In this country when a large central station plant is to be installed, as we all know, it is not competed for by 25 or 30 concerns the majority of whom are engineers who understand the entire construction of the work and manufacture the apparatus in addition, but generally the plants are built by the people themselves, by some one of their employes, merely purchasing the apparatus from some one or two or three manufacturing concerns.

As to the question of dynamos and motors and the argument that we have, as I thought, better dynamos and motors than they have abroad, I can only say that I think the best reason for this is that there are no patents on them which even the smallest concerns are afraid of, and therefore we do have active competition from the smaller concerns which do not have large capitalization due to patents and heavy fixed charges, which necessitate the large profits of corporations such as I was commenting on.

The point as to the batteries not having been properly estimated by the fact that three and one-tenth watts was assumed, is not correct. The lamps were assumed at three and one-half watts per candle. Even if for the sake of argument it be assumed that the battery will cost $80 or $90 per kilowatt as against $50 for engine and boilers and dynamos, it would not affect the conclusion materially.

The argument was advanced that we ought not to consider the elevator as being a kind of load that was detrimental in its present state, because it is running all day long. But that does not alter the fact that if it does run all day long it only has a load factor of five per cent., and the revenue of that per kilowatt is only $181 per year, even at 30 cents per kilowatt hour, and that it will come on and be on the top of the peak of your maximum load. As an instance of that, I have a practical figure of an elevator which does require about 30 kilowatts to start it up, and its bill is $75 per month, and it does come on the top of the peaks at the maximum load.

(To be continued.)

No Standing in Court.

Trade Combinations are Dangerous to the Peace and Good Order of Society.

Judge Baker's Decision in the Harrow Trust Case.

The following is an abstract of Judge Baker's recent decision at Indianapolis, refusing an injunction against an acknowledged infringer of patents owned by the Harrow Trust :

"So far as I can perceive, the complainant is organized to receive assignments of the legal title of harrow patents, to grant back licenses to assignors to use and enjoy the same, to collect from each member of the combination or trust $1 as a license fee for each harrow manufactured and sold, to regulate and control the price at which harrows may be sold by the members of the combination, and to prosecute and defend all suits involving the alleged infringement of such assigned patents.

"It seems to me that such a combination is illegal, and that its purposes are violative of sound public policy. The common law forbids the organization of such combinations composed of numerous corporations and firms. They are dangerous to the peace and good order of society and they arrogate to themselves the exercise of powers destructive of the right of free competition in the markets of the country, and by their aggregate power and influence imperil the free and pure administration of justice.

"Complainant says that its title to the patent in question is valid, and that it has a lawful right to its protection from invasion by a stranger, regardless of the objects and purposes of the combination which it represents. On the other hand, the defendants contend that to give its title protection would be to give aid to the unlawful purposes of the combination. In suits at law it is doubtless true, as a general proposition, that a wrongdoer will not be permitted to dispute the legal title of one in possession of money or property by showing that the title thereto was unlawfully acquired, or that the owner intends to apply it to an unlawful use. I have strong doubts whether this rule ought to apply to a suit in equity, where nothing but clean hands and a good conscience will move the court to act. The combination represented by the complainant is not illegal in any other sense except that the law will not lend its aid to the accomplishment of its purposes. The common law does not prohibit the making of such combinations. It merely declines after they have been made to recognize their validity by refusing to make any decree or order which will in any way give aid to the purposes of such combinations. It seems to me that the court connot sustain the present bill without giving aid to the unlawful combination or trust represented by the complainant. The question is not free from doubt; but in case of doubt I feel it my duty to resolve it in such a way as will not lend the countenance of the court to the creation of combinations, trusts or monopolies. They have already grown to alarming proportions, and courts, to the full extent of their powers, ought to discountenance and repress them."

What the Public has Waited for.

A Formidable Rival to the Bell Telephone Company.

Money, Men and Methods are All Right.

The Standard Telephone Company, of 68 Broad street, New York, announces that it is ready for business throughout the United States. The capital of the concern is $10,000,000. Its board of directors is made up of Thurlow Weed Barnes, president; John A. Brill, president of the J. G. Brill Company, car builders, of Philadelphia, Pa.; Carl F. Baker, of the hardware, steel and iron house of H. Baker & Co., of New York; John W. Candler, formerly Representative, railroad president and merchant, of Boston, Mass.; George Crocker, of San Francisco, Cal.; Henry Merz, president of the Heller-Merz Company, manufacturers of colors, of New York; Allen T. Nye, promoter of the company; Manning C. Palmer, president of the Syracuse National Bank and Electric Light Company, of Syracuse, N. Y.; Felix Rakeman, of Bulch & Rakeman, of Boston; John E. Searles, secretary and treasurer of the American Sugar Refining Company, better known as the Sugar Trust, of New York; Charles T. Strauss, of Charles T. Strauss & Brothers, importers of lace, of New York, and Louis Windmuller, of Windmuller & Roelker, of New York.

The company proposes to make a rate of $25 per subscriber in New York City. Local companies with State rights have already been organized in New York, Boston, Philadelphia, Jersey City, Washington, Cleveland, Indianapolis, Detroit and many other cities.

It is said the plan of operations will be similar to that of the Bell people. A large number of politicians in various localities have been interested.

It looks as though the enterprise was the first one in the field with all the facilities for conducting a successful business in opposition to the Bell Company.

It will have the public in its favor from the start, and not alone because it offers cheaper service, but because of the rascally methods of the Bell people in the Patent Office, where they committed what has been judicially characterized as "grand larceny from the people of the United States."

Receiver for the Mather Co.

The Reorganization Not Successful.

On Saturday last, Mr. Charles M. Jarvis, of the Berlin Iron Bridge Company, and one of the directors of the Mather Electric Company, was appointed receiver of the latter company.

About two years ago the Mather Company compromised with its creditors, paying, we believe, about 40 cents on the dollar.

Although the leading stockholders are men of large wealth, the company has not had anything like enough capital to work on. It seems to have been the intention of those in control to use long credits in place of working capital until such time as it was certain that a further investment would pay.

The creditors of the company are entitled to every dollar of their claims, and we presume they will be paid in full. Indeed it is not apparent how the concern could go on again on any other plan.

Truth Expressed in Poetic Language.

"ELECTRICITY is a beneficent fairy who, with infinite tenderness, now offers to open the unexplored portions of her domain, and to yield up her treasures to you.—*Alfred Picard.*

THE ELECTROPOISE AND ITS PROMOTERS.

Where Does the Responsibility Rest for the Continuance of the Swindle ?

On March 14 it was reported from Chicago that Dr. W. C. Gray, editor of the *Interior*, was in trouble with his constituents because his paper, the organ of the Presbyterian Church in the West, had appeared with the partially nude picture of a prominent burlesque actress covering almost the entire first page.

Of course this was due to a mistake, which the Doctor explained satisfactorily.

But we do not know why the readers of the *Interior* should have been surprised. After so-called religious journals like this one, or the *Observer*, the *Evangelist*, the *Christian Standard*, the *Churchman* and dozens of others have violated all the laws of decency and propriety, have thrown aside the obligations which they are supposed to bear to the public, by persistently printing the advertisement of a notorious swindle such as the Electropoise, we see no reason for surprise if they go one step further down the scale of journalism and print nude pictures or nasty stories.

The publishers and editors of these papers have shown as clearly as they could that all they look for is revenue, whether obtained from legitimate sources or from the advertisements of swindlers.

They would doubtless change the character of their papers completely into anything that would pay better if they knew just what was a sure venture. Conscience does not guide them.

They cannot plead ignorance. ELECTRICITY, in its complete exposé of the fraudulent device and of the methods of its promoters, left them no ground for this excuse. Indeed, if they had the least anxiety to know the truth they could have informed themselves, as we did, by investigation and by referring the matter to authorities competent to judge of the quality of the Electropoise.

Not one medical man of standing, not one single scientist can be found to endorse it. ELECTRICITY referred it to six of the leading electrical scientists of the country and to a dozen of the leading physicians in New York City, every one of whom pronounced it an unqualified fraud.

The policy adopted by the larger number of the religious papers shows them to be conducted on infinitely lower lines than the leading daily papers of the country, or than the trade papers. It shows that the standards of morality of the organs of the church are lower than those prevailing in ordinary commercial circles, lower than those governing the conduct of gentlemen anywhere. These papers would accept pay for any advertisement, however gross the fraud intended, if that fraud were disguised so that they could escape the law governing such matters. They would print lottery advertisements if they dared.

If the publishers of the New York *Evangelist* and the New York *Observer* have any confidence in their own position in this matter let them avail themselves of the following offer :

ELECTRICITY will divide $1,000 between any two charities named by those two journals if they will secure the admission of the Electropoise advertisement into the columns of the *Youth's Companion*, for instance, or any one of a dozen other papers which we can name.

If the Electropoise is not a swindle, it will be easy for these gentlemen, assisted by the Rev. Dr. De Puy, to convince any fair-minded publisher that the advertisement should be accepted.

As to the *Churchman*, it is largely removed from criticism by the statement made by a member of its staff to a representative of ELECTRICITY, that they did not consider it their duty to exclude *any advertisement* of any concern which could pay its bills; they did not consider themselves bound to discriminate between legitimate businesses and frauds. True, he said, if anyone advertised for a governess, or something of that nature, by which young girls might be lured to their ruin, they would investigate the matter and refuse the advertisement. This is the only species of advertisement mentioned on which the *Churchman* would draw the line.

If the *Churchman* would now go one step farther and print its views on this subject every week at the top of its first advertising column, there would be no ground for criticism remaining.

ELECTRICITY again congratulates three of its religious contemporaries which have shown that they prefer sending clean and unobjectionable advertisements to their constituents over the few paltry dollars which they could make by advertising the fraud called Electropoise—

The Christian Advocate, New York,

The Sunday School Times, Philadelphia,

which would not accept the advertisement at all, and

The Outlook, New York,

which dropped it after ELECTRICITY's exposé appeared.

If any others desire to be added to this roll of honor, let them send in their names with the facts showing that they are entitled to the mention.

We print herewith a few of the hundreds of letters received by us on this subject. Some of them are amusing, and some ought to make one or two publishers stop to think :

To the Editor of ELECTRICITY.

I saw the Electropoise advertised in *Zion's Herald*, Boston, and a minister's name given as agent. A. G.

Norwood, Mass.

Either Deceptive or a Fraud.

To the Editor of ELECTRICITY.

Have received your paper, ELECTRICITY, and had previously received some extracts from your paper in the form of criticism upon Electropoise. I am in possession of one, bought in consequence of the testimonial of the publisher of the *Christian Standard*, Boston. I put it aside some time ago, convinced that either there was some defect in the instrument or it was a fraud.

Is the instrument described in the enclosed pamphlet of the same character ? Yours truly,

E. S. S., Methodist Minister.

Sandhurst, Ontario, Canada.

This Man Was in Hard Luck.

To the Editor of ELECTRICITY.

Gentlemen, in reply to your article entitled Electropoise I desire to say I have been afflicted with neuralgic rhumatism for 30 years—piles for 20 years—constipation 12 years—Kidney trouble 5 or 6 years. I have tried everything heard of and spent much money for relief: about one year ago bought an Electropoise—or "Oxydonor Victory." The results to-day are—entirely cured of constipation: entirely cured of Kidney trouble, partially cured at least greatly relieved of Piles—and much benefit received as to rhumatism—Entirely cured allso of Variocele and greatly benefited in general health which had become run down. Nothing else was used after receiving the ——.

Will you please explain how I was *humbugged* I am not interested in this apparatus one cent other than as stated above. Mr. Craig of the Shipbuilding Co. of Toledo might give you a similar recommendation.

My dear sirs, Electricity is a mystery yet and we don't understand all about it. There is much to learn yet. So is magnatism—which is but negitive electricity. I have studied this silent force just enough to know that we know nothing as yet. Very truly yours,

O. A. BUSARD.

Marion, O.

These Clergymen Were Humbugged—Perhaps.

To the Editor of ELECTRICITY.

Permit me to express my appreciation of the crusade against quacks and quackeries which you are so earnestly waging. Particularly do I rejoice over your exposure of that diabolical swindle, the "Electropoise." At least two years ago I took to task the publishers of the *Christian Witness* of Boston, expressing in a personal letter my astonishment at the fact that they would advertise such a humbug. I received in reply a letter stating that the publishers themselves—Revs. McDonald and Gill—had both been tremendously blessed by the use of the Electropoise. That cured me of the *Christian Witness*.

Then came the endorsement of Dr. De Puy, assistant editor of the *Christian Advocate*. As a regular subscriber of that paper I took this as a personal insult. Yours truly,

WM. L. CLARKE.

The Edison Electric Illuminating Company of New York.

Is This True?

To the Editor of ELECTRICITY.

Find enclosed two Electropoises opened at my own instance February 1, 1895, by J. B. O'Mera, chief engineer and electrician of the Union Club, 21st street and Fifth avenue. The *Evangelist* quite recently refused Electropoise advertisements, but after personal interview with Du Bois they sold themselves outright through large contract for advertisements, representing a very big sum of money, at *Evangelist's* own rate. This can be verified. Yours, etc.,

New York. H. K. LONG.

ELECTRICITY, the leading journal in this country devoted to that science, says that the Electropoise is a rank fraud. The editor bought an instrument and examined it and states that the claims of the owners that it possesses any virtue as a remedial agent are absolutely talse. He also puts the cost of manufacturing the Electropoise at 42 cents. It is sold at $25. The editor makes an earnest appeal to all respectable publishers to discontinue advertising the Electropoise.—*The Great South.*

A Dangerous Competitor.

Our fighting contemporary, ELECTRICITY, like the pitcher that went to the well too often, has come to grief.

Some weeks ago it began a crusade against a notorious fake cure-all, called the Electropoise. This Electropoise is a fraud that has a great run among weak-minded and credulous persons and in the columns of the religious press. It will cure anybody except a sick hen, and the only reason that the hen is proof against its wiles is that the hen is deficient in imagination.

Our contemporary pursued its devastating career unchecked, to the great discomfort of the church papers, until a man in Philadelphia came to the rescue, and in a letter of great originality in spelling, punctuation and the use of capital letters, showed the secret animus that inspired Editor Greene. He pointed out that the Electropoise was a competitor of Mr. Greene's ELECTRICITY and was making great inroads on his business.

Mr. Coleman, who thus exposes the secret designs of our contemporary, is evidently a man of careful and impartial judgment, for he writes : "I kan't say there ain't no Merit In your Electricity that would be wrong for me to do." Still he is evidently of the opinion that our contemporary could not cure a broken leg or put a man to sleep as quick as the Electropoise.

The Philadelphia man writes : "I was a compleat wreck my self from Blood Poison and I cured myself" with the Electropoise. After reading his letter one may possibly doubt whether the cure was so "compleat" as he thinks. Still Editor Greene has apparently not had much better luck in his attempt to cure a case of "Blood Poison" in a certain well-known corporation. He has come nearer killing than curing. As a business competitor of Electropoise ELECTRICITY is not a success.—*Pacific Electrician.*

He Believes In It.

To the Editor of ELECTRICITY.

I notice an "Electro Medical Fraud," an article from *Western Christian Advocate.* Why don't your great men that publish your paper the ELECTRICITY tell us what the alleged closed cylinder of two rare metals are composed of. It only shows your great electrical chemists are not so smart as your Book wants to make people believe they are. Keep on (Greene) perhaps people won't think you are so (green) after all when you display your smartness concerning the Electropoise these very smart people whom write you with very big words with no meaning or no sound logic to explain what they are talking about. sometimes Cultured minds like you selves are like stubborned asses that kick in the Harness not knowing what they are kicking about. So you go along groping in the darkness expecting some fool like your self may give you some day some light to help you along your poor Book Electricity. What poor Mortals we be. But poor (Greene) take courage poor (Greene) you will get to your haven of rest after while. Keep on publishing your rubbish concerning the Electropoise and your poor Book will place you with the great books of the world Great Head you have. Yours Respt,

New York. Electropoise.

A New Wiring Slide Rule.

We are indebted to Prof. E. P. Roberts, of the Correspondence School of Technology, Cleveland, O., for a very neat and simple little wiring calculator, which is destined, we think, to come into wide popularity among those who have to do with electric light wiring. The calculator is neatly made of celluloid, with metal trimmings, and comes in a flat leather case of convenient size for the vest pocket. The scale is based on the law of the B. & S. G., and ranges from No. 20 up to 500,000 circular mils. The directions for its use are so simple as to be readily understood, and by simply moving the slide until the pointer is in the proper position the results may be read off direct.

In every wiring problem there are three elements involved, viz., ampere feet (or lamp feet), volts loss and size of wire. If any two of these are given, the third is determined at once. For the purpose of avoiding calculation, resort is usually had to wiring tables or curves, but the slide rule is more convenient than either of these and quite as accurate.

We understand that Prof. Roberts first introduced this rule to facilitate the work of his students, but that its immediate popularity was such as to induce him to bring it into wider use by putting it on the market. It is being sold at 50 cents, at which price it may be had, postage prepaid, either of Prof. Roberts himself or of Electricity, 6 Park Place, New York.

General News.

What is Going on in the Electrical World.

Arcadia, Wis.—A stock company is to be formed here to put in an electric light and water supply system.

Waverly, N. Y.—South Waverly was to decide at an election held on the 9th, whether the village should have electric lights.

Elizabeth, N. J.—The fire committee of the city council have reported in favor of getting an electrical fire alarm apparatus for the city.

Oakland, Md.– The receivers have sold the plant of the Oakland Electric Light and Power Company at public auction to D. E. Offutt for $5,000.

Oswego, N. Y.—The directors of the Oswego Street Railway Company have decided to apply to the courts for the appointment of a receiver for the road.

Martinsburg, W. Va.—The electric light plant of this city has been sold at public auction by the creditors of the concern to W. E. Tebo for $18,500.

Chelsea, Mich.—The council, in accordance with the vote of the people at the recent election, will make a contract with the Chelsea Electric Company for lighting the village.

Ocean City, Md.—The Sinepuxent Beach Company intends making extensive improvements at this resort; an electric plant will be provided for lighting the hotels and cottages.

Brunswick, Ga.—Captain W. A. Jeter has applied to the city council for a five years' franchise to build and operate an electric car line in this city. The franchise will probably be granted.

Elberton, Ga.—At the recent election to decide the question of bonding this town for the purchase and instalment of an electric light plant, the vote in the affirmative was almost unanimous.

Troy, N. Y.—The directors and stockholders of the Cohoes City Electric Railway Company have voted to issue $50,000 worth of bonds, the money to be applied to the construction of the road.

White Plains, N. Y.—Under the terms of the charter which recently went into effect the trustees are commanded to advertise for proposals to light the streets of the village for three years from November next.

Lafayette, Ind.—The Citizens' Gas and Electric Power Company, with a capital stock of $100,000, has been organized here to compete with the present electric lighting company, a Thomson-Houston concern.

Ocean Grove, N. J.—It is reported here that plans for an electric railway system in this place are under consideration and are likely to be carried into effect so as to have the road in operation early in the summer.

Poughkeepsie, N. Y.—The Poughkeepsie Electric Railroad Company is trying to purchase the Poughkeepsie and Eastern Railroad for the purpose of equipping it with electricity and extending the track to Millbrook.

Fort Dodge, Iowa.—The Fort Dodge Electric Company has completed the rebuilding of its electric light plant and added machinery to furnish power for operating the trolley railway for which it recently got a franchise.

Port Huron, Mich.—Suits have been commenced against the Excelsior Electric Light Company of Port Huron to recover an aggregate of over $40,000 due on notes against that company to local banks and individuals.

Williamstown, Mass.—The preliminary survey for the electric railway between this town and North Adams has been made, and work on the line will begin immediately after the bill granting the right of way is passed by the Legislature.

Vicksburg, Miss.—Proposals will be received by the mayor, W. L. Trowbridge, until April 15, for the lighting of the city of Vicksburg with 81 electric arc lights of 2,000 c. p. and 84 incandescent lights of 50 c. p. for periods of three or five years.

Oneida, N. Y.—Last week parties were here consulting about an electric railroad. Their scheme is to purchase the street railway and extend it up through Oneida Castle. A line from here to Oneida Lake by way of Canastota is also talked of.

Greenbush, N. Y.—The highway commissioner of East Greenbush has granted a franchise to F. R. Barnes to construct and operate an electric railway through that town from Albany to Castleton. Mr. Barnes is backed by Boston capitalists.

Knoxville, Tenn.—A representative of the Excelsior Electric Light Company of New York has held conferences with the mayor and city engineer on the subject of a city lighting plant. He stated that a plant of sufficient capacity could be erected here for $40,000.

Attleboro, Mass.—The Interstate Street Railway has been sold by public auction for $101,000 to E. R. Price for the trustees of the syndicate which bought the Attleboro, North Attleboro and Wrentham road. The sum of $15,000 was deposited as a forfeit.

Stroudsburg, Pa.—Judge Craig has issued a decree ordering a receiver's sale on April 22 of the personal property and effects of the Delaware Valley Electric Railway Company. The sale will include the property and franchise of the East Stroudsburg and Matamoros Railroad Company.

New Brighton, S. I.—The Staten Island Electric Railroad Company (Thomas syndicate), which obtained a franchise from New Brighton, has deposited $10,000 with the Central Trust Company as a guarantee for the construction and operation of the line in accordance with the terms of the franchise.

Jacksonville, Fla.—The Jacksonville Electric Light Company, having failed in its attempt to have the city enjoined from serving the citizens with light from the new municipal plant, intends to compete with the city in furnishing light to private consumers at the same prices as the city advertises.

Jersey City, N. J.—The power-house of the New Jersey Electric Railway Company, now in course of construction on the Meadows, will be completed and fully equipped with its engines and dynamos by May 1. The power-house is 75 by 175 feet in size and of brick. The car storage house will accommodate 65 cars.

Richmond, Va.—A conduit ordinance is before the city council requiring telegraph, telephone and electric light and power wires and cables, including feed but excluding trolley wires, and all other appliances for conducting electricity, and the poles therefor, to be removed from certain named streets.

Woburn, Mass.—Judge Knowlton, of the Supreme Court, has ordered the plant of the Woburn Electric Light Company to be sold on May 15, subject to the first mortgage of $35,000 and all incumbrances and liens except the second mortgage for $100,000 and the receiver's certificates, amounting to $1,000 more.

Asbury Park, N. J.—The plant, franchise and good will of the Neptune Electric Light and Power Company of this city have been sold for $61,000, subject to a mortgage of $41,000. The purchaser was George A. Smock, on behalf of the recently organized Asbury Park Electric Light Company. The original cost of the plant was $160,000.

Norfolk, Va.—The syndicate who have been negotiating for the purchase of the street railroad have made a deposit and are expected to take charge immediately. The old tracks will be taken up and a complete electric system put in. The purchasers will expend $150,000 in improvements and extensions including West Norfolk and other suburbs.

Sharon, Pa.—A complete reorganization of the Shenango Valley Electric Company has been effected. The officials elected were: President, A. M. Jolly, Beaver Falls; secretary, A. R. Leyda, Beaver Falls; treasurer, A. F. Barker, New Brighton. Directors: J. A. Whitla, A. R. Leyda, J. P. Stone, A. W. Jolly, Beaver Falls, and F. G. Barker, New Brighton.

Savannah, Ga.—Judge Speer has issued an order directing the receivers of the electric street railway to proceed with the reorganization of the company's property. For the old bonds there will be exchanged $600,000 new bonds at 5 per cent., which take up $800,000 now outstanding. The debts of the company will be paid out of the Brush Electric Light Company's stock now in the company's treasury.

Passaic, N. J.—The gas and electric companies have consolidated under the title of the Passaic Lighting Company. The new directors are W. R. Brown, E. LeB. Gardiner, Richard Morrell, H. P. Brown, B. W. Spencer, G. A. Hobart, J. J. Slater, L. B. Gawtry and John A. Willett. The officers are W. R. Brown, president; B. W. Spencer, vice-president and treasurer; E. LeB. Gardiner, secretary.

Memphis, Tenn.—The Memphis Street Railway Company, F. G. Jones, Thomas B. Turley, Luke E. Wright, John K. Speed and W. B. Mallory, incorporators, has filed its charter of incorporation in the register's office. The charter authorizes the consolidation of all the present electric roads operated in and around Memphis under one name.

Baltimore.—A new four-masted schooner, the C. S. Glidden, just arrived here with a cargo of phosphates, is believed to be the only electrically equipped schooner on the coast. The commander of the schooner can sit in his cabin and summon the steward, or give orders about handling the sails by means of electric buttons. Is the quarter deck doomed?

Eau Claire, Wis.—The new Electric Light and Power Company will expend nearly $300,000 in improvements here. The upper dam will be improved so as to give a fall of 16 feet, the lower dam will also be improved and the horse-power greatly increased. A large dam will also be constructed at the falls near Altoona, all of which will give the new company a capacity of 600 or 700 horse-power.

Niagara Falls, N. Y.—The first test of the 5,000 h. p. dynamo recently set up in the power-house of the Niagara Falls Power Company was made on the night of the 5th inst., and was followed next day by another test in the presence of the officers of the Cataract Construction Company and a number of other gentlemen, including several English capitalists. Both tests were pronounced thoroughly satisfactory.

La Porte, Ind.—A franchise has been granted for an electric road between La Porte and Michigan City, a distance of 12 miles. This is said to be the inception of a scheme, backed by Eastern capitalists, to build an electric railway to Indianapolis and, paralleling the Lake Erie and Western Railroad, to the State capital, which is estimated to cost over $1,000,000. The Michigan City and La Porte road is to be an experimental line to determine the feasibility of the project.

Flushing, N. Y.—The Flushing and College Point Electric Street Railway has been sold by the special master to Cravath & Houston, representing the reorganized company for $25,000. The road will be operated by the new company, which promises improved service. Among those forming the reorganized company are Daniel Odem, E. Bayard Halstead, Paul D. Cravath, John W. Houston, V. K. McElhenny, Frank A. Dillingham, Philip F. Kobbe, Harvey Romer and Charles Snow Kellogg, of New York.

Cleveland, O.—The Cleveland, Painesville and Eastern Railroad Company has filed an application in the county commissioner's office for a 25-year franchise for a line to run from the Euclid Creek terminus of the Big Consolidated line out Euclid avenue to the county line. The line is to be operated by electricity, and is backed by Henry A. Everett, the president of the Consolidated Company.

Atlanta, Ga.—The Georgia Electric Light Company has petitioned the council for a renewal of its lighting contract with the city for a period of five or ten years, at a reduction of 10 and 15 per cent. respectively, and pleads for preference on the ground that it has invested $750,000 in the business, has furnished satisfactory light and has never earned or paid a dividend. The present contract expires July 1.

Chester, Pa.—The directors of the proposed Media, Middletown, Aston and Chester Electric Railway Company have voted to increase the capital stock of the road from $30,000 to $150,000. It is expected that the contract for the construction of a portion of the road will be given out in a few weeks. Samuel L. Kent, of Clifton Heights has been elected a director to fill the vacancy caused by the death of Hon. William Ward.

Buffalo, N. Y.—It is understood that at a secret session of the committee on the 2d the corporation counsel was instructed to draw up a franchise for supplying power to Buffalo, which is to be submitted to the Niagara Falls Power Company at an early day. The grant is for fifty years. The Power Company will probably arrange to use the New York Central's road for an overhead wire line for the transmission of electrical energy to this city.

Calais, Me.—The People's Electric Light and Power Company, with a capital stock of $50,000, has been organized in Calais, and two per cent. of the stock has already been paid in. The intention of the company is to provide power, light and heat to Calais patrons. Hon. John G. Murchie is president.—Gerald & Libby have sold their interest in the Calais Street Railway to the Messrs. Curran and Charles Pray, who will have the management of the plant.

Chicago.—The *Journal* states that "the largest system of electric street railway in the world under the management of an individual owner is that which will soon be put into operation on the West Side by Charles T. Yerkes. The entire system is composed of about 200 miles of road, and it cuts up that portion of the city into sections, penetrates districts which have not heretofore had locomotive privileges, and presents the most extensive plan of main and cross-town lines ever built."

West Salem, Wis.—S. D. McMillan has been granted a franchise to establish an electric light and power company in this village. Mr. McMillan controls the fine water power at Neshonoc, about a mile and a half from West Salem. It is well known that his purpose is to reach La Crosse with his power within a year. Another company is endeavoring to secure rights lower down La Crosse River solely for developing electricity to be conveyed to La Crosse. It is likely an electric railway line up La Crosse valley will be organized before the year is out.

Utica, N. Y.—A dispatch from Watertown to the *Press* states that "a big scheme is on foot to utilize the water power of the Black River for the generation of electricity. Owners of water rights in Watertown and neighboring towns that border on the Black River have been asked for options on their privileges. It is understood that the Rome, Watertown and Ogdensburg Railroad Company is the prime mover in the scheme and that electricity will be used as the power by which railroads will be operated in Northern New York."

Red Bank, N. J.—A party of New York, Brooklyn and Newark men have been looking over the route proposed for an electric railway between Red Bank and Long Branch, and subsequently decided to ask the board of commissioners for a franchise for the road in Red Bank. The road is to cost $300,000 and the indications are that it will be built at once. S. B. Dutcher and Benjamin Frick, of New York; S. S. Whitmore, P. B. Purdy, J. F. Dobson, D. S. Arnott and A. B. Eldridge, of Brooklyn; Robert Lightfoot, of Jersey City, and W. B. Williams, of Newark, are the men mentioned in connection with the project.

Lincoln, Neb.—The State Senate has passed a bill enabling cities of a population less than 5,000 to make contracts for lighting plants. It provides that these cities are authorized to make contracts with and authorize any person, company, or association to erect and maintain gas or electric light works, and give such person, company, or association the exclusive privilege of furnishing gas or electric lights to light the streets, lanes, and alleys of such cities for any length of time, not exceeding twenty-one years, and to levy a tax not exceeding five mills on the dollar in any one year, for the purpose of paying the costs of lighting the streets, lanes and alleys of said cities.

Albany, N. Y.—The Governor has signed the bill authorizing North Tonawanda to establish an electric lighting system and the bill authorizing Lockport to vote on the question of establishing an electric light plant at a cost not to exceed $25,000.—The Assembly has passed these bills: Mr. Ainsworth's, increasing the amount for which villages may contract with electric light companies; the bill requiring all motormen and electrical assistants in New York, Brooklyn and Buffalo to pass an examination by a board of electrical inspectors, who shall be appointed by the mayor.—A bill has been introduced in the Assembly empowering the Equity Gas Light Company to supply electricity in Brooklyn.

Stamford, Conn.—The Stamford street railway has been purchased by a syndicate of New York capitalists, among whom are J. Pierpont Morgan, E. C. Benedict and H. O. Havemeyer. The sale, it is understood, was completed the last week in March, ending negotiations first entered into a year ago. The plans of the buyers are as yet unknown, but it is rumored that the road will be equipped with electricity throughout; that a power plant will be erected at Glen Brook, and that power will also be supplied to the New Canaan and Stamford branch of the Consolidated. The deal is reported to be a move on the part of officers of the Consolidated road to control by investments by its large shareholders the systems of trolley lines which may run parallel to its tracks.

Los Angeles, Cal.—The Los Angeles Consolidated Electric Company has passed out of existence, giving place to the Los Angeles Railway Company, which was organized for the purpose of taking over the franchises and all the property of the Consolidated Electric Company. The men at the head of the new company are well known in business circles in San Francisco, among them being A. H. Payson, the capitalist, and George Stone, president of the People's Savings Bank. Morris Trumbull, of Chicago, was appointed temporary general manager. Mr. Trumbull says "it is intended that the service shall be improved in many ways, and at once. It is realized that a large number of cars are needed in order that a better time schedule shall be observed. The cable lines are to be electrized, and already orders have been placed for material looking to a speedy change in this direction."

Burlington, N. J.—Contracts have been awarded by the Pennsylvania Railroad Company for the electrical equipment of the Burlington branch of the Amboy division, which connects Mt. Holly and Burlington. The Westinghouse Company will furnish the engine and generators, and the combination cars, for baggage and passengers, will be equipped with Westinghouse motors and car equipments. There will be three of these cars, two of them provided with two motors of 75 horse-power each, making 150 horse-power to a car, and these motors are to drive the cars at a rate of 45 to 60 miles an hour. The third car will have four motors of 50 horse-power each, a total of 200 horse-power. Railway motors of 75 horse-power have never been used, and those for use on these cars are to be built especially for them. The use of four motors on a car is also an experiment. These cars are intended to draw one, two or three Pennsylvania Railroad coaches such as are used in the regular traffic.

Telephone and Telegraph.

A telephone exchange is being put in at Waycross, Ga.

The Phœnix Mutual Telephone Company, organized under the laws of New Jersey, has filed articles of incorporation in Jersey City. The capital stock is $20,000. Incorporators: Thomas Brady and Chester D. Ayers, of Bayonne, and George Christian, of New York.

Messrs. Clarence F. Hotchkiss, George C. Bayless, Edward L. Rose, Cyrus Strong, Jr., Judge Downs and Col. Dunn are back of the movement for a new telephone company in Binghamton, N. Y.

A movement was started at Garrison, Col, last week for the building of a telephone line between there and the Duncan mining camp with the result that in less than three hours enough money had been raised to pay almost the entire cost of the line.

Pittsburg, Pa., business men are making a move for lower telephone rates, and promise encouragement to any new company that will give them good service at reasonable rates. A Chamber of Commerce man says that "Pittsburg pays higher prices for telephone service than any other city in the world."

The National Telephone Construction Company has petitioned the village board of Waukesha, Wis., for a franchise to construct and operate an exchange in Waukesha.

When the uncertainty in regard to underground wiring is removed, St. Louis will be placed in line with the other great cities of the Union by the erection of a long distance telephone system, which has been delayed by the council's dilatory action in the matter of subways.

At a recent meeting of the stockholders of the West Shore Telephone Company at Kingston, N. Y., it was agreed to have the charter amended so as to permit an extension to Stamford, thus covering the Ulster and Delaware territory where subscriptions for stock have already been made, and also to permit an extension to Walden from Gardiner.

Subscribers of the Hudson River Company in Kingston, N. Y., have been informed that the former rate of $5 per month is cut to $25 a year. This was done to compete with the West Shore Telephone Company, which recently put up a line along the Hudson Valley and cut the old rate down to $30 a year.

The board of directors of the Home Telephone Company of Mobile, Ala., have elected the following officers: H. Piser, president; James K. Glennon, vice-president; W. H. Fitzpatrick, secretary; Adam Glass, treasurer. This completes the organization of the company and preliminary work on the plant has already begun. Nearly 500 subscribers have been secured and new names are being added to the list daily.

The Indiana Telephone and Construction Company have asked the city council of Muncie, Ind., for a franchise to put in a telephone system in that city.

The county board of Waterloo, Ill., has granted Drs. S. C. and S. S. Skeel and John A. Jakle the right to erect a telephone line from Harrisonville to Waterloo. Work on the line will begin at once.

At Shamokin, Pa., a local telephone company, to be known as the Anthracite Telephone and Supply Company, has been formed by Shamokin and Mt. Carmel capitalists.

The Harrison Telephone Company has organized a branch at Sioux City, Iowa, and will begin putting in the new system in a few weeks.

The Harrison Telephone Company is making an effort at Olean, N. Y., to get 150 subscribers at $30 for offices and $18 for residences per year. The established concern there, the Western New York and Pennsylvania Telephone and Telegraph Company, has reduced its rates.

The Anderson (S. C.) Telephone Company is putting in 'phones, doing inside wiring and completing such details as are necessary to a perfect telephone system. The company has fifty-two subscribers.

The Home Telephone Company of Wabash, organized for the purpose of furnishing telephone service to the city of Wabash, Ind., has been incorporated by residents of that city. The capital stock is $10,000.

The Menominee Range Telephone and Construction Company has been organized by local capitalists at Iron Mountain, Mich., and will operate an exchange in Iron Mountain, Norway and other range towns. It will furnish instruments for $24 a year.

At a meeting of citizens at Rockford, Ill., last week it was decided to organize the Rockford Telephone Company with a capital stock of $60,000, a large part of which was subscribed. Each subscriber for a 'phone is to take $100 worth of stock, payable in instalments. The rates fixed for the new company are $30 a year for business houses and $20 for residences. The citizens' committee, while recommending no system at present, have four under consideration for adoption. All of the leading citizens are in the fight for cheaper 'phone rates and the chances are the Bell monopoly will be driven out.

The Wizart Telephone Company's representative, C. J. Willow, has visited Omaha and Council Bluffs for the purpose of interesting telephone users in the Wizart Company's system.

The Central Pennsylvania Telephone and Supply Company has reduced its rates about 25 per cent. at all exchanges in its territory.

The local Phœnix Telephone Company of Greencastle, Ind., has been incorporated. Its capital stock is $8,000. The company was organized for the purpose of furnishing telephone service in Greencastle.

The Nebraska Telephone Company has had a representative in Tecumseh consulting with business men in regard to erecting a telephone system in that town. He met with much encouragement.

The Indianapolis Phœnix Company, organized for the purpose of operating a telephone system in Marion County and Indianapolis, has been incorporated. Its capital stock is $200,000, and among the stockholders are Alfred B. Gates, Rufus K. Syfers, Charles A. McCleary, William N. Gates, George W. Stout, Charles F. Smith, George C. Webster, Edward M. Churchman, R. H. McCrea and Benjamin L. Webb.

The Mutual Automatic Telephone Company, a branch of the Automatic Telephone and Electric Company of New York State, has issued a circular in which it is intimated that the company will open offices in New York and Brooklyn as soon as arrangements can be made. The Strowger automatic telephone will be used and the projectors state that telephone rates will be radically lowered once the new system is in working order. Officers: Smith M. Weed, chairman of the board; J. Wesley Allison, president; Silas B. Dutcher, first vice-president; John C. McGuire, second vice-president; Henry N. Whitney, treasurer; A. B. Macklin, secretary. Executive Committee: Smith M. Weed, John C. McGuire, Silas B. Dutcher, J. Wesley Allison, David A. Boody. Board of Directors: Dr. W. Seward Webb, president Wagner Palace Car Company, New York; David A. Boody, banker and ex-mayor of Brooklyn, New York, vice-president Sprague National Bank; J. Wesley Allison, president Automatic Telephone and Electric Company; Henry N. Whitney, president Schermerhorn Bank, also of Kissam & Whitney, bankers, Wall st., New York; Silas B. Dutcher, president Hamilton Trust Company, Brooklyn, N. Y.; John C. McGuire, lawyer, surveyor of the port of New York; Joseph T. Keiley, lawyer, New York; A. B. Macklin, secretary Mutual Automatic Telephone Company, New York; John Jacob Astor, New York; Smith M. Weed, president C. O. and I. Company, German-American Investment Company, etc., New York; Charles F. Cox, president American Safety Deposit Company, vice-president Canada Southern Railway, vice-president Second Avenue Railway, New York.

COMMERCIAL PARAGRAPHS.

The Royal Electric Company of Peoria, Ill., have completed arrangements with Messrs. H. B. Coho & Company, No. 203 Broadway, New York, to handle their alternating current apparatus in the East. Messrs. Coho & Company have secured the services of Mr. George C. Hoffman, formerly of the Westinghouse Company, who will have charge of the alternating current department.

The Mather Electric Company of Manchester, Conn., have just closed a contract with the Berlin Iron Bridge Company of East Berlin, Conn., for equipping their new orge shop with electric power. A 40 K. W. generator and a 50 H. P. motor will be used.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

APRIL, 1895.

Day of Mo.	Light. H.M.	Day of Mo.	Extinguish. H.M.	No. of Hours. H.M.
1	P. M. 11.20			5.20
2		2	A. M. 4.40	
3	A. M. 1.20	3	" 4.40	3.20
4	" 2.00	4	" 4.40	2.40
5	" 2.40	5	" 4.40	2.00
6	" 3.00	6	" 4.40	1.40
7	No light.	7	No light.	
8	No light.	8	No light.	
9	No light.	9	No light.	
10	P. M. 7.00	10	P. M. 9.20	2.20
11	" 7.00	11	" 10.30	3.30
12	" 7.00	12	" 11.40	4.40
13	" 7.00	14	A. M. 1.00	6.00
14	" 7.10	15	" 1.40	6.30
15	" 7.10	16	" 2.30	7.20
16	" 7.10	17	" 3.00	7.50
17	" 7.10	18	" 3.30	8.20
18	" 7.10	19	" 4.00	8.50
19	" 7.10	20	" 4.20	10.10
20	" 7.10	21	" 4.20	10.10
21	" 7.10	22	" 4.10	10.00
22	" 7.20	23	" 4.10	9.50
23	" 7.20	24	" 4.10	9.50
24	" 7.20	25	" 4.10	9.50
25	" 7.20	26	" 4.10	9.50
26	" 8.00	27	" 4.00	8.00
27	" 9.10	28	" 4.00	6.50
28	" 10.20	29	" 4.00	5.40
29	" 11.00	30	" 4.00	5.00
30	" 11.20	May 1.	" 4.00	4.40
Total				170.10

INCORPORATIONS.

The Topeka Water and Electric Power Company, Topeka, Kan.—to develop and improve water power from Kansas River and other places; construct dams, electric works, water works, compressed air, milling establishments, etc. Capital stock, $1,000,000. Promoters: F. A. Session, Ionia, Mich.; L. H. Withey, Anton C. Hoclenpyl, T. F. McCarry, Grand Rapids, Mich.

The Saranac Lake Electric Light Company, Saranac Lake, N. Y.—to use electricity for light, heat and power. Capital stock, $30,000. Promoters: Orlando Blood, Wallace Murray, O. S. Morse, all of Saranac Lake.

The Prospect Street Railway Company, Chester, Pa.—to build a street railway operated by electricity or other power than locomotive. Capital stock, $50,000. Promoters: Geo. Rodgmen, Wm. D. Pullon, Jr., Edw. J. Nugent, all of Chester.

The Chase Electric Cyclorama Company, Chicago, Ill.—to manufacture, buy, sell and operate electrical, photographic and optical machines, instruments and apparatus, stereopticon slides, lime light and all other lighting apparatus. Capital stock, $100,000. Promoters: Chas. A. Chase, D. Wiley McCaughey, Geo. E. West.

The Kansas Telephone and Electrical Company, Parsons, Kan.—to maintain and operate a system of telephones and electrical alarms and calls. Capital stock, $40,000. Promoters: A. B. Kerlin, Freeport, Ill.; D. S. Stewart, Shelbina, Mo.; C. W. Ryan, Parsons.

The Telegraphic Page Printing Company (incorporated in W. Virginia), New York, N. Y.—to manufacture, operate and sell electric printing telegraph machines and all other electrical and mechanical devices, etc. Capital stock, $500,000. Promoters: Edw. T. Hickey, Chas. H. H. Cottrell, New York City; Chas. F. Sesinger, Philadelphia, Pa.

The Steuben County Electric Telephone Company, Angola, Ind. Capital stock, $5,000. Promoters: Lorenzo Taylor, Sol. A. Wood, J. E. Naught, N. W. Gilbert, of Angola.

The Bristol Gas and Electric Company, Bristol, Va.—to operate a gas and electric light plant. Capital stock, $100,000. Promoters: J. H. Wood, H. C. Wood, R. W. Crenshaw, Bristol, Va.; Wm. Hurt, Lynchburg, Va.

The Berwyn and Deven Passenger Railway Company, Philadelphia, Pa.—to build a street railway in Chester County, Pa. Capital stock, $18,000. Promoters: Geo. Roney, John A. Carry, Russell Hawkins, Philadelphia.

The Newtown, Langhorne and Bristol Trolley Street Railway Company, Newtown, Pa.—to build an electric street railway. Capital stock, $60,000. Promoters: Geo. C. Worstall, Newtown, Pa.; Henry Lovett and Wm. B. Parry, Langhorne.

The Rawson Light and Power Company, Leicester, Mass.—to furnish light, heat and power. Capital stock, $25,000. Promoters: Edwin L. Watson, Walter C. Watson, Wm. F. Whittemore, J. S. Whittemore, Lory S. Watson.

The Bureau County Telephone and Telegraph Company, Walnut, Ill. Capital stock, $1,500. Incorporators: Joseph W. Ross, John H. Knight and A. E. Burres.

Richwood's Street Railway Company, Peoria, Ill.—to construct a street railway through the counties of Peoria, Tazewell and Woodford. Capital stock, $50,000. Incorporators: Robert M. Cox, James M. Morse, Theodore J. Miller.

The Cascade Light and Power Company, Cascade, Iowa—to furnish electricity for lighting, heating and power. Capital stock (paid up), $7,000, with the privilege to increase to $15,000. Incorporators: James A. Hayes, D. M. Finley, L. P. Freeman, H. L. Dehner, J. W. Beatty.

The Charleston Electric Company, Charleston, Ill. Capital stock, $5,000. Incorporators: Richard Cadle, Frank A. Brooks and W. A. Highland.

The Baird Electric Conduit Company, Chicago—to build and operate street railroads. Capital stock, $5,000,000. Incorporators: F. E. Baird, G. E. Baird, W. H. Craig.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED APRIL 2, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

536,704. Safeguard for Cable or Electric Cars. Geo. Rischmuller, San Francisco, Cal. Filed Feb. 24, 1894.

536,764. Electric Block-Signal. Fred P. Snow, Lynn, Mass. Filed April 27, 1894.

536,795. Switch for Street-Car Controllers. Gustaf Valley, Cleveland, Ohio, assignor to the Steel Motor Company, same place. Filed Dec. 3, 1894.

536,828. Supply System for Electric Railways. Albert C. Crehore, Ithaca, N. Y. Filed July 22, 1893.

536,855. System of Electrical Propulsion for Railway-Cars. Leon Dion, Natick, Mass. Filed June 14, 1894.

536,918. Closed-Conduit System for Electric Railways. Edwin D. Chaplin and Leon Dion, Natick, Mass. Filed June 14, 1894.

536,923. Safety Device for Electric Railways Having Sectional Conductors. Leon Dion, Natick, Mass. Filed June 14, 1894.

536,952. Conduit Electric Railway. Tyre C. Hughes and Arthur W. Adams, St. Louis, Mo., assignors of one-half to Ewing Hill and E. C. Smith, same place. Filed Feb. 12, 1894.

536,967. Trolley-Support for Electric-Railway Cars. Emil B. W. Reichel, Charlottenburg, assignor to Siemens & Halske, Berlin, Germany. Filed Oct. 25, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

536,792. Socket for Incandescent Lamps. Francis H. Soden, Chicago, Ill., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 12, 1890.

536,856. Shade for Incandescent-Lamp Globes. Leon Dion, Natick, Mass. Filed June 14, 1894.

DYNAMO ELECTRIC MACHINERY.

536,608. Electrical Transformer. Malcolm Dickerson, Fort Wayne, Ind., assignor of one-half to John F. Curtice, same place. Filed Nov. 26, 1894.

536,748. Dynamo Driven from Axles of Railway-Cars. William Biddle, Brooklyn, N. Y. Filed May 31, 1894.

536,794. Electric Controller. Gustaf Valley, Cleveland, Ohio, assignor to the Steel Motor Company, same place. Filed Dec. 3, 1894.

536,816. Combined Dynamo-Electric Generator and Current-Director. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Wheeling, W. Va. Filed Jan. 2, 1892.

536,963. Dynamo-Electric Machine. James F. McElroy, Albany, N. Y. Filed July 24, 1894.

536,973. Brush-Holder for Dynamo-Electric Machines and Motors. Gustaf Valley, Cleveland, Ohio, assignor to the Steel Motor Company. Filed Dec. 15, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

536,655. Terminal Attachment for Flexible Conductors. Wilton L. Richards, Malden, assignor to the American Bell Telephone Company, Boston, Mass. Filed Sept. 10, 1894.

536,705. Telephoning Apparatus. William B. Robeson, Philadelphia, Pa. Filed Sept. 7, 1894.

536,763. Telephone. John Serdinko, San Antonio, Tex., assignor to the National Union Telephone Company, same place. Filed Dec. 4, 1894.

539,787. Telephone-Exchange System and Apparatus. Hammond V. Hayes and Theodore Spencer, Cambridge, assignors to the American Bell Telephone Company, Boston, Mass. Filed Sept. 10, 1894.

536,914. Telephone. Fred H. Brown, Chicago, Ill., assignor by mesne assignments, to the Economy Transmission Company, same place. Filed Oct. 17, 1894.

536,920. Telephone System. Frank R. Colvin, New York, N. Y. Filed Dec. 20, 1894.

BATTERIES.

536,689. Electric Battery. Hosea W. Libbey, Boston, Mass. Filed Feb. 23, 1894.

SIGNALS AND SIGNALING APPARATUS.

536,871. Electric Double-Semaphore Block-Signal. Nathaniel O. Goldsmith, Cincinnati, Ohio. Filed March 24, 1894.

536,872. Electric Block-Signal. Nathaniel O. Goldsmith, Cincinnati, Ohio. Filed March 24, 1894.

MISCELLANEOUS.

536,684. Self-Locking Cleat for Electric Wiring. Frank O. Creager, Marseilles, Ill. Filed Jan. 14, 1895.

536,730. Electrical Controlling System for Elevators. Cyprien O. Mailloux, New York, N. Y. Filed Dec. 20, 1894.

536,808. Contact-Finger for Electric Controllers. Samuel Harris, Cleveland, Ohio., assignor to the Steel Motor Company, same place. Filed Dec. 5, 1894.

536,809. Electrical Switchboard. Francis W. Jones, New York, N. Y. Filed Jan. 22, 1895.

536,811. Electric Mercurial Switch, or Contact-Maker. Hermann Lemp, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 26, 1888.

536,857. Means for the Insulation of Conductors of Electricity. Leon Dion, Natick, Mass. Filed Dec 6, 1894.

536,926. Electric Clock-Winding Mechanism. Martin V. B. Ethridge, Everett, and Joseph H. Eastman, Boston, Mass., assignors to the Century Clock Company, North Berwick, Me. Filed April 28, 1894.

536,974. Electric Organ-Coupling Mechanism. Edwin S. Votey, Detroit, Mich. Filed April 7, 1894.

536,975. Electrically-Controlled Magnet and Valve for Pipe-Organs. Edwin S. Votey and William D. Wood, Detroit, Mich. Filed April 7, 1894.

536,977. Electromagnet for Pipe-Organs. Edwin S. Votey, William B. Fleming and William D. Wood, Detroit, Mich. Filed April 7, 1894.

536,978. Electropneumatic Stop-Action for Pipe-Organs. Edwin S. Votey, William B. Fleming and William D. Wood, Detroit, Mich. Filed April 16, 1894.

DESIGN.

24,175. Telephone-Support. David J. Hauss, Cincinnati, Ohio. Filed Sept. 15, 1894. Term of patent 7 years.

ELECTRICITY.

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ELECTRICITY

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THE WESTERN NEWS COMPANY,
And their Agencies in all Principal Cities.

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EDITORIAL NOTES.

The Destiny of Gas. Our entertaining contemporary, the *Progressive Age*, the champion of the Welsbach light, in its issue for April 15 has a leader of a column and a half entitled "The Destiny of Electric Lighting," which is a review of an editorial on "Central Station Economy" which appeared in our issue for February 20. It will be remembered that this same journal, while defending the Welsbach light, very adroitly avoided the real questions at issue, and endeavored to concentrate the attention of its readers upon minor points not pertinent to the question. It was the case of the fits doctor over again, who used but a single remedy, and that was for fits. No matter what the patient's disease, he converted that disease into fits, and then cured the fits. With our contemporary the "main holt" is the Welsbach light. It matters not what subject it *commences* to discuss, it always brings it around in some way to the Welsbach light, for like the aforesaid physician, it thinks it is immense on its particular specialty.

After quoting freely from our remarks it says:

> Now, we have no quarrel to pick with our esteemed contemporary's figures; in fact, we think they are first-rate figures. But we should like to submit the following question:
>
> Since gas light costs 37½ per cent. less than steam-driven electric light, and, since gas-driven electric lights are cheaper still than the gas light, why don't the electric light companies make their light from gas-engines?
>
> To put this in another way, and perhaps more clearly—Since the electric companies are losing money in selling for a dollar what the gas companies are getting rich in selling for 62½ cents, and, since the electric companies could manufacture their same product, with the help of a gas-engine, for 317-743, or 42.7 per cent. of the cost incurred by their competitors, why don't they do it?

The answer is that they *are* doing it. We are speaking now of the cost of generation. There is probably not a central station in the country that could not afford to sell electric light cheaper than gas is sold if it could operate its station continuously at its most economical rate. Unfortunately, the central station manager has no such means of storing up his surplus energy during the hours of light load as is at hand to the gas engineer, hence the earning capacity of his plant is reduced to about one-third what it should be. One of the chief advantages of the gas engine is that it has no standby losses, and by its use the large standby losses of the steam boiler, which add so much to the cost of current, are obviated. In an increasingly great number of cases, not only in New York City but elsewhere, the gas engine operated dynamo in isolated plants has supplanted street service, with a consequent reduction in the cost of that service of at least 40 per cent. on the cost of gas light.

Continuing, it says:

> Is this a specimen of the executive ability that keeps electric stock at two-fifths of the value of gas stock? Since the only deduction to be drawn from ELECTRICITY'S figures is that the electric companies, by adopting gas engines, could reduce their price per candle power by 73 per cent., and then stand just as good a chance of making money as they do now, either those figures are wrong or else the electric men are— well, we won't call names.

This state of affairs does not imply a lack of executive or other ability on the part of the central station man, but is attributable almost entirely to the exceedingly variable character of the service which he is now supplying. That there can be any competition between the two illuminants with this disparity in price certainly implies an intrinsic merit in the electric light that even the cheaper cost of gas light does not overcome. This cannot be very gratifying to our contemporary, we think.

Concluding, it says:

> But this isn't all. ELECTRICITY confines its comparisons in small lights to the batswing flame. It admits that the Welsbach is at least three times as economical. So, if the electric companies are losing money in selling for a dollar what the gas companies get rich in selling for 62½ cents, how can they hope to compete with the new burner which furnishes the same thing for 21 cents? Even if the electric companies adopt gas engines and get all the gain in efficiency offered by electricity, and are thereby enabled to reduce their prices by 73 per cent., their light would still be 6 cents, or 29 per cent. higher in price than the Welsbach. "Alas! Othello's occupation——"
>
> We do not really think that the above represents the true state of the case. But in so far as ELECTRICITY'S figures, even if exaggerated, are correct in general, just so far is it evident that the inevitable goal of the course electric lighting is now running is the time when all electric current not derived from water power will be derived from gas power.
>
> Whether they sell their gas direct to the consumer of light or indirectly through the electric companies makes little difference to the gas fraternity.

Here's where the fits come in. Observe the swing around to the Welsbach light. But we must correct our contemporary—we *do not* confine our comparisons to the batswing flame nor do we admit that "the Welsbach is at least three times as economical." Doubtless it was an unintentional oversight on the part of our contemporary that caused the omission of what we really did say. It was this : "Extravagant claims have been made for the Welsbach light, but assuming the highest figures claimed, viz., 55 C. P. from 4.6 cubic feet," we still have "a ratio of 4.99 to 1 in favor of electricity." We regret that our esteemed contemporary omitted to quote these remarks, but, as we said before, we feel sure that it was an *unintentional* oversight.

But the electrical industry is fast working out its own salvation and building up industries of its own which it can supply with power during its hours of small lighting load. In this way the central stations will equalize their load lines and the electric light will be sold at a profit for less than gas light can be sold for, and we will have a light that is both cheaper and better than gas. Gas should never be burned except in connection with a chimney. The inevitable goal of electricity is to do *all* the lighting. The "inevitable goal" of gas is to be used for fuel. But we can make a gas suitable for fuel purposes much cheaper than is now made for illuminating purposes. Those wanting gas for fuel—and that is what it is best fitted for—will patronize fuel-gas companies, which our gas light companies will finally become. The gas light companies will then become serviceable adjuncts to the electrical station, and as such be useful. But as far as direct illumination is concerned—"alas ! Othello's occupation——" Words fail us here.

* * *

The Tesla Two-Phase System. In this issue Mr. Perry concludes his description of the polyphase installation at the new Westinghouse shops at East Pittsburg. It will be noticed that he has not confined himself strictly to a description of the apparatus there employed, but in order that the system of transmission as well as of distribution might be given in a connected way he has assumed that these works are at the further end of a long transmission plant, and, after having described the generators, has assumed that they have been replaced by step-down transformers. In a cursory way he has touched on the various apparatus which would be involved in this long transmission, and then takes up that which is actually employed in the distribution itself.

After an operation for several weeks of the many two-phase motors already installed, engaged in the greatest variety of service, it must be gratifying to the Westinghouse Company that their performance leaves nothing to be desired and that the reports from the motor hospital show all the beds empty. It has been claimed by Dr. Bell that it was impossible to burn out a polyphase motor. It is true that there is very little likelihood of its burning out—much less, perhaps, than with the direct current motor—but any self-respecting motor will burn out if the proper conditions are supplied. One case of the kind has actually occurred with the Tesla motor under conditions where the machine would have been condemned if it hadn't burned out. It may be said, however, that the polyphase motor is practically indestructible from this cause under any conditions which it is likely to be called upon to meet, and we only mention this instance to contradict the positive statement of an enthusiast who sometimes allows his words to run away with his judgment.

IF the rules of personal conduct and business probity which guided the late George M. Phelps had a greater number of adherents the world would be the better for it.

His thirty odd years of activity in the electrical trade brought him few enemies; yet he did not lack force in controversy nor in handling his business. Always courteous, always impressing those about him with the desire to be just, it was his good fortune and his merit to escape the bitterness which too often follows the successful man through the struggles which lead to that success. He never failed to respond liberally to the many calls for charity made upon him, and always had a hearty word of encouragement for the unfortunate. He has left a creditable mark upon his time, and ELECTRICITY extends to his intimate associates sincere sympathy in their loss.

The Situation. No officer of either the G. E. or Westinghouse Company has been found ready to state that any trade of any kind has been closed between the two companies. On the other hand, more than one has stated that nothing had been definitely agreed to, and that consequently no prediction could be made.

It is futile, therefore, to add much to what has been lately said in these columns on the fallacies of combinations.

There is no doubt that a game has been played, deeper in portent than any scheme ever hatched in the brain of Mr. C. A. Coffin. This game has been in the hands of masters, who amuse themselves only behind the double-barred doors of banks, but who nevertheless are sometimes compelled to consult those who play more in the open before they can reach conclusions.

That some plan was intended by which fresh money could be raised to place the G. E. wreck in better shape to speculate with, there is little doubt. The stockholders have been robbed almost to the point where they will call on the courts to stop the thievery, and ANY TRADE of any nature, whereby new money and new men could be pulled in would be welcomed by them. This has been the nigger in the woodpile from the beginning—a desire to float new securities. And the knowledge that ELECTRICITY was prepared to kill any such scheme at its birth has been an unpleasant fact in the situation for the schemers. We have ruined their credit once, and can do it twice or three times if necessary.

There may have been more truth than nonsense in the remarks of the financial editor of the New York *Sun* on Sunday, that the whole series of consolidation rumors had been handled to work G. E. stock up and down by two Westinghouse and one G. E. directors, who knew that no such trade could be made, but who also knew that they could make money as individuals out of the reports if properly handled.

There is no trade in sight which could result in anything but benefit to the G. E. manipulators and in corresponding injury to any legitimate interests on the other side.

The best thing to do will be to let these G. E. wreckers proceed with their own game until they have robbed the stockholders of their last dollar, even to an assessment, and until one or two of the prime movers are landed where they belong —in jail.

Under the Searchlight.

Views and Opinions on Timely Topics.

SOUND PHILOSOPHY.

The Best System Will Win.

(From the New York Sun.)

It may be hard upon the steam railroads to lose business; but it is important to the community that transportation shall be as cheap as possible. The steam people have no right to complain even if they should be driven out. For, did they not drive out of business the old stage coaches by which folks traveled, and the wagons by which goods were transported, and the horseback carriers who swept over the highways with their mail bags? Indeed, they did ; and thus they threw hundreds of men out of employment in Connecticut, besides reducing the price of horses. They did not care a copper how many stage drivers were knocked out by steam, or how many country inns were ruined by the rail, or how many stables were closed because animals were superseded by engines. Not a copper, so long as they drew their dividends and rose to the top of society. If they, in their turn, are injured by the electric people, they must take the time to think that this world is but a fleeting show, and that the whirligig of time often gives compensation for losses suffered.

* * *

WE are glad to know that Sawyer-Man lamps are again on the market, and that the price has been put at a figure high enough to encourage all makers of good lamps to refuse to meet the competition of inferior lamps like the Edison. ELECTRICITY adheres to the opinion on the lamp situation expressed a few weeks ago. The best lamps will win, if they are not sold too cheap.

* * *

THE ELECTROPOISE.

An Authority Pronounces It a Fraud.

The following letter has been received by the editor of *Bee Culture* and a copy forwarded to us :

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF CHEMISTRY,
WASHINGTON, D. C.

Mr. A. I. Root, Medina, Ohio:

DEAR SIR : I was much interested in reading your letter of the 27th ultimo, and also in looking over the enclosure which you sent. You ask my opinion of the marked part of page 5 of the circular which you enclose. From a scientific point of view it is rank charlatanry. I should want to go no further than such a sentence to form an opinion of the merits of the invention. I do not think, however, that I could properly give an opinion on the invention itself, as I do not claim to be an expert on electrical matters. I fully agree with you, however, that it is a humbug, pure and simple. I am, respectfully,

H. W. WILEY, Chemist.

April 1, 1895.

How much more proof do the religious journals and high-class magazines need before they will be forced to abandon their present dishonorable position ?

* * *

A SAMPLE of the hocus-pocus methods which have brought the storage battery methods of this country into disrepute is furnished by the Consolidated Electric Storage Company which recently paid a dividend of 1 per cent. (quarterly) although Mr. Bracken, the president, is on record as saying that he would not give over $8 per share for the stock, while at the same time he was claiming to others that it was worth $12. It is inconceivable that this concern can be paying any dividend honestly, or for any other purpose than to humbug somebody. At the time of the recent consolidation Mr. Coffin admitted over his own signature that the Consolidated Company was a bankrupt concern, owing to the G. E. and Brush companies alone over $165,000.

* * *

Electricity would like to know how many of the companies making electric light carbons and claiming to be independent concerns are really so. The public would also like to know. Only a few of them have the courage to use the advertising columns of Electricity. This is a sure test of their independence from the control of the interests arrayed on the side of monopoly, and purchasers may well look upon the others with suspicion. The plan of owning one or more so-called independent companies is not new to the Carbon Trust.

* * *

When Dr. Depew recently commented on the Pullman strike in a manner which did not please Gov. Altgeld, the latter made a severe attack on the Doctor's reputation, stating that he did not know which end of a steer the horns belong on. Evidently Gov. Altgeld and Mr. Herbert Lloyd learned the art of controversy at the same school.

* * *

We regret to add the names of *Public Opinion* and the *Chautauquan* to the black list of morally weak journals willing for a small consideration to carry the advertisement of a flagrant and exposed fraud like the Electropoise.

* * *

We recently announced that the Boston *Advertiser* had so far fallen from grace as to be engaged in booming the barefaced Pennock swindle in its advertising columns. Another former pillar of respectability in journalism, the New York *Times*, has been doing the same thing. If these journals persist in this policy, what will their advertising space be worth to reputable concerns?

* * *

AN EXPLANATION NEEDED.

We have before us a communication from Mr. J. G. Pangborn, occupying two full pages (foolscap size) of the finest linen paper to be bought in the market. In the center of the heading is an artistic crest in blue and gold. The heading reads as follows:

COMMISSION WORLD'S TRANSPORTATION
FIELD COLUMBIAN MUSEUM.
J. G. Pangborn, Honorary Director Museum World's Railway, F. C. M., *President.*
George Wood Logan, United States Navy, *Secretary.*
Hugh T. Reed, United States Army.
Wm. H. Jackson, Colorado.
Edward Everett Winchell, New York.
Clement F. Street, Illinois.
John A. Barnes, Illinois.
Edward Hill, *Messenger.*
Lahore, India, February 9th, 1895.

Mr. Pangborn is trying to induce American manufacturers to patronize an agency which he claims to be establishing for handling exhibits at the Paris Exposition in 1900.

We quote Mr. Pangborn:

"The establishing of headquarters in Paris at the termination of the travels of the Commission in *1897*, and the ultimate constituting of the staff of the associated manufacturers of, say, four of the members—Mr. Street, the mechanical engineer; Mr. Winchell, the draughtsman and artist; Mr. Stevenson, my secretary, and myself—would be very desirable."

The headquarters is, of course, to be maintained by the exhibitors. No doubt it "would be very desirable" for Mr. Pangborn, or most anyone else, to be maintained in Paris for three years with a secretary and staff on some one else's money.

But what we would like to know is this:

What connection has Mr. Pangborn with the Field Columbian Museum? What connection has the Field Columbian Museum with this scheme? Who pays for this elegant stationery?

We suppose the Field Columbian Museum management were as much surprised when they learned of the scheme as are the manufacturing companies who receive the circulars and wonder just what the "Commission World's Transportation Field Columbian Museum" means.

It is easy to see what Mr. Pangborn means.

He is no doubt having more fun than he did when he was earning his living as G. P. A. of the Baltimore and Ohio Railroad.

While the circulars are dated "Lahore, India," replies are requested to be sent to London, care B. F. Stevens, U. S. Dispatch Agent, with whom Mr. Pangborn says he is in "constant telegraphic communication."

Who pays for the telegrams?

* * *

EVOLUTION.

BY ELECTRICUS.

In the early days each winter night,
When we lived up on the farm,
Choice pitch-pine knots served us with light
And the backlog kept us warm.
Contented we to have it thus,
No sigh escaped our lips
Till a rich man moved next door to us
And *he* used tallow dips.

Unheard of such extravagance
In all the country round,
The neighbors marked the circumstance
And on such doings frowned;
But each with envy reasoned thus,
Though words ne'er 'scaped his lips,
"We'll beat that rich man next to us
With all his tallow dips."

So pa he sold a shoat one day,
And ma she went to town
And blew the money in, they say,
On candles and a gown;
And when she came back spake she thus,
With a quiver on her lips:
"We'll show that rich man next to us
What's better'n tallow dips."

And when those candles burned that night
They made it light as day,
And our neighbor when he saw the light
Threw his tallow dips away.
He got next day some whale-oil lamps,
The first that we had seen,
But pa he sold the sow for stamps
And bought some kerosene.

This knocked our nabob's whale-oil lamps
To the middle of next week
And left him naught but to decamp
And other fields to seek.
My father bore his triumph well,
But, grown ambitious, he
Resolved the farm and stock to sell
And a city swell to be.

He bought a place in Houston street,
And there we burned coal gas
Whose constant rays each night did greet
The throngs as they did pass.
But from the windows next to ours
There came a sickly sheen,
Reminding one, by all the powers,
Of a moonlight yallery green.

My father didn't think it right
To be outdone this way,
So he put in the electric light,
Which made it bright as day;
And when we turned it on that night
He softly raised a prayer:
"Heaven help the man with the Welsbach light
Who lives next door, right there."

Our neighbor's wife grew wan and thin,
His children sick and pale,
And he himself grew lank and lean,
Though once so strong and hale;
A shadow of his former might,
They bore him in the hearse,
A victim of the Welsbach light
Which also killed his nurse.

* * *

Our Style Is Appreciated.

And It Grows More Fascinating Every Week.

(From the Baltimore American.)

Electricity has always had, and will ever have, a fascination for man.

The next G. E. report will show, we are informed, no less than $8,000,000 written off from the assets for the year, and will claim a profit of $900,000 on the year's business. The latter amount is equivalent to less than one-half of 1 per cent. on the common stock after taking care of the preferred stock and the bonds. It is understood that Mr. Coolidge has insisted that the amount written off shall be as above instead of $6,500,000 as first intended.

* * *

The Brush Electric Company's business must be booming along in a manner to compel that concern to join the ranks of Schuyler Electric et al. Five of the leading men at the works, Messrs. Phipps, Bagnall, Adams, Arnold and Cox, have recently resigned to organize a competing arc lamp business.

And still those minority stockholders stick. We guess the holders of the $500,000 mortgage will be the first to kick in earnest.

* * *

The Walker Company Did Not Want It.

As recently announced in Electricity, the Walker Company of Cleveland were awarded the contract for a 1,500 K. W. generator by the Union Depot Railway Company of St. Louis. Subsequently the Walker Company refused to accept the contract, which was taken by the next higher bidder, the G. E. Company.

COMMUNICATION.

THE UNDISCOVERED FIELD.

"Quien Sabe?"

To the Editor of Electricity.

Dear Sir: Could you believe that there is such a thing as perpetual motion? Was it not supposed that Sir Isaac Newton discovered it? Is it not supposed that electricity is an undiscovered field? I am a young mechanic who hardly knew what electricity was derived from until a few months ago, and from my knowledge gained since I see how to construct in three different ways a powerful perpetual motor. When I was a youngster I remember that when I heard of magnetism I supposed that there then was some powerful magnetic motors, but it does not seem so, for I do not know of any; but magneto-electro motors are immensely superior, and I am here in this city and I see the way to construct the marvel of modern times, and owing to my financial straits I am helpless. Talk of your Count Edison, Tesla and others—why a blind man would think of what I see. It will give power to everything, will produce heat and light, will revolutionize life, make aerial navigation a reality; and I who see it is not a count or wizard, but a bright ex-newsboy and at present a painter. If you know of any investors you may recommend them to me. I will make the agreement to supply electricity if started.

Respectfully yours,
H. T. D.

P. S.—One is magnetic. One creates its own electricity, thus making itself magneto. The other is simplicity. I have an excellent idea on aerial navigation, to work by an aeroplane lifted, propelled and steered by fans—should go by

Powerful Perpetual Motion.

An Electric Scenic Theater.

Mr. John A. Seeley's scenic theater at Coney Island, which was not completed in time to open last year, is now receiving the finishing touches and the apparatus will be installed next week. The building is located just at the head of the walk leading up to Surf avenue from the Iron Pier.

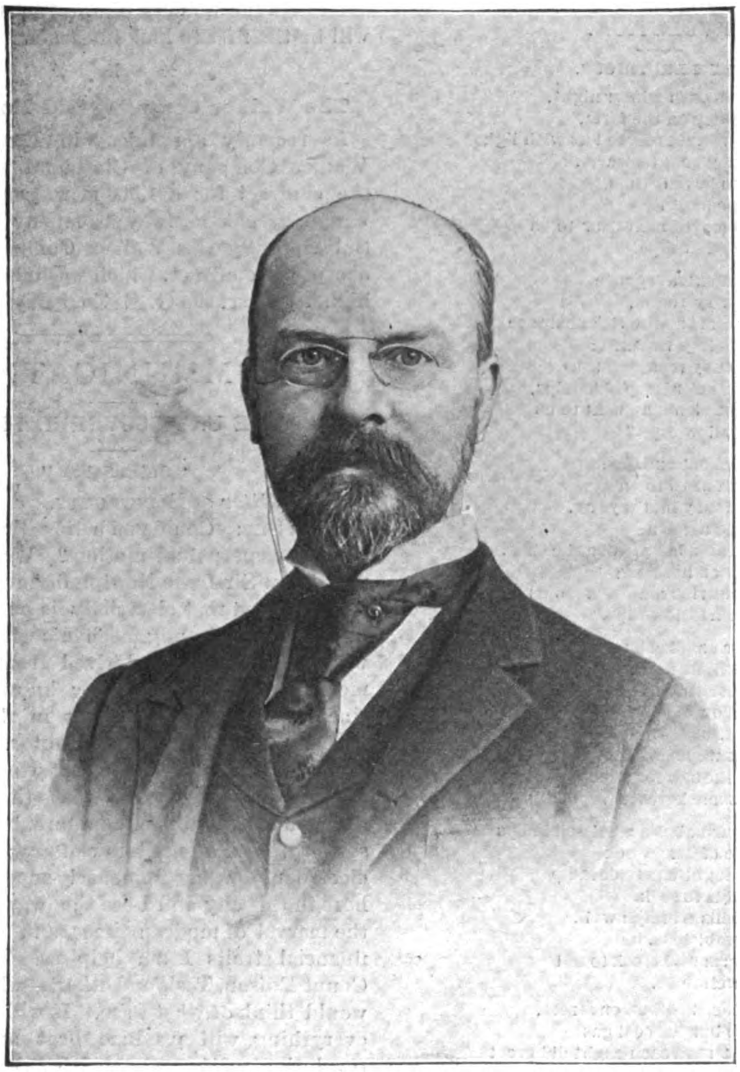
GEORGE M. PHELPS.

George M. Phelps died at the home of his sister in Division avenue, Brooklyn, E. D., on the night of April 11, after a brief illness from pneumonia, and was buried on Sunday at Troy, N. Y., his former home.

Mr. Phelps was born in 1843 at Troy, where he was educated. His first connection with the electrical business dated back to 1861, when he entered the shops of the American Telegraph Company.

Mr. Phelps's father was superintendent of this company from its organization up to the time of its absorption by the Western Union.

From 1863 to 1866 Mr. Phelps was in the auditing department of the American Telegraph Company, and from 1871 till 1879 was assistant to his father in the conduct of the Western Union Company's factory in New York. When, in April of the latter year, the telegraph company gave up its own manufacturing and disposed of its factory to the Western Electric Company, he was appointed superintendent of the factory by the latter company, which position he held till December, 1885. Early in 1886 he joined Mr. Franklin L. Pope in the conduct of *The Electrician and Electrical Engineer*, then published monthly, and acquired a proprietary interest in that journal soon after.



George May Phelps.

He was a charter member of the American Institute of Electrical Engineers, and was elected one of its managers on May 19, 1885. He served on the Council in this capacity until his election as treasurer on May 17, 1888, to which office he has been re-elected each year and which he held at the time of his decease. He had been nominated for the same office by the Council for the term beginning May 14, 1895.

When the *Electrical Engineer* was changed from a monthly to a weekly, a new company was organized and Mr. Phelps became the president, retaining the position until his death.

He had also been prominent in the affairs of the New York Electric Club. The funeral services were conducted by the Rev. John W. Chadwick, at the house where he died, on Saturday evening last, many prominent electrical men attending to pay their last respects.

Detroit's City Plant.

The municipal plant of the city of Detroit has been in operation over two weeks. There are four Western Electric 100 light arc machines running. Everything so far has given the best of satisfaction to all concerned, and Mr. Alex. Dow, the engineer who has had charge of the matter from the start, has been receiving many congratulations, in which Electricity heartily joins.

American Institute of Electrical Engineers.

The 96th meeting of the Institute will be held at 12 West 31st street, New York City, on Wednesday, April 17, at 8 P. M.

A paper will be presented by Prof. Edwin J. Houston and Mr. A. E. Kennelly, of Philadelphia, on "Resonance in Alternate Current Lines."

A paper will also be presented by Prof. W. A. Anthony, of New York City, on "Underwriters' Rules."

A meeting of Western members will be held the same evening, where the above papers *will* be read and discussed.

The Tesla Two-Phase System.

II.

EXTENSIVE USE AT THE WESTINGHOUSE WORKS, BRINTON.

The New Plant Fully Equipped with Alternating-Current Apparatus—The Most Important Installation Thus Far Attempted.

BY NELSON W. PERRY, E. M.

Returning to the power-house we find, as already stated, two 500 H. P. direct connected direct current units furnishing current at 500 volts. These are used for testing the direct current apparatus manufactured by the company and are at present operating the five electric traveling cranes, the elevators and several large direct current motors, all of which it is intended to replace as soon as possible with alternating two-phase motors. As these generators are of the standard street railway type with which all are familiar, they need not take more of our attention at this time.

Turning now to the alternating current machines on the other side of the building, we find them very different from the two-phase apparatus employed for lighting purposes at the World's Fair. In those machines, it will be remembered, there were practically two armatures revolving in a common field. The windings of these two armatures were in such relation to each other that the phases of the two currents were in quadrature with each other. In fact the World's Fair generators were really two separate machines operated on the same shaft and in a common field. The frequency of the currents was 7,200 and their voltage approximately 2,000. The present machines, which are admirably illustrated in Fig. 2 (page 170 of last issue), in many respects resemble multipolar direct current machines, except that four collecting rings replace the familiar commutator. The field magnet yoke is of massive cast-iron with inwardly projecting laminated pole-pieces, fourteen in number. The armature is single instead of double and resembles very closely in outward appearance a Gramme ring. The winding is continuous and connections are brought out at four points, 90° from each other, to collecting rings, as represented in diagram, Fig. 7, the two terminals of each diameter forming the terminals of a different circuit the phases of which differ also by 90°.

In the diagram A and B represent the collector rings of one circuit and their connections, and C and D those for the other circuit.

In three of these wires are placed automatic circuit breakers, so that in case of a short circuit between any two of the wires the circuits involved will be opened.

The windings of the armature are carried in slots in its cylindrical surface and held against centrifugal force by vulcanized fiber rods slipped into grooves in the slots just over the conductors. No binding wire is therefore employed on the cylindrical surface of the armature as is necessary when the conductors lie upon the surface.

The pole-pieces are fourteen in number and consist of laminated iron inserted into the yoke at time of casting. This insures the most perfect continuity between the two and obviates the reluctance factors due to mechanical joints. The magnetic circuit of the yoke is of high conductivity by reason of its massiveness, and the high permeability required of the pole pieces is obtained by the soft iron, and the prevention of foucault currents where they are most likely to occur is obtained by its lamination.

In the machines under discussion the fields are separately excited from a Tesla rotary transformer, illustrated in Fig. 6 (page 171).

This receives the alternating currents at the collector ring end, running as an alternating current motor and transforming them to direct currents which are taken off the commutator end for field excitation.

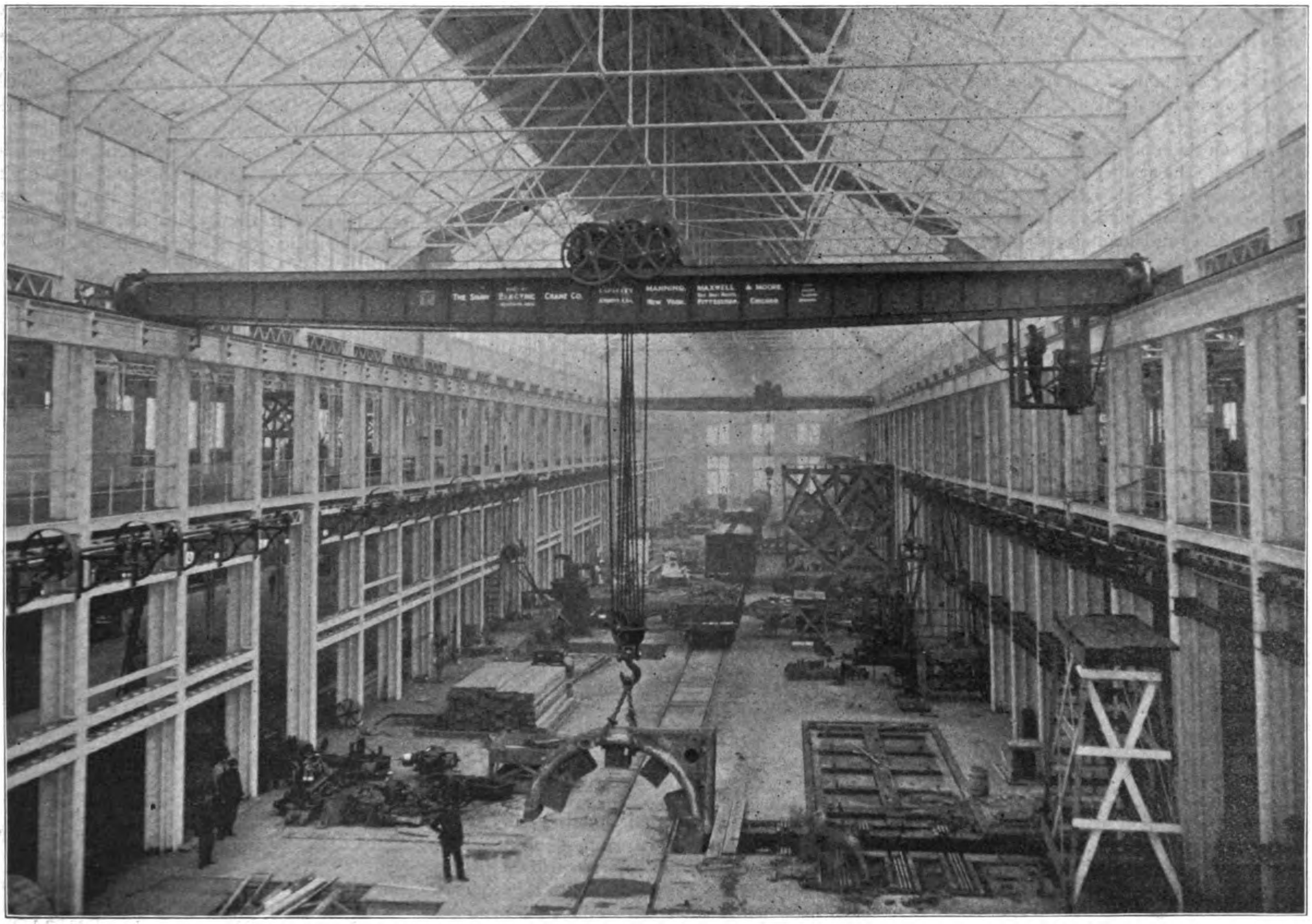
The two generators run at 220 revolutions, giving currents of 3,000 alternations—the same frequency as is to be employed at Niagara. Since in this installation the greatest distance of transmission is but about 1,100 feet, high potentials were not necessary nor desirable. The voltage employed is therefore only 230 at the generator terminals or about 220 at the motors.

Much has been written about the practicability of coupling alternators in multiple, and while it has been successfully done in a number of cases it has also failed in a sufficient number to give rise in the popular mind to a question as to its practicability. It is of the utmost importance to the central station man that he have the ability to throw units in and out of action, in multiple, as his load changes, for without this ability he must drop out in the race for supremacy. One of the points which the Westinghouse Company wished to emphasize, therefore, was that their two-phase generators could be operated in multiple, and upon their ability to operate in this way they staked the entire success of the new plant. It had not been a question with them, for it had already been demonstrated to their entire satisfaction, but the public required assurance on this point, and the object lesson which these works was intended to afford would have been incomplete had the two generators been employed on separate sets of circuits. They are therefore coupled up in multiple, and during the days when the writer saw them operating were giving a combined output of more than 400 amperes on each of the two circuits. The variation between the two machines was practically negligible, and they seemed to work in parallel in every respect as well as two direct current machines similarly connected are accustomed to do.

Where longer distances are concerned, machines giving higher potentials would be employed and step-down transformers used at the point of distribution to bring the voltage down to that suitable for motor work or lighting; or if very long distances were involved, requiring higher potentials than it would be desirable to generate directly in the armature, these same machines generating 230 volts could be used, step-up transformers employed at the power station to raise the voltage to that required for economical transmission, and step-down transformers at the point of distribution employed as before to reduce the pressure to the requirements of service.

The simplicity and efficiency of the closed magnetic circuit transformer are too well known to require remark here further than to say that they are the most efficient transformers of energy known to man. So high has this efficiency been for several years past that little improvement seemed possible or even desirable in this direction. There has been room for improvement, however, in methods of insulation against the increasingly high potentials now being used and in the dissipation of the heat energy which constitutes inevitable losses in the transformer. Theoretically a transformer working with a hot core and a cool coil would be the most efficient, but these two conditions are incompatible. They have been partially realized, however, in the Westinghouse transformer, which is illustrated in Fig. 8. This photograph shows very clearly the method of building up the laminated core around the coils adopted by this company, but the main feature to which it is desired to call attention at this time is the spreading of the ends of the coils after they come out of the iron, which affords a much better opportunity for the dissipation of the heat energy developed in the coils than any other method thus far suggested which does not at the same time dissipate the heat from the iron as well.

Still another essential to a good transformer or converter, as the Westinghouse people call it, is that it shall be proof against the breaking down of the dielectric. Where comparatively low potentials are concerned, it is not difficult to insulate against them, but when extreme pressures such as long-distance transmissions require are used, the insulation against these pressures becomes a question of the utmost importance. Tesla has shown that the air itself is a most fruitful cause of discharge across either from static or dynamic charges, and that if this be removed many of the difficulties of transformer insulation are also removed. The Westinghouse Company, therefore, exclude the air from the transformer chamber by utilizing a fluid dielectric, which has the further quality, not possessed by solid dielectrics, of repairing itself in case it does at any instant break down. The transformer shown is the latest type of the oil transformer now manufactured and used on high-potential circuits. As will be observed, no attempt is made at high insulation in the winding of the coils, they being simply wrapped in untreated cotton tape. The transformer, however, when ready for use is simply immersed in an oil



VIEW CENTRAL AISLE OF MACHINE SHOP. 30 TON ELECTRIC CRANE.

bath, the air driven out as far as possible and then connected up for service.

The Westinghouse Company was the first to appreciate the possibilities of the alternating current in long-distance transmission, and when the inventions of Gaulard and Gibbs had placed it on a commercial basis, they at once procured the exclusive right to their use. They have therefore been the pioneers in this class of apparatus, and while the system of to-day bears little resemblance to that elaborated by Gaulard and Gibbs, the system of transformation is based primarily upon the fundamental patents issued to those two gentlemen. Many other fundamental patents bearing upon this important field were also early acquired, among the most important of which are the Tesla polyphase patents, which it is claimed completely cover the whole field of polyphase transmission and distribution and which will find their highest and most extensive application in the great Niagara scheme.

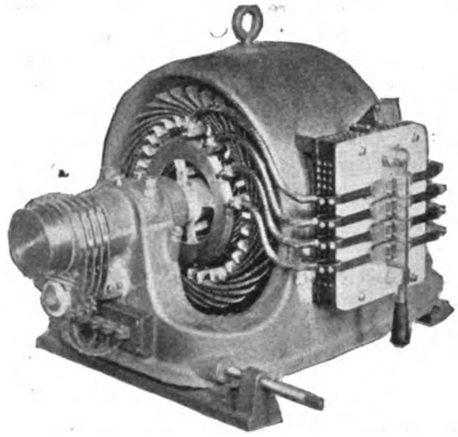


FIG. 3.—TESLA 50 H. P. TWO-PHASE MOTOR. OLD STYLE SWITCH. NEW STYLE COLLECTOR BRUSHES.

The Tesla polyphase patents upon which the Westinghouse Company base their claims of ownership in this field are the following :

May 1, 1888. Nos. 381,968—381,969—381,970—382,279—382,280—382,281, 382,282.
October 2, 1888, Nos. 390,413—390,414.
October 9, 1888, Nos. 390,721—390,820.
April 16, 1889, No. 401,520.
June 25, 1889, No. 405,858—405,859.
December 3, 1889, Nos. 416,191--416,192—416,-193—416,194—416,195.
December 31, 1889, No. 418,248.
March 25, 1890, No. 424,036.
August 5, 1890, Nos. 433,700—433,701—433,702—433,703.
January 27, 1891, No. 445,207.
June 30, 1891, No. 445,067.
September 22, 1891, No. 459,772.
December 8, 1891, No. 464,666.

Making twenty-nine patents all told, which the company believe completely cover the polyphase field so far at least as it has been developed.

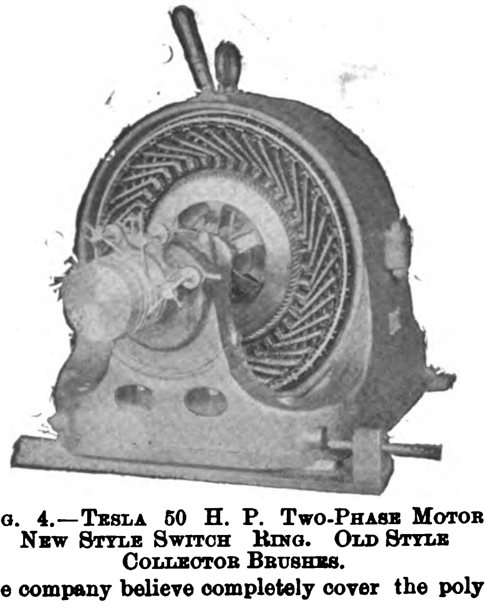
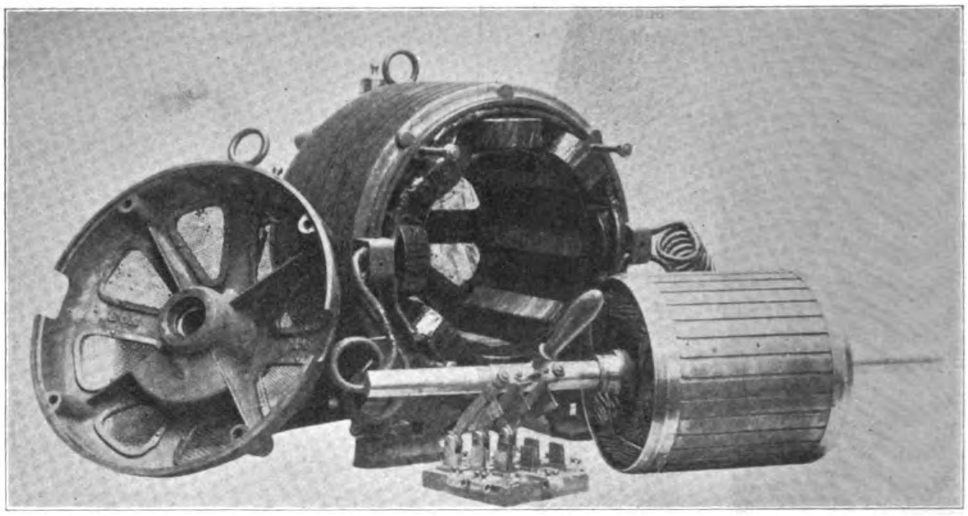


FIG. 4.—TESLA 50 H. P. TWO-PHASE MOTOR. NEW STYLE SWITCH RING. OLD STYLE COLLECTOR BRUSHES.

It is not to be supposed, however, that any one mind has contributed all that goes to make up the completed commercial system of to-day. Many minds indeed have contributed to the perfected system as exemplified in the plant under discussion, and while, if we were to confine ourselves strictly to this particular plant, we would necessarily pass lightly over some of these features, or not mention them at all, the description of the system as a whole would be incomplete. At the risk, therefore, of seeming a little prolix some of the more important accessories will be referred to.

Where lights are to be supplied as well as power, it is of the utmost importance to have means at hand by which the potential on the various circuits may be regulated so as to compensate for the change of losses due to variations in load. The voltmeter as usually employed in the generating station indicates only the pressure at the generator terminals and not that at the point of consumption where the variable effects of drop are encountered. In ordinary practice it has been customary to bring back small *pressure* wires from the points of distribution, by which means the pressures at those points were indicated and the proper regulation indicated to the station manager. A method of equalizing the pressures among a number of distribution points, often resorted to, has been that of connecting them all together with equalizing wires. Both of these methods are cumbersome and expensive, and have been discarded by the Westinghouse Company. In their places have been substituted the following arrangements :



TESLA 5 H. P. MOTOR, OLD TYPE.

The voltmeter is supplied by the secondary of a small converter, usually reducing in the ratio of 30 to 1 where the initial voltage is 3,300, or in a greater ratio if higher. In the voltmeter circuit there is placed a compensator. This is shown in Fig. 9, and consists of a small transformer with its primary in series with the main circuit and its secondary in series with the voltmeter circuit, and connected in such a way that the compensator pressure to the main current opposes the voltmeter pressure to an extent proportional to the loss in the conductors. The voltmeter by this arrangement, therefore, indicates the potential--not at the station, but at the point of distribution.

Now as this pressure varies it becomes necessary to have some means of correspondingly varying the station pressure. If there were but one circuit extending from each generator, this would easily be accomplished either by varying the field excitation or the speed of the armature, but in practice there are usually a number of circuits extending from each machine in each of which a different compensation is required, and the methods referred to would not be applicable. To meet such cases resort is had to the Stillwell Regulator, represented in diagram in Fig. 10.

THE STILLWELL REGULATOR.

The great value and importance of this instrument as a part of the modern complete central station equipment has been demonstrated beyond question. The principle of the instrument—as beautiful as it is simple—is that of induction. For this reason no similar device can by operated from a direct current system. It consists primarily of a converter, suitably designed, with secondary coil adjustable in length, i. e., with connections brought out from different parts of the secondary coil to a multipoint switch. By means of this switch the whole or any part of the secondary coil may be thrown in series with the main circuit, thus adding to the initial primary potential of the circuit the additional potential of the secondary coil, or a part thereof. Within the limits of the voltage thus added the potential of the supply circuit is, therefore, subject to the most delicately shaded adjustment, independent of whatever may be the potential at the alternator terminals. Consequently, it is the practice to have several supply circuits taking current from the same generator, and hence, of course, they are at absolutely the same potential. Although each circuit may be operated at a different percentage of loss, by the use of the Stillwell Regulator all lamps will be maintained at a uniform voltage and brilliancy. The attachment of a double-throw switch makes it practicable to reverse the action of the regulator and decrease instead of increase the initial potential. This may be frequently done to meet local conditions, and is an additional convenience.

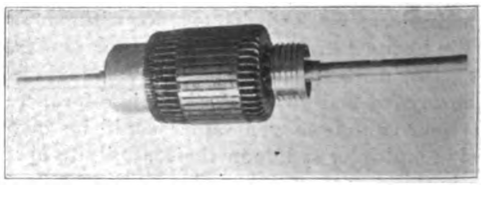


FIG. 6.—ARMATURE ROTARY TRANSFORMER.

It will be noted that this instrument simply increases the electromotive force in the circuit by a few volts. To do this it is necessary to transform but a small portion of the electrical energy passing through the regulator. The efficiency of conversion of this fraction of energy is easily 95 per cent., and it is therefore evident that the loss of energy in the regulator will be but an extremely small percentage of the total energy of the circuit. For example, at full load a 100 ampere regulator, designed to raise the initial potential 10 per cent., would receive at the terminals of its primary coil 10 amperes at 1,000 volts, and at the terminals of its secondary coil would deliver 100 amperes at 100 volts, less any losses suffered in conversion. These losses, being the same as those of a standard converter of equal capacity, aggregate not to exceed 5 per cent., i. e., 500 watts. The total energy supplied to the circuit by the generator being 110 amperes at 1,000 volts, i. e., 110,000 watts, the percentage of loss is therefore .00455, or less than ½ per cent.

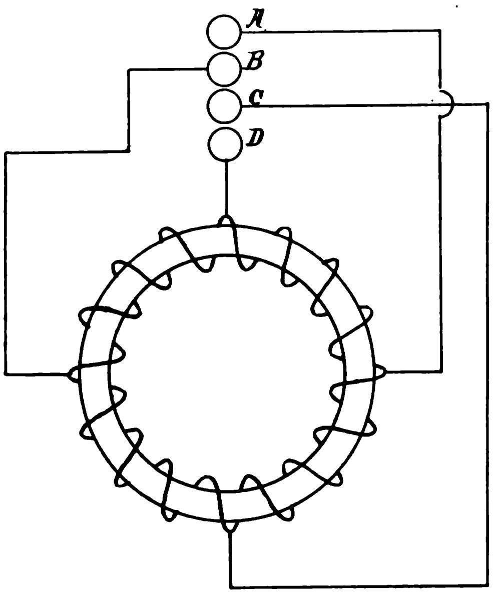


FIG. 7.—DIAGRAM OF GENERATOR ARMATURE CONNECTIONS.

The extreme flexibility supplied by the use of the regulator is illustrated by an example which occurs almost daily in practice. Let us assume a small station operating under ordinary conditions with, say, a loss of 2½ per cent. in its feeders and 1 per cent in its mains, the territory supplied being within a radius of one mile from the station. Let us further assume that there is a point two and one-half miles distant where an additional 500 lights can be secured. It would evidently not pay to erect a special alternator to supply this number of lights, and yet to supply them from the same alternator sufficient additional copper must be put into the new circuits to reduce the losses over the greater distance to those already incurred in the shorter circuits. This also would prove uneconomical and the station manager would find himself confined to a choice of three undesirable methods: 1st, to install a new alternator for the 500 lights; 2d, put in a sufficiently heavy wire to maintain the same loss at the greater distance, and 3d, abandon the idea entirely of supplying the new customers. I do not know whether dilemmas usually have three horns, but this one seems to have and they all promise to be equally uncomfortable to sit upon. The regulator, however, comes to the station manager's assistance in this way: Assuming an average of $\frac{1}{10}$ ampere in the primary line for every 16 C. P. lamp on the secondary circuits and a 10 per cent. Stillwell Regulator to be attached to the new circuit, it is immediately possible to raise the initial electromotive force 10 per cent. above the electromotive force of the other circuits supplied from the same dynamo, and to therefore allow an additional loss of the same amount on the line. The line cost for supplying these lights by this means (including the cost of the regulator) would be only about one-third what it would were the extra copper otherwise required employed. It also effects economies in operation and renders possible much better service by placing in the hands of the station manager a most perfect means of independent regulation of the various circuits extending from the same dynamo.

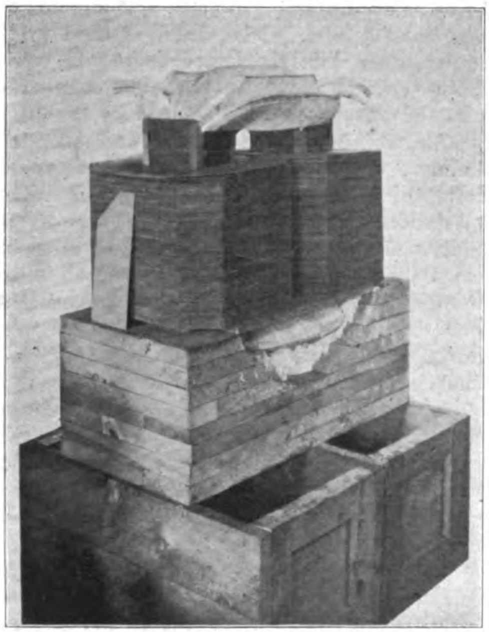
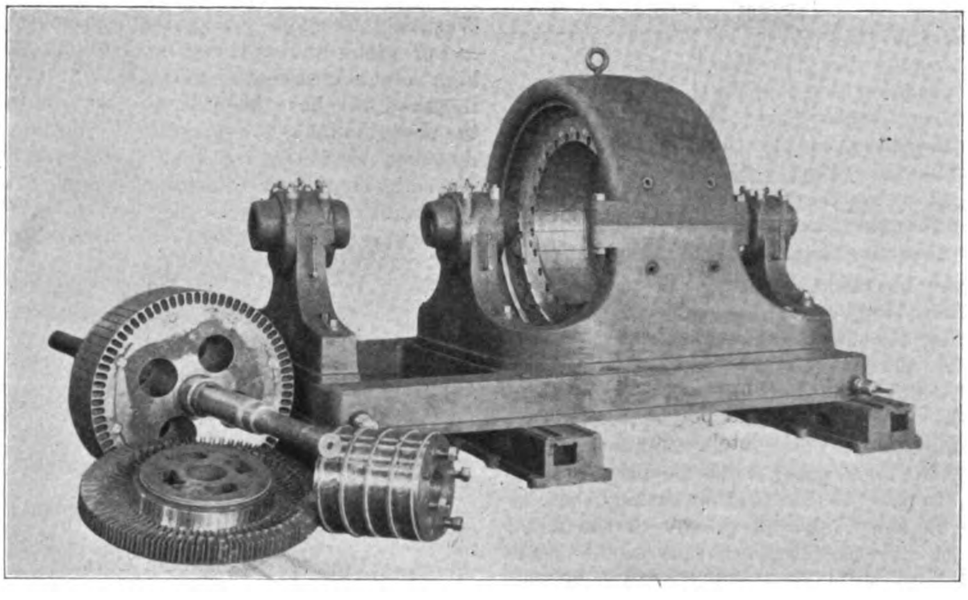


FIG. 8.—OIL TRANSFORMER PARTLY BUILT UP.



TESLA 300 K. W. MOTOR, WORLD'S FAIR TYPE.

In the regulators as now put on the market, the secondary is divided into small sections, each of which has an electromotive force equal to 1 per cent. of the primary. Any number of these sections may be placed in series with the supply circuit, and thus with standard apparatus the variations in pressure at the point of distribution may be compensated for through all variations in load within less than 1 per cent.

All long lines of overhead wire, and particularly such as traverse mountainous sections, are subject to violent atmospheric conditions which if not provided against in some efficient manner are liable to result in the destruction of the machinery at both ends of the line. The popular belief is that these destructive effects are due to lightning, but while they are apt to occur most frequently in sections of country where severe thunder-storms prevail it is doubtful if the lightning itself ever, or at least frequently, actually strikes the wires. The so-called lightning strokes on circuits are now known to be chiefly inductive effects, due to sudden changes of potential of the earth or clouds due to lightning flashes occurring not necessarily in the immediate proximity of the circuits, but which by inductive effects set up electrical surgings in the wires. These surgings if they reach the transformer or dynamos are liable to cause disruptive discharges across the insulation which may lead to its destruction. It is not the disruptive discharge, however, that does so much damage, as it is the dynamo current which, having had this path opened to it by the disruptive discharge, follows it. An effective lightning arrester, therefore, has two distinct offices to fill: 1st, to offer an easier path for the surgings than that through the coils of the machinery whereby it may be drawn off the line, and second, to prevent the passage of the dynamo current over the same path that the disruptive discharge has opened for it. The old idea was that the first of these functions was fulfilled when a grounded conductor was separated by a short air-gap from the circuits to be protected, and the second by providing some mechanism, either mechanical or magnetic, by which the arc which followed might be broken instantaneously and the normal air gap re-established for subsequent protection. Experience has taught, however, that these electrical surgings do not seek to leave the wires with equal force at all points and that they will frequently pass by a number of short air gaps and then find the ground through a much longer and apparently more difficult path. The reason for this is now well understood and is implied by the name by which I have

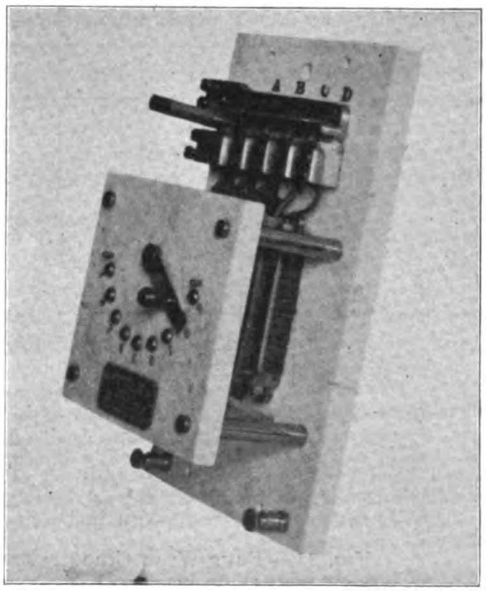


FIG. 9.—COMPENSATOR.

described them, viz., surgings. If an air gap be provided where the crest of the wave happens to be, a discharge will take place, whereas similar air-gaps, or even shorter ones, would be passed by by the same surging if they happened to be situated at any other point than where the crest happened to be found.

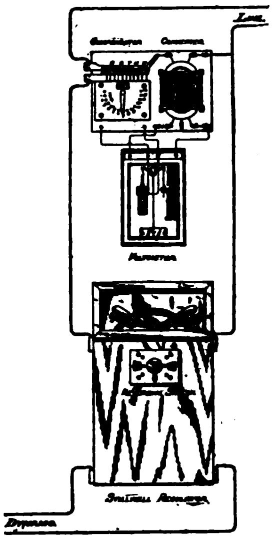


FIG. 10.—STILLWELL REGULATOR.

Mr. Alexander Jay Wurtz of the Westinghouse Company has made, under their auspices, a very exhaustive study of the phenomena of so-called lightning discharges on overhead circuits, and has discovered a method by which the lines are afforded almost absolute protection from these dangers. The basis of this discovery is that of a non-arcing metal which, when employed as the terminals of an air gap, permits the disruptive discharge to pass but immediately extinguishes, by virtue of some inherent quality of the metal itself or its vapor, the arc that would otherwise follow. In his completed arrester he employs seven cylinders of the metal—each one inch in diameter, and three inches long. These are mounted side by side, separated from one another by $\frac{1}{32}$ of an inch. The central one is connected to the ground while the two outside ones are connected to the two sides of the circuit. With these metals and this arrangement it has been found impossible to start and maintain an arc when they are separated by an air gap of this size, but strange to say, where the gap is longer—say half an inch—the arcing is said to be very vicious. In recognition of the value of this discovery of non-arcing metals and their application to the protection of circuits, the Franklin Institute of Philadelphia awarded to Mr. Wurtz the John Scott Legacy premium and medal. These lightning arresters are placed at such frequent intervals along the line that some one or more of them is sure to be in the proper position to draw off the charge at the crest of the wave. The arresters are also placed in the stations at both ends of the line. As showing the frequency of these discharges in some localities, an instance is cited in the experience of a line at Telluride, Colorado, when forty-two discharges of the lightning arresters were observed in as many minutes, any one of which might, if not thus provided for, have damaged or destroyed the machinery at one or the other end of the line.

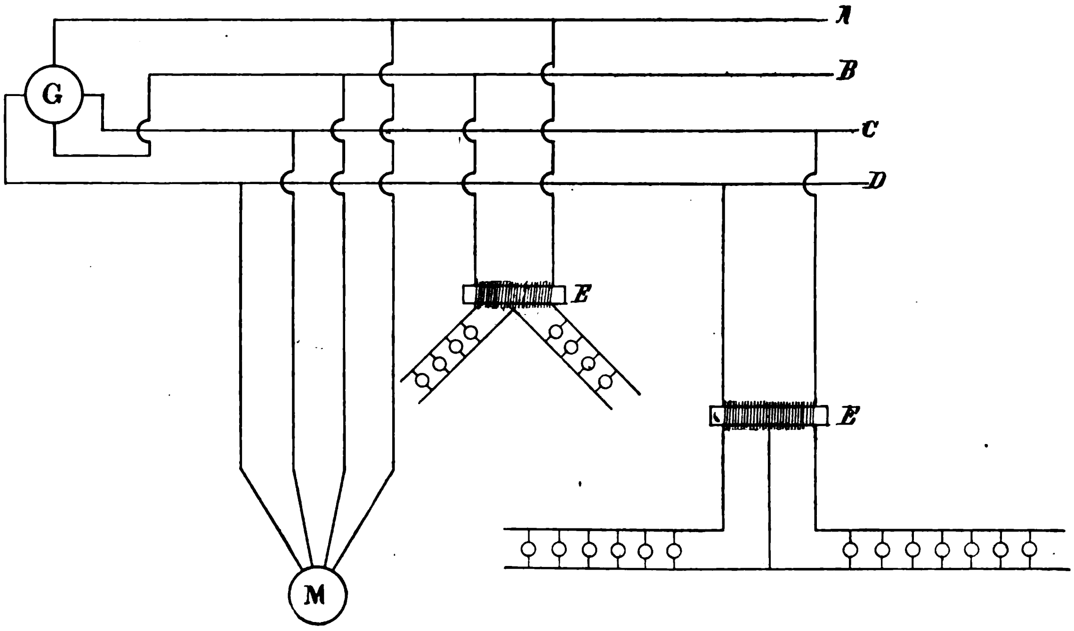


FIG. 11.—FOUR-WIRE CIRCUIT WITH MOTOR AND LIGHT CONNECTIONS.

The above digression has been indulged in to call attention to some of the accessories to a transmission plant installed on the Westinghouse system. This is scarcely pertinent to the subject in hand, but we may consider that the Westinghouse shops are located at the further end of a long line of transmission, and that the high voltage transmission currents of 5, 10 or 20 thousand volts have been transformed down in the power house to 230 volts for distribution, the dynamos previously described being simply replaced by step-down transformers, and we have the conditions exactly as they would be if the shops were actually hitched on to Niagara or any other distant source of power. The switchboard would remain as it is, and from it would run, as they do now, the four circuits—two for each of the two-phase currents.

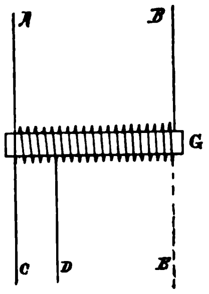


FIG. 12.—BALANCING COIL.

At Pittsburg these wires are carried overhead on insulators to the various buildings where power and light are required.

Fig. 11 shows the methods of distribution and the manner of taking current off from the circuits both for motors and light. It will be observed that the lights are taken off of both circuits indiscriminately. Usually, it would be better to divide the lights about equally between the two circuits, for the reason that where all the motors used are two-phased motors, as in this establishment, the only chance for unbalancing the circuits is by overloading one circuit with lights at the expense of the other. Some writers have held that this unbalancing of the circuit would introduce undesirable complications in the operation of the apparatus. There seems to have been no foundation for these fears, for the irregularities do not develop in practice. The Westinghouse Company have put the system to the severest test of fully loading one side with lamps and operating them with no load on the other side. The difference observed under these conditions between the two sides was only 4 per cent.

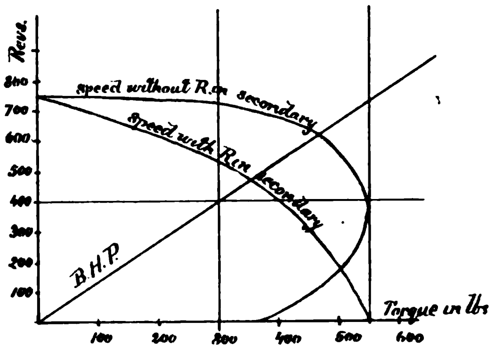


FIG. 13.—CURVE OF TORQUE.

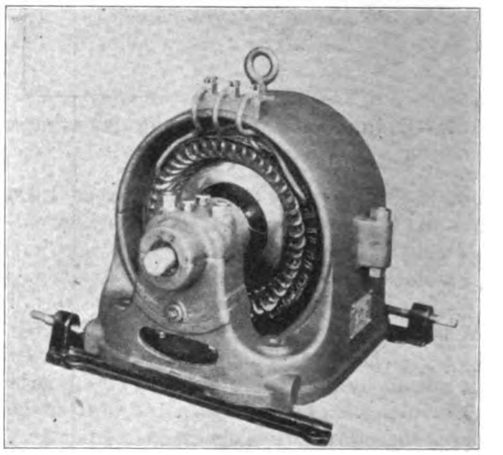


FIG. 14.—TESLA THREE-PHASE MOTOR.

THE BALANCING COILS.

It will be observed in the diagram (Fig. 11), that the lights are taken off of either circuit, between which there is a difference of potential at this point of about 220 volts. The lamps require but 110 volts. The usual method would require either that the lamps should be wired two in series or that the potential be reduced by means of a transformer. Instead of the usual transformer with separate primary and secondary windings, the balancing coil is here used. While the functions of this coil are doubtless well understood by many of the readers of this paper, it may be well for the benefit of others to describe it in detail. In Fig. 11 this coil is represented by E, and in Fig. 12 on a larger scale by G. In the latter figure, A and B are the two sides of the 220 volt circuit connected to the terminals of a coil with iron core G. If there were no secondary coil, or if the secondary coil were open, this coil would act by self-induction as a choking coil, and no current could pass from A to B. For the purposes of illustration I have represented this coil as having twenty complete turns. If to one end the wire C were attached, and another one D were attached to the fifth turn, then the twenty turns would act as a primary and the five as a secondary—the currents in the two being in opposite phase, and the reduction of potential between these two wires would be from 220 volts to 55. If now a third wire E were attached to the other end of the coil, the whole coil would again act as a primary to that portion of the coil between D and E as a secondary—in this case fifteen turns—and the potential between these two wires would be $\frac{15}{20}$ of the primary voltage, or 165 volts. By this means it is possible with a single coil to divide up the voltage into two or more parts by including between the secondary wires the proper proportions of the coils to effect the desired reduction. It is in fact a transformer, but one of exceedingly simple and economical construction, and for distributing a 220 volt current to 110 volt lamps is made use of by connecting a neutral wire into the center of the coil, and from this elementary three-wire circuit taking off the two-wire circuits at convenient points. Since the coil is equally divided between the two circuits, the electromotive force of the primary is also equally divided between the two branches, and there is obtained 110 volts in each branch. If it were desired to take off four circuits of 55 volts each, for arc lamps or other purposes, the coil would be divided into four equal portions, or any other portion of the primary voltage could be obtained in the secondary by simply including between the two wires of the secondary the proper proportion of the primary coils.

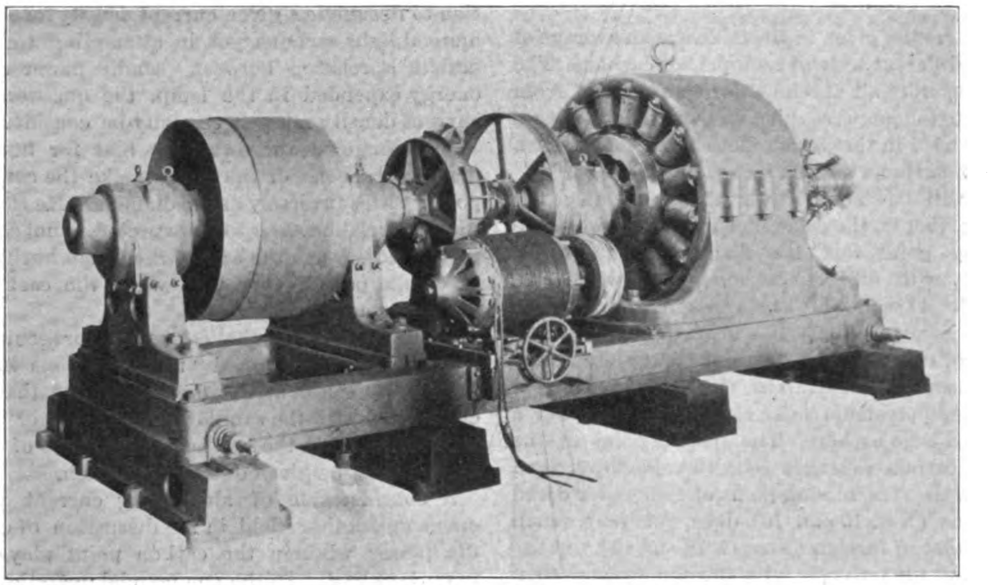


FIG. 15.—250 H. P. SYNCHRONOUS AND STARTING MOTOR.

The advantage of this arrangement over the two-coil transformer for this purpose is its simplicity and the economy both of copper and of attendant copper losses.

TWO-PHASED MOTORS.

The motors' currents are taken off the two circuits as shown in Fig. 11, the connections being made as shown at M. The alternating current motor is in reality a transformer so constructed as to permit of relative motion between the primary and secondary coils. If either one of these be fixed in position, the other becomes the rotating part, and from one point of view it is entirely immaterial which is made the stationary and which the rotating part. Carelessness in the use of language has accustomed us to refer to the rotating member of a motor as the armature, but strict scientific accuracy forbids such indiscriminate use of the term. The Westinghouse Company are therefore to be commended for introducing a more accurate nomenclature, which is bound to find general acceptance as soon as it is better known. At the Westinghouse Works the word "armature" is no longer used when speaking of the two-phased motor, but it is described as the "rotating primary" or rotating secondary" as the impressed E. M. F.'s are led into the rotating or the stationary part. There is nothing in direct current practice to indicate the advisability of introducing resistances into the armature circuit, and they are avoided as far as possible except for starting purposes, when their function is simply prevent too great a rush of current. These resistances are not only wasteful, but actually cut down the starting torque of the motor by the exact amount by which they cut down the current. The starting resistance in a direct current motor is therefore the lesser of two evils, because nothing could be worse for the motor than to have its armature burn out, as it most surely would do if started under heavy load without the resistance. It has been found, however, that in the polyphase motor the starting resistance has performed a valuable service, viz., it *increases* the starting torque of the motor.

For the purpose of illustration the diagram, Fig. 13, is given. These curves are not intended to be correct, but merely to illustrate the point which it is desired to emphasize. If a polyphase motor were started without a resistance in its secondary, the curve determined by torque and speed would be something like the upper one. The torque would be comparatively low at start, but reach a maximum in this case when the speed had reached 400 revolutions per minute.

Now the torque of that particular motor can never exceed this maximum, but the position of the maximum may be made to come anywhere on the vertical line passing through this point desired and will descend as the resistance in the secondary increases. If this resistance be just right, the point will be brought down to the intersection of this vertical line with the line of no speed, or in other words, the motor will have its maximum torque at starting. Under these conditions the curve will take the form shown in the lower of the two curves, which is an actual curve taken from a 40 H. P. 220 volt two-phase motor with old style switch.

The resistance which performed this valuable function of giving the motor its maximum torque at starting in addition to preventing a too great rush of current at that time, will, after speed has been attained, be a detriment, so that means are provided by which it can be then cut out. To facilitate the cutting in and out of the starting resistances the larger sized motors which are likely to be called upon to exert a heavy starting torque are usually made with a stationary secondary—the current from the line being led to the revolving part by means of brushes bearing upon four rings on the shaft. Fig. 3 represents a motor of this kind. In this the brushes are of an improved type, but the switch is one that, although still used, is being superseded by another to be described later. In the old style, Fig. 3, all of the windings of the secondary are in series with each other, and when the switch is open are also in series with the starting resistances. When speed is attained these resistances are simply short-circuited by closing the switch, as shown in the engraving. The new style switch shown in Fig. 4, is considered a great improvement on this and is arranged as follows: At starting each conductor of the secondary is in series with a small resistance and with every other conductor. By means of a closed copper ring and sliding contacts connected with it, by a movement of the controlling switch, not only are the starting resistances thrown out of circuit but all of the conductors of the secondary are thrown from a series arrangement into a parallel one, being short-circuited on this ring. This not only greatly reduces the internal resistance of the secondary windings over that which is possible by the previously described arrangement, where at best they are in series, but leaves each of the short conductors free to act independently irrespective of the disturbing influences which the others might have upon it were they all in series. In Fig. 4 the brushes are of the old style. No photograph has yet been taken of the improved type motor, and it cannot therefore be shown here, but if the brushes shown in Fig. 3 were substituted for those shown in Fig. 4 the latter would then accurately represent the latest development of the Tesla two-phase motor with revolving primary.

For the smaller sizes, where a starting torque is not so essential, the primary coil is made the stationary part and the secondary coil the revolving part. The primary is a continuous winding of the drum type with connections brought out to binding posts from the points 90° apart. The secondary consists of a laminated iron cylinder into whose surface are sunk copper bars of large section, forming elements of the cylindrical surface. These copper bars, which form the windings of the secondary, are simply short-circuited at both ends on heavy copper rings, as is the case in Fig. 4 when the latter has reached speed. There are no collecting rings, brushes or other means of connection between the rotating part and the outside circuit on motors of this type, and although they do not attain a maximum torque until considerable speed is reached, they still have an initial torque sufficient to start under a very considerable load.

While the two-phase motor is the only kind at present in use in these shops, the company also makes several other types, one of which, the three-phase motor, similar to those employed in the Lauffen-Frankfort experiment, is shown in Fig. 14. Another type is the single-phase synchronous motor, such as has been in successful use for about four years in the long mining transmission plant at Telluride, Col. This latter type will not start under load, but when brought up to a speed synchronous with the generator it will then take the load and maintain it without further attention. In this motor the fields are excited by a direct current derived from a second winding parallel with the main coils around the teeth of the armature. This is commutated and led to the field coils.

A motor of the synchronous type requires an auxiliary device for starting, however, which is usually a small motor—a special modification of the Tesla type. Fig. 15 is a photograph of a 250 H. P. synchronous motor, with the Tesla starting motor and friction clutch, installed at Telluride some years ago and still in successful operation.

With this somewhat hasty and necessarily incomplete description of the New Westinghouse Works this paper must be brought to a close. Much that would be of interest has been passed over lightly or omitted entirely, but enough has been said probably to verify the opinion expressed in the beginning, that this is the most interesting, and from many points of view the most important, electrical installation thus far attempted.

ARC CARBONS AND THE RATING OF ARC LAMPS.

BY L. B. MARKS.

At the last Convention of the National Electric Light Association a special committee on the rating of arc lamps submitted a report which was adopted and ordered printed in full in the Standard Rules of the Association. The report reads as follows:

> "Recognizing the difficulty, if not impossibility, of measuring with any degree of accuracy the illuminating power of the arc lamp, and the great necessity for a more precise definition and statement of the obligation of the producer of electricity for illuminating purposes to the consumer thereof; be it
>
> "*Resolved*, That in the opinion of this Convention what is ordinarily known as a 2,000 C. P. arc lamp is one requiring on the average 450 watts for its maintenance, measurements being made at the lamp terminals where no sensible resistance is included in series with the arc; in case such resistance is used it must be excluded in the measurements of the voltage."

This report naturally suggests the inquiry as to how far the candle power produced depends upon the watts consumed. In the present paper attention will be confined to the part played by the arc carbon in this important relation.

It is, of course, well known that the so-called 2,000 C.P. arc really gives a mean candle power of only 300 to 600, the candle power at the angle of maximum illumination seldom being greater than 1,200 and often as low as 700. In an elaborate series of comparative tests made by the writer* several years ago there was found to be a variation of over 80 per cent. in the candle power of commercial arc light carbons consuming the same energy. Quite recently Prof. W. M. Stine† has reported on a number of tests, the results of which show a variation of about 30 per cent.

The difference in the quality of arc carbons is well brought out in the following table, in which values are given for the hissing point and the flaming point of various American and foreign products respectively:

Number.	Structure.	Diameter (inches).	Basic Material.	Process of Manufacture.	Hissing Point (Volts).	Flaming Point (Volts).	Range (Volts).
1.	Solid	½	Petroleum Coke	Molded	43.6	71 3	27.7
2	Solid	½	Petroleum Coke	Molded	48.2	79.0	30.8
3	Solid	7/16	Petroleum Coke	Molded	45.7	79.7	34.0
4	Solid	[illegible]	Petroleum Coke	Squirted	51.3	62.7	11.4
5	Solid	½	Petroleum Coke	Squirted	47.3	75.0	27.7
6	Solid	½	Lamp Black	Squirted	47.2	70.8	23.6
7	Solid	7/16	Lamp Black	Molded	43.0	67.3	24.3
8	Solid	7/16	Lamp Black	Squirted	43.7	76.8	33.1
9	Solid	7/16	Gas Black	Squirted	46.	70.7	24.7
10	Solid	7/16	Gas Black	Molded	41.3	74.3	33.0
11	Solid	7/16	Not Ascertained	Squirted	41.7	75.3	33.6
12	Solid	7/16	Pure Coke	Molded	53.7	73.7	20.0
13	Solid	7/16	Pure Coke	Molded	52 0	71.5	19.5
14	(+), 1/16 hole (−), solid	½	Petroleum Coke	Squirted	42.8	60.7	17.9
15	(+), cored (−), solid	(+), [illegible] (−), ½	Petroleum Coke	Squirted	35 0	61 7	26.7
16	(+), cored (−), solid	½	Petroleum Coke	Squirted	31.3	58.7	27.4
17	(+), cored (−), solid	(+), ½ (−), 7/16	Not Ascertained	Squirted	31.3	70.7	39 4
18	(+), cored (−), solid	7/16	Not Ascertained	Squirted	32.3	66.3	34.0
19	(+), cored (−), solid	(+), ½ (−), 7/16	Not Ascertained	Squirted	31.7	71.3	39.6

Table showing the hissing and flaming points respectively for mean current, 9.5 amperes. Measurements by Wm. C. Hubbard.

In order to determine these values a pair of carbons was placed in a lamp and burned for twenty to thirty minutes. After the point had been well formed the carbons were gently brought together until the arc hissed. A voltmeter connected to the terminals gave the potential difference. The lamp was then adjusted for a silent arc and the mechanism so arranged that the rod was held rigidly. The carbons were then allowed to burn away until they flamed, the voltmeter being carefully watched meanwhile. Before the flaming point was reached the instrument would invariably fluctuate, due to "jumping" of the arc. At the flaming point there was a marked drop in the potential, as indicated by a voltmeter. Great care was taken to secure perfect alignment of the upper and lower carbons.

The results given in the table are an average of three different tests of each pair of carbons. The carbons were all intended for a current of from eight to ten amperes, nine and one-half amperes being used in the tests. The total length of a pair of carbons was ten inches in each case.

It will be noted from the table that the *range*, that is, the difference in volts between the hissing point and the flaming point, varies greatly with different carbons; thus, while carbon No. 4 (see table) has a range of only 11.4 volts, carbon No. 3 has a range of 34 volts. Both of these carbons are sold by representative American manufacturers, the former being a squirted petroleum coke carbon and the latter a molded coke carbon. The hissing point of the cored carbon averages over 10 volts lower than the solid. The hissing point of American cored carbons (Nos. 15 and 16) does not vary much from that of foreign (Nos. 17, 18 and 19), but the range of the latter is fully 10 volts greater than that of the former, and exceeds that of any of the American products tested, cored or solid. In the case of some makes of cored carbons not recorded here it was impossible to measure the hissing point with any degree of accuracy, because of the deposition on the negative of small portions of the core thrown out by the positive at low potential differences. Carbons Nos. 11, 17, 18 and 19 in table are of foreign manufacture, all the others being home products.

The amount and nature of foreign matter in a carbon have much to do with the commercial efficiency of the latter and determine to a large extent the range of the carbon.

It has been the desire of central station men to obtain, and the aim of the manufacturer to produce, an absolutely pure petroleum coke carbon, thinking that this would, in a large measure, solve the candle power question so far as uniformity is concerned. The writer is of the opinion, however, than an absolutely pure coke carbon, if such could be commercially manufactured for arc lamps, would not meet the requirements of central station practice to-day. Carbons 12 and 13 (see table) are taken from two batches made with special reference to purity. It will be noticed that one of them hissed at 53.7 and the other at 52.

To be operated at maximum efficiency these carbons would require more than 55 volts at normal current and under no conditions in practice would they give satisfactory service at less than 55 volts average—fully five volts higher than that of good commercial carbons. In connection with the potential difference required for maximum candle power in a given case, it is interesting to refer to a test reported by Prof. H. S. Carhart, in which a pair of commercial carbons designed for use on full arc circuits showed a maximum efficiency at about 55 volts. These carbons at 10 amperes and 45 volts gave 450 candle power.

Thus, it is of the utmost importance to the carbon manufacturer to test not only the range of his carbons, but also the voltage at which they give maximum efficiency. The importance of steadiness in arc lamps has been very well shown by the introduction of cored carbons. Here, again, we are confronted with the question of candle power in relation to the consumption of energy. If we assume that a 450 watt arc gives nominally 500 candle power with efficient solid carbon sticks, we must make an allowance of at least from 15 to 20 per cent. for reduction in candle power for the same energy substituting an efficient cored carbon stick. Yet, for indoor illumination the consumer is better satisfied with the cored carbon than with the solid.

Reference has already been made to current density. It would be entirely out of the question to designate a given current density for commercial light carbons, yet, in attempting to formulate a relation between candle power and energy expended in the lamp, the question of current density must necessarily be considered.

Schreihage* deduced the law that for homogeneous carbons of the same make the candle power varies inversely as the diameter. He states that this relation, as is to be expected, is not completely satisfied in the case of the mean horizontal candle power, especially when the carbons are very small or very large.

When we consider that as a means for securing long life, flat carbons and "twin" carbons have been more or less used, we are reminded that in connection with the available candle power per watt expended in the arc lamp the shape of the carbon must be given due consideration.

A consideration of alternating current arcs opens up another field in the discussion of candle power wherein the carbon point plays an important part. In the commercial operation of alternating current arcs, cored carbons are almost exclusively used. The constituency of the core has much to do with the efficiency of this type.

The comparison of the candle power of a commercial alternating current arc with that of a direct current arc consuming the same energy, as measured at the carbon points, shows that the former gives less illumination than the latter. So important is the relation of the carbon point to efficiency of the alternating current arc that the substitution of a solid carbon for a cored carbon in this form may reduce the candle power and decrease the efficiency to such an extent as to make the lamp unmarketable.

Thus far we have discussed arcs which burn with free access of oxygen. In the case of inclosed arcs, or those which are operated in small bulbs, to which the air has very limited access, the conditions that govern the relation of watts to candle power for the open air arc are more or less modified. With inclosed arcs, purity of the carbon is very important, and in some applications of these arcs the objections which stand in the way of commercial utilization of pure carbon electrodes in open-air arcs do not apply.

The importance of details in the manufacture of carbons cannot be overestimated in the consideration of this subject. With the carbon maker rests the task of supplying a uniform and efficient product; but even with the best carbon product, it would seem advisable to discard the term "2,000 candle power," or "1,200 candle power," as applied to arc lamps.

Measurement of the wattage, provided for in the resolution of the Committee on the Rating of Arc Lamps, appears to be the true solution of the problem. The central station manager will undoubtedly find it to his interest to furnish good carbons, and if he demands them the carbon manufacturer will supply them. To quote Capt. William Brophy: "The sooner you sell your light as power, the sooner this trouble will end; and I advise every man in the future to sell his lamp at 450 watts, or whatever is necessary, and bury out of sight the term '2,000 candle power.'"

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* L. B. Marks: "Life and Efficiency of Arc Light Carbons." Trans. Amer. Elec. Engineers, Vol. VII, Nos. 6 and 7, 1890.

† W. M. Stine: "Influence of Arc Light Carbons on the Candle Power." "N. Y. Elec. Engineer," Oct. 3, 1894. See also "Elec. World," Feb. 23, 1895.

* M. Schreihage: Centralblatt fur Elektrotechnik No. 22, 1888.

Notes on Recent Electrical Engineering Developments in France and England*—III.

Discussion.—(*Concluded*).

As to the plant in Brighton and the question of how they do the switching, I will say that in that instance the different sections I referred to are somewhat like the spokes of a wheel, and there are only about four or five such switching points and they do, in that instance, thus far control them by hand. That is, the operator goes and throws the switch and then goes to another point. But methods have been devised by which they can be handled from the central station automatically, and if there were any sufficient reason for it at Brighton it would have been done there, as they were fully aware of the method and its feasibility.

As to the underground system at Newcastle, the conductors are not lead covered, as I remember the matter, but are covered, I think, with jute or some similar material, and the air is chemically dried by being passed, I think, over chloride of lime.

As to why the cost of small dynamos and motors is higher in European practice than here I do not know, but I am inclined to think that one of the reasons is that in this country the present popular method is for the manufacturers to bid on the machine delivered f. o. b. without any further work done in connection with it, and consequently there is very little chance for argument one over another if the machines are very good and the competition is very keen, whereas the method abroad is for the man who builds it to install it. In other words, the men who are manufacturers are generally electrical engineers, and they build and wish to install their own machines, and consequently do not care to bid so low on the dynamo alone.

One of the speakers mentioned that there was no reason why there should be any more difficulty in the ordinary locomotive in taking care of the steam and using it economically in the cylinder and delivering it rapidly and exhausting it properly than there would be with the Heilmann locomotive. But I call attention to the fact, that while it is theoretically conceivable that we should have a type of valves independently controlling the admission and exhaust in the ordinary locomotive such as we have on stationary engines, we do not have them. It has been tried and retried and they have stuck to the simpler type of Stephenson link and slide valve, because the additional economies obtained by the use of the higher class of valve motion did not compensate for the additional complications introduced, which, however, does not apply at all to a steam engine placed above on a platform in which the most refined mechanism can be used to the best advantage.

I would like to call attention to one thing that I do not think I mentioned in the paper, and that is that by actual test by the engineer of the Chemin de Fer de L'Oest, who conducted the test of the Heilmann locomotive, they did operate the Heilmann locomotive over exactly the same distance, the same roadbed, running on the same time, hauling the same weight, the conditions being identical in every particular, and the amount of coal used by the Heilmann was 24 per cent. less than the amount used by their best compound locomotive.

A point which was made by one of the speakers was that there was no reason why if we used 16 wheels we should not be able to do just as well as the Heilmann does with its 16 wheels. It seems to me that it would be difficult to conceive a steam locomotive with 16 driving wheels. It would meet with difficulties upon the curves and the rigidity of the steam locomotive is certainly going to be troublesome if we come to make a machine 50 feet long all upon the drivers, and I wish to emphasize the point that every pound of the weight of the Heilmann locomotive is resting on springs, and there is no such rigidity of the wheel base. There is the four-axle bogie at one end which has a flexible arrangement connecting it to the platform above, and a similar bogie at the other end, and there is no such difficulty as regards rigidity of construction as it seems to me would be met with in the steam locomotive under the same conditions. And, furthermore, it impressed me that there is not an exact parallel, for the reason that a part of the 16 wheels counted as belonging to the steam locomotive by the speaker are on the tender and they are not at all effective for traction.

As regards the question of wear, and the statement that one-third of the cost of maintenance, roadbed and locomotive is represented by the destructive effects of the hammer blow and side thrust, I certainly would not dare to make any such figures as that for myself. I got that figure from a discussion which was held recently before the Civil Engineers' Society, and the figure was one which seemed to be agreed upon by more than one speaker. The speaker who named that figure, I think, was Mr. Strong. At any rate it was one whose name was familiar to me as that of a man who had a very wide experience and is a pretty good judge of such matters and whose statement ought to be rather authoritative.

Another point I wish to bring out is this: they made measurements of deflection in crossing bridges in the case of the Heilmann locomotive and in the case of the compound reciprocating steam locomotive, and the deflection measurement showed the deflection in the case of the steam locomotive was 80 per cent. more for the same weight than in the case of the Heilmann, which of course is attributable to this hammer blow effect, and which one of the speakers has pointed out has been found, in the case of a little error in the counterbalancing, to be sufficient to entirely lift the weight of the locomotive from the rails at times, as evidenced by tests at Purdue.

I agree with one of the speakers who said that he thought that our progress was not in spite of but by reason of the big corporations, because I think that such progress in the engineering line as we have been lately making has necessarily been made by these corporations, because they have blocked other people who were trying to go ahead.

The same speaker mentioned the misfortune of losing the flexibility which we had all been attributing to the electric locomotive as compared to others, and that in the Heilmann that flexibility seemed to be lost. It seems to me it would be difficult to find a finer example of the flexibility of electrical transmission of power than is illustrated in the Heilmann locomotive. We can have an engine running at constant speed in one direction, and from that we can get any possible reduction or any torque we desire, and any speed in either direction, and the flexibility is as perfect as is conceivable to my mind. In fact, it seems as though the electric energy were used there as a flexible connecting rod acting through an infinite number of gears, and acting between the source of power and the work that was to be done.

Another point which has occurred to me is that, conceiving that we could put bigger boilers upon our locomotives, bigger drivers and cylinders, until we finally could secure the horsepower necessary to handle the high speed or large loads, one difficulty which I have recently noted about an engine of that kind is that it cannot start. It may run at full speed when it is in motion all right, but even with the drivers we have to-day and with the boilers, etc., it is impossible for the Empire State express to start itself at Albany, and it is necessary that a freight locomotive, a slow speed locomotive with eight or ten drivers should come along at the other end of the train and push it before it can start. No such difficulty as that pertains to the Heilmann locomotive or any similar locomotive, because there is an unlimited torque for starting. and I point out that the two limitations in present practice for locomotives are, it seems to me, that we want to go faster; that is one point, and as to that, we have every advantage in connection with the electric locomotive; and the other point is, we want to pull more freight cars up a grade, and we can do that better with an electric locomotive than to my mind we can ever hope to do with a steam locomotive.

Mr. Lloyd [*communicated after adjournment*]—Referring to Mr. Leonard's reply to the foregoing criticisms (to which I had no opportunity of replying at the time), I can only say that if Mr. Leonard denies that a first-class generating plant costs $100 per horse-power he is mistaken. The remainder of his reply is simply facetious, and not logical or consistent. The experience of engineers in this country with batteries ten years ago has no bearing on the results obtained to-day. Apropos of this, if my information is correct, the express object of Mr. Leonard's visit to Europe was to investigate steam turbines, of which he speaks so glowingly, with the idea of adopting them for driving the generators used in the welding of street rails. Immediately on Mr. Leonard's return he contracted for the use of three complete battery installations to do this work instead of the steam turbines.

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*H. Ward Leonard's paper read at a meeting of the A. I. E. E., February 27.

To Correct Patent Abuses.

New Rules Go Into Effect.

New Patent-Office rules went into effect on April 15, preventing an applicant for a patent from holding it in abeyance and shutting out other patents by appealing repeatedly and making slight changes in his specifications. In the Berliner case, recently declared illegal, the patent was in the office fifteen years, and was granted to the inventor for seventeen years more.

The new rules require applications and appeals to be made within six months, and direct the rejection of any claims that have been pending for five years.

There can be no criticism of the above regulations from bona fide inventors with honest intentions as to the use of their patent privileges.

As often stated in Electricity, the American patent system is the best system in the world. Its fundamental plan, however, presupposed its use by men of at least ordinary honesty, and too little protection was afforded against the sharks, the speculators and the schemers, whose consciences have not deterred them from taking dishonorable advantage of provisions which were made in a spirit of justice and beneficence.

BOOK REVIEW.

A Text Book on Electro-Magnetism and the Construction of Dynamos. Vol. I. By Dugald C. Jackson, B. S., C. E. 8vo, cloth. Pp. 289. New York and London: Macmillan & Co.

This little book, as its title implies, is intended for a text book on the subject treated, which, as stated in the preface, is limited to the fundamental principles and their application to direct current machinery of the constant potential class.

Prof. Jackson's treatment of his subject is clear and concise, as it should be, and his methods are direct. It involves the use of the calculus, however, which has its advantages and its disadvantages. For students who have progressed that far in mathematics the methods of the calculus are by far the best, but for those who do not use these methods readily they become at once obstacles which they do not attempt to surmount. A still further limitation to the usefulness of the book is imposed by the author's apparent assumption that the student has the facilities of a well equipped laboratory at hand as well as the assistance of a teacher as able and competent as himself. Unfortunately it is unfair to assume either of these conditions, but granting them, the book will doubtless fulfil its mission in an admirable manner.

The first chapter of twenty pages is devoted to "Primary Definitions and Evaluations." So far as we have observed, the author has taken the utmost pains here to be both clear and correct. Chapter II, of fifteen pages, discusses simple electro-magnets. So far as the author goes into the subject this is good, but he leaves too much for the instructor to fill in. Much of what might have been expected in Chapter II is found in Chapter III under the title "The Magnetic Properties of Iron," but the want is not sufficiently supplied here to affect our criticism. The remainder of the book is devoted to a somewhat mathematical treatment of the elements of dynamo electric machinery, including—IV, The Establishment of Electric Pressures; V, The Magnetic Circuit of the Dynamo; VI, Compensation for Cross-turns and the Effect of Brush Contact; VII, Characteristic Curves and Regulation; VIII, Efficiencies, and IX, Multipolar Dynamos.

The book is well printed in fair type on heavy tinted paper, and the illustrations, which are outline drawings and diagrams, are good.

The Crocker Lectures.

"The Electric Motor and Its Application to the Transmission of Power," was the subject of the fourth in the series of lectures Prof. Francis B. Crocker is delivering on Thursday evenings at Columbia College. Considerable attention was given to the history and development of the motor from the time of Barlow's wheel until the present day. The convertibility of the dynamo into a motor and the converse operation of transforming a motor into a dynamo was shown by a series of interesting experiments. In enumerating the manifold applications of the electric motor and the decided and many advantages of utilizing and applying power, Prof. Crocker said that the tendency is to use electric motors for all power purposes. He could not admit that the alternating current motor, as recently developed, would supplant the direct current motor, except in so far as applies to long-distance transmission.

Highly interesting experiments were made showing very plainly the relation of counter to direct electromotive force in the regulation of motors; others showing how the work done by a motor can be measured.

The next lecture in this course will be on "The Electric Railway," and will be delivered by Prof. George F. Lieber of Columbia College.

LEGAL NOTES.

At Cleveland, O., recently the Akron, Bedford and Cleveland Electric Railway Company began suit to appropriate a right of way along the New Bedford road in Newburg hamlet, and the hamlet trustees resisted the application. The company claimed the same right to take the necessary land that a steam railroad enjoys and leave the damages to be assessed by a jury. The trustees claimed that the line was a street railroad and that the company must gain their consent before opening the line. Judge White found no difference between a railroad operated by electricity and one operated by steam, and decided that the appropriation proceedings are proper.

An order has been signed by Judge Wickes, at Baltimore, Md., directing the receivers for the Ries Electric Specialty Company to call upon the stockholders of the company for the unpaid instalments of the capital stock issued to them. These payments are necessary in order to pay the indebtedness of the company.

Personal.

Messrs. C. S. Knight and J. J. Woods, of the Ft. Wayne Electric Corporation, were New York visitors last week.

Mr. C. H. McIntyre, of Newark, N. J., has returned from a Southern pleasure trip.

William H. McKinlock, president of the Metropolitan Electric Company, Chicago, was called East last Monday morning on business. He was accompanied by his family. Mrs. McKinlock, son and daughter left New York Wednesday, April 10, on steamship La Touraine for Paris, to be absent one year.

A Large Portable Plant.

At Ambrose Park on Wednesday a successful test was made of two portable electric arc lighting plants made for Buffalo Bill's Wild West Show by Ridsdale & Lewis, of 39 Cortlandt street, New York. Each equipment consists of a Case engine coupled direct to a Ball 30-light arc machine. Steam is supplied from a Clapp boiler, the whole plant being compactly built on a heavy wagon truck. The entire plant of 60 lamps can be erected and put in operation in about two hours.

The contract for building the big power house at Birmingham, Ala., has been awarded to Thomas Purvis. The plans were drawn by Stone & Webster, of Boston.

General News.

What is Going on in the Electrical World.

Taylor, Tex.—The Taylor electric plant has been purchased by B. Gary for $10,975.

Canfield, O.—The people here have voted in favor of bonding the town for an electric street railway.

Elgin, Ill.—Right of way for an underground trolley road has been secured between Elgin and Geneva.

Bismarck, N. D.—The city council has repealed the electric light ordinance granting a franchise to Edmond A. Hughes.

Grantsburg, Wis.—St. Paul parties have purchased land and water power here and will erect an electric light and water plant the coming season.

Sandford, Fla.—J. M. Saunders has been granted a franchise to construct and maintain a plant for electric lighting and for a street railway in this place.

Helena, Mont.—A school house, planing mill and a waterworks and electric system are to be built at the Crow Agency this summer at an expense of $40,000.

Milwaukee, Wis.—The city engineer is preparing plans and estimates for a municipal lighting plant for this city. The Badger Illuminating Company's contract expires next fall.

Mauch Chunk, Pa.—The new power station of the Mauch Chunk Electric Light, Power and Heat Company has just been completed at a cost of $25,000. It is operated by water power.

Rome, N. Y.—The Rome City Street Railway Company has received permission from the city council to change the motive power of its road from horses to electricity or other power except steam.

Morristown, Tenn.—The commissioners have under consideration a plan to utilize the water power attainable here for the production of electricity for lighting the town and for other purposes.

Auburn, N. Y.—F. W. Dana, H. W. True and N. Q. Pope are the prime movers in a company formed to build an electric railway from East Auburn to Turner. The capital stock of the company is $50,000.

Appleton, Wis.—The city council has declared the Tillotson interurban electric franchise void. This action will prove a severe blow to the plans of the interurban line from Oshkosh to Kaukauna, as Appleton is the main point on the proposed route.

Pensacola, Fla.—B. R. Pitt, president, and J. S. Leonard, secretary and treasurer, of the Pensacola Electric Light and Power Company, having resigned, their places have been filled by Benjamin F. Peach, Jr., and W. S. Garfield, both of Boston.

Lynchburg, Va.—The city council has finally determined the much-agitated question of lighting the city by awarding the contract to the Lynchburg and Rivermont Electric Company, thus defeating the proposition for the establishment of a city plant.

Ottawa, Ill.—The Ottawa Electric Street Railway Company, controlled by the General Electric Company, has stopped running its cars. President Evans says if the Ottawa business men do not purchase the road at once he will pull up the tracks and take it elsewhere.

Bristol, Conn.—The Bristol Electric Light Company and the Bristol and Plainville Tramway Company are to be consolidated. The light company has a well equipped plant and will have to add but little to its present equipment to furnish motive power for the tramway.

El Dorado Springs, Mo.—A franchise has been granted to W. B. Lewis by the board of aldermen to erect an electric light plant in this city, the franchise lasting 21 years. The ordinance granting the franchise provides that the plant shall be in operation within two years.

Pottsville, Pa.—There is a project on foot to extend the Schuylkill Electric Railroad Company's road from West Woods Junction down through the Germantown Valley, touching at Cressona and other towns on the route. The company hold franchises for the right of way through North Manheim township and will in all probability build a road through that section.

Harrisburg, Pa.—The Senate has passed the bill extending to cities of the first, second and third classes the act authorizing boroughs to manufacture electricity for municipal purposes. The bill authorizing street railways to carry freight passed third reading in the House.

Denison, Tex.—The Electric Street Railroad Company, organized in this city, have applied for a charter. The capital stock is $50,000. Directors: C. D. Witherspoon, Denton; P. H. Tobin, E. H. Lingo, T. E. Horan, A. F. Platter, George McLeggan, Tim Murphy, Denison.

St. Louis, Mo.—A franchise has been granted to the King's Highway Railroad Company, giving them the right to construct, maintain and operate a double track passenger street railway with electricity as a motive power. The road will be a suburban line connecting with an established line in this city.

Philadelphia.—All trolley cars in this city must be equipped with fenders by June 25, and there is consequently much looking about for fenders that will fend at a cost not too exhaustive of dividends. The penalty for non-compliance within the specified time is $10 a day for each car run without a fender, and after thirty days $40 a day for each car.

Los Angeles, Cal.—The Los Angeles and Santa Monica Electric Railway Company has been incorporated to build a railway between the places named in the title. The road will have a branch fifteen miles long to Pasadena and another five miles long to Cold Water Canyon, leaving the main line about ten miles west of Los Angeles.

Annapolis, Md.—President W. S. Musgrove of the Bay Ridge Improvement Company is meeting with encouragement in his efforts to provide an electric railway for public use in this city. The proposed line would connect the two railroad depots, the State House and the United States Government grounds, which are the principal points of interest in the old capital.

Neenah, Wis.—O. L. Huie, acting for the Central Wisconsin Electric Railway Company, has served notice on the supervisors of the towns of Oshkosh, Vinland, Neenah, Menasha, Grand Chute and Harrison to the effect that the franchises heretofore granted to J. K. Tollotson have been assigned by him to the above-named company, who will carry out the same as soon as practicable.

Belleville, Mich.—The town board has granted a franchise to an electric railroad company for a route through the township of Van Buren. The proposed road is to run from Ann Arbor to Detroit, via Ypsilanti, Wayne, and Dearborn, on the gravel road. Eastern capitalists are backing the enterprise. The company promises cheaper rates from Ann Arbor to Detroit than the Michigan Central Railroad now offers.

Pittsburg, Pa.—The Duquesne Traction Company proposes to extend its electric line to Verona, Oakmont and Hulton, and the Citizens' Traction Company has a similar project in view.—The new electric air line to Carnegie will be commenced this summer as soon as the plans for the bridge across the Monongahela River have been approved by the Secretary of War. The road will be exactly five miles long.

Louisville, Ky.—The Citizens' General Electric Company has issued a circular announcing an advance in its rates for incandescent lights after the 1st of May. The price after that date will be 20 cents per 1,000 watts, with a discount of 30 per cent. if paid before the 10th the month. The present rate is 10 cents per 1,000. The Louisville Electric Light Company has also increased its rates.

Hornellsville, N. Y.—There is considerable talk of an electric railroad from Hornellsville through Howard, Bath and Urbana, along the west side of Lake Keuka to Penn Yan. It is said a company has been formed with a large capital with this end in view. If the scheme materializes it is thought an electric plant will be located at Bath which will furnish power for the road and also for lighting the village.

Hartford, Conn.—The *Post* states that Chas. Barrows, of this city, has sold a two-thirds interest in the storage battery electric street car which he recently patented to Massachusetts parties, and a trial car is being built which will be tested on the Brockton, Mass., street railroad. If the result is successful a strong company will be formed to manufacture the cars. The chief feature is the trucks—which have a novel system of traction.

Waco, Tex.—The electric railway and the light plant of the Waco Electric Railway and Light Company, are to be sold May 7 by order of Judge Goodrich. The company is in the hands of a receiver and the sale is ordered for the purpose of winding up its affairs. The Waco Gas and Citizens' Street Railway companies have secured control of $164,000 of the $200,000 bonds of the insolvent company, and in all probability will get the property.

Catonsville, Md.—The stockholders of the Edmondson Avenue, Catonsville and Ellicott City Electric Railway Company, whose line is one of the links in the proposed electric railway between Baltimore and Washington, have elected the following directors: George Yakel, Robert Biggs, Louis Yakel, Dr. H. J. Berkley, John Hubner, B. N. Baker and David M. Newbold. The officers are: President, George Yakel; treasurer, Louis Yakel; secretary, William L. Layfield.

Wilmington, Del.—The Electric Construction and Supply Company of this city, who were the successful bidders for furnishing the Government with the electrical material for the electric plant for Fort Delaware, have received official notice to go ahead with the work and have entered into bond with the United States for the completion of same. Work on the plant will begin April 20, and will include a complete electric power, light and trolley system.

Birmingham, Ala.—The indications are that Birmingham will soon have the largest electric power-house in the South. It is understood that plans are already prepared for a building 150 feet square, completely equipped in every particular and prepared to furnish power for industries large and small throughout the entire Jones Valley. It is also understood that one of the leading railroad companies of this city will convert their extensive line of steam roads into electric roads.

Austin, Tex.—It has been decided to have an International Regatta and Electrical Exposition in this city in June, and to have the National Travelers' Protective Association members attend in a body. Gaudaur, Stansberry, Peterson, Hanlan and other oarsmen have agreed to enter for the regatta. The Electrical Exposition will be free to every manufacturer who desires to exhibit his machinery. The motive power will be furnished free. The exposition is to celebrate the completion of Austin's dam and water and electric light plant at a cost of $1,250,000.

Stroudsburg, Pa.—The Middletown and Goshen Traction Company has purchased the property, rights and franchises of the Delaware Valley Electric Railway Company which proposed to build an electric railroad to Port Jervis, N. Y., from East Stroudsburg. The officers of the Middletown and Goshen Company are: James C. Hinchcliffe, of Paterson, president; M. J. Wightman, vice-president and electrical engineer; W. B. Rockwell, treasurer, and E. G. Wightman, secretary.

Jersey City, N. J.—It is said that Abram S. Hewitt, who is the owner of the Greenwood Lake Railroad (steam), has been studying a project of operating that road entirely by electricity with the main source of power to be derived from the outflow of Greenwood Lake, which supplies the Morris Canal with a constant flow of water. Upon the stream in the Cooper and Hewitt tract at several points there is a good fall and it is believed that a constant power, sufficient to operate the road from the lake to Jersey City, can easily be obtained.

Boston.—A trolley postal service is being arranged here which, it is thought, will be the most complete system yet established in this country. There will be six distinct routes leading to the suburbs wherever the trolley lines extend, and the plan is to have the cars collect mail at the stations, sort it on the way in and have it ready for immediate delivery on arrival at the central office. The same course will be pursued, as far as possible, in taking mail from the central office and sorting it for street delivery on the cars.

Spokane, Wash.—Several months ago L. S. Roberts obtained a general electric franchise from the city, to run fifty years, agreeing to pay an increasing royalty upon it each year. One payment of $500 was made, but the second $500 payment lapsed and last week an ordinance to repeal the franchise was introduced in the council. It was referred to the committee on judiciary and legislation, who have reported recommending not only that the franchise be not revoked but that suit be brought against Mr. Roberts to recover the second payment of $500.

Hempstead, L. I.—A project that is interesting this part of Long Island is the proposed electric road connecting the villages of Roslyn, Port Washington and Thomaston or Great Neck, forming a triangular system about fifteen miles long. Among the interested parties are Jesse H. Bunnell, senior partner in the electrical supply firm of J. H. Bunnell & Co., of New York; Thomas Mott, of Sands Point, president of the Queens County Agricultural Society; Thomas Fay, of the Standard Oil Company, and J. H. King, of the Union Mortar Works, which recently erected immense factories on the west shore of Hempstead harbor.

Atlanta, Ga.—The Georgia Electric Company, of which H. M. Atkinson is president, has been awarded the contract for the city's lights for the next five years. Under the new contract the price of arc lights is reduced from $100 to $85 per year, and of incandescent lights from $40 to $35 per year, making a saving to the city of $9,000 per year, or of $45,000 for the five years for which the contract is binding. It is further agreed that the Georgia Electric Company shall reduce the price of commercial lighting 25 per cent, and as the sum of $50,000 is now paid every year for electric lighting for residences and business purposes, there will be a saving of $12,500 a year to the consumers.

Chicago.—The Chicago Electric Company's power house, from which power is furnished to the North Side trolley lines, is about completed. The building is 124 x 245 feet, and is equipped with fine machinery. The engine room contains four Fraser & Chalmers cross compound Corliss engines, horizontal and condensing, and rated at 1,000 horse power maximum capacity. Siemens & Halske generators are coupled directly to the engine shafts, one for each engine. They are of the street railroad type, compound wound for 525 volts. The eight field magnets are inside of the armature. The armature is of the Gramme type, made of copper bars. The switchboard is in two tiers. The upper board, in a gallery 160 feet long, contains forty feeder panels, each one carrying an automatic circuit-breaker and a switch. The lower board, on a level with the floor of the engine-room, is used for handling and the regulation of the dynamos. The entire switchboard is built of enameled slate, supported by an iron frame. The instruments are chiefly of Weston make.—The Baird Electric Conduit Company, recently incorporated, claim to have secured the consents of 75 per cent. of the property holders along Indiana avenue for a street railway constructed on their conduit system, which the inventor claims is "thoroughly insulated and so compact and simple that no part can get out of order. The return being insulated the same as the lead, the corrosion of water, gas piping, etc., is entirely prevented. Water, dirt, alkalies will not affect the system and there is no open slot for young America to monkey with."

Newark, N. J.—The following is given as the estimated cost of the entire system of the New York and Philadelphia Traction Company, by division, the calculations being based on actual experience in electrical railroad building: Paterson City and Passaic, 32 miles, cost $1,500,000; Paterson to South Orange, including City of Orange and Bloomfield, 30 m., $600.000; South Orange to Westfield, 11 m., $275,000; Westfield, Rahway, Elizabeth to Springfield, 10 m., $300,000; Elizabeth to Bound Brook, including City of Plainfield, 25 m., $650,000; Raritan to New Brunswick, including New Brunswick, 19 m., $600,000; Bound Brook to Kingston, 16 m., $400,000; Kingston to Trenton, 14 m., $350,000; City of Trenton, 32 m., $1,200,000; Trenton to Burlington, 16 m., $400,000; Burlington to Camden, 18 m., $450,000; City of Camden, 32 m., $1,200,000; Trenton to Frankford, 20 m., $500,000; Plainfield to Metuchen and New Brunswick, 10 m., $250,000; New Brunswick to South Amboy, 16 m., $400.000. Total, 301 miles at a cost of $9,575,000. The road is calculated to connect practically with every steam road in the State and with almost every electric road between the Hudson River and Cape May. It forms a connection between the Metropolitan Traction Company of New York, the Consolidated Traction Company of Newark and Jersey City, and the Philadelphia Traction Company of Philadelphia, all three of which are practically controlled by the same interests and represented by John D. Crimmins, of New York, B. M. Shanley, of Newark, and Messrs. Widener and Elkins, of Philadelphia.

Telephone and Telegraph.

The mayor of Chattanooga, on reading the report of the telephone committee giving the new rates of the East Tennessee Telephone Company, recommended that the city council suspend action on granting a franchise to the People's Telephone Company. The ordinance granting this franchise had passed to its second reading.

The Postal Telegraph Company has asked the council of Quincy, Ill., for the right to construct and maintain telegraph lines in the streets of that city, connecting with a central office.

A resolution is now before the Connecticut Legislature for the incorporation of a company to be known as the People's Telephone Company. The capital stock is not to exceed $500,000. Ex-Gov. T. M. Waller, J. E. Bowles, J. Irving and J. J. Lawton are named as incorporators.

At New Castle, Ind., R. H. Cokefair has a force of men at work constructing a telephone system. The Harrison instrument will be used, at $2 a month for business houses and $1 for residences. The Central Union people have given notice that they will erect a plant.

A telephone line between Marshfield place and Hewitt, in which is used one of the wires of a barbed wire fence extending along the Wisconsin Railroad tracks, has been such a practical success, says the Fond du Lac *Reporter*, that it will be extended to Auburndale.

Articles of incorporation have been filed at Minneapolis by the Standard Telephone and Electric Company which intends to manufacture telephones and electrical apparatus. The capital stock is $50,000. Incorporators: Samuel S. Kilvington, H. C. Dodge, George Batchelder and George L. Scott.

The Universal Telephone Company of Indianapolis, just incorporated, was formed for the purpose of manufacturing a transmitter which it is claimed is superior to the one used by the Bell Telephone Company. Robert Martindale, one of the directors of the new company, secured a patent for the transmitter some years ago, but as it was claimed it was an infringement no attempt was made to put it on the market until the Bell patent expired.

A representative of the American Construction Telephone Company of Anderson, Ind., is making efforts to get up a local telephone stock company in Memphis, Tenn., and introduce there the Hunting transmitter which he says is popular in Europe and manufactured at Kokomo, Ind.

The grain men in Decatur, Ill., and vicinity have decided to erect a telephone line of their own. Each of the dealers has stock in the company, which is capitalized at $5,000. On the circuit will be several towns that have no telephones now.

The city council of Anderson, Ind., without a dissenting vote, passed the ordinance giving the Harrison Telephone Company a franchise in that city. The Bell Company there has reduced its rates to $40 and $30. The Harrison rate will be $30 and $18.

The Make or Break Telephone Company has filed articles of incorporation at Trenton, N. J. The paid in capital is $25,000. The object of the company is to sell, lease and repair telephones and construct telephone lines. Incorporators: John W. Hamer, of Beverly, N. J.; John P. Logan and Aubrey H. Gillingham, of Philadelphia.

In Davenport, Iowa, a citizens' committee proposes to organize a local company and negotiate with the Harrison Company for the establishment of a telephone plant.

Three companies are asking for telephone franchises at Ishpeming, Mich., each of them desiring to furnish service to a group of cities in the northern part of the Michigan peninsula.

Papers are being circulated in Marshalltown, Iowa., for a new telephone service.

At Madison, Ind., J. W. Scott, Allison Scott, Edward Marks, Isaac Taylor and others have applied to council for the right to establish a telephone exchange, their rates being put at $2 a month for business and $1.50 for residences.

L. C. Boyle and others, of Viroqua, Wis., have decided to open a telephone exchange there as soon as they have settled upon the most desirable system.

The Western Union Telegraph Company has

just completed a new wire from Butte to Logan, Mont., over the Bozeman branch to meet the demand of the increasing business at points on that road.

The Standard Telephone Company has completed its New Orleans organization, which will be under the management of Capt. Harry Allen, whose district will include Louisiana, Mississippi, Alabama, Georgia and Florida.

The Central Standard Telephone Company pledges itself through its secretary and manager, Griffith Coit, to give St. Louis an excellent telephone service at a charge of $3 per month to business houses and $2 per month to private families.

The Orange County Telephone Company is the name of a company recently organized in Middletown, N. Y. A telephone system will be put in operation which will include not only that city, but Goshen, Warwick, Montgomery, Walden, Newburg, Bloomingburg, Ellenville, Port Jervis, Monticello, Unionville and all the neighboring villages.

The directors of the new Citizens' Co-operative Telephone Association of Shreveport, La., have elected the following officers: W. F. Taylor, president; S. B. Johnson, vice-president; L. M. Carter, treasurer; J. W. Taber, secretary and general manager. Executive Committee: Levi Cooper, C. S. Steere, S. B. Johnson, Ben Holzman and H. F. Doll.

A company has been formed at Keithsburg to construct a telephone line connecting all the important towns in Mercer County, Ill.

Articles of incorporation have been filed by the Standard Telephone and Electric Company of Minneapolis with a capital stock of $50,000. S. S. Kilvington, E. W. Batchelder, H. C. Dodge and G. L. Scott are the incorporators.

A number of the citizens of Brazil, Ind.. have in contemplation the formation of a home corporation to put in a telephone plant that will give the people a service at $1 per month.

The representatives of the Phœnix Telephone Company have made a proposition to the Board of Works of Indianapolis to furnish telephones to business houses for $3 a month and to private residences for $2. if granted a franchise. They would furnish the city telephones for $18 a year, and put in separate lines for police and fire department use.

A dispatch to the Kansas City *Times* from Guthrie, Ok., states that a company has been organized in Guthrie to build a telephone circuit connecting all the towns in seven counties in that section.

At Tampa, Fla., the Citizens' Telephone Company has been organized with the following officers: S. J. Drawdy, president; A. C. Clewis, vice-president; John Trice, treasurer; C. H. Keller, secretary and manager. S. J. Drawdy, A. C. Clewis, C. W. Stevens, John Trice, Frank Bentley, F. C. Bowyer and Hon. Peter O. Knight, directors. The company is capitalized at $12,000; it expects to have its line in operation in ninety days.

It is reported at Deadwood, S. D., that the Postal Telegraph Company will soon extend its lines into the Black Hills towns. Ever since the Black Hills were well settled, the Western Union has had a monopoly of the telegraph business there.

The New Orleans *States* says that the telephone company which has been doing business in that city for several years at its own rates is soon to have a number of competitors. Applications for franchises by companies offering much lower rates are just now adding special interest to the council's proceedings.

Articles of incorporation have been filed with the Secretary of State at St. Paul, Minn., by the White Bear Telephone Company. The capital stock is $10,000; the incorporators are John L. Pratt, of Chicago, and James L. Brass, James Berlingett, Tracy Lyon and Robert C. Wright, of St. Paul.

The Bell Telephone Company is making arrangements to place Atlanta, Ga., in telephonic communication with the entire country. A line direct to New York will be opened in another year and with its completion Atlanta will be the center of telephonic communication for the entire South.

The Southern Michigan Telephone Company has lately erected lines connecting Battle Creek with a number of towns and villages in the surrounding country, making it a telephone center of considerable importance.

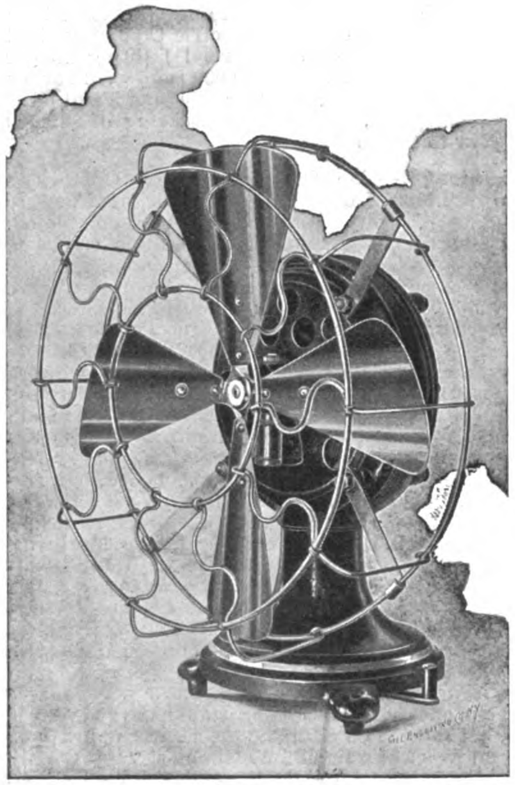
An ordinance authorizing the South Jersey Telephone Company to put in a telephone system at Cape May has passed its second reading in the city council.

The New York and Eastern Telephone Company intend to extend their lines in Brooklyn and are preparing for a large amount of wiring and other work. The recent decision of the court sustaining their right to a business footing in the city is gratifying to the friends and patrons of the company.

Lundell Alternating Fan Motor Outfits.

The demand for an alternating fan motor as attractive as the Lundell Direct Current Fan Motor is now met by the latest production of the Interior Conduit and Insulation Company.

In appearance the Lundell Alternating Fan Motor Outfit, illustrated herewith, presents a beauty of design and finish equal to that of the direct current outfit, having a cylindrical field-magnet on a hollow cast-iron base. It is designed in two types, high frequency (14,000 to 16,000 alternations per minute) and low frequency (7,200 alternations per minute), at 52 and 104 volts.



LUNDELL ALTERNATING FAN MOTOR.

Tests of the high frequency motors show that a current of 1.8 amperes at 52 volts with 12" fan is a fair average for their operation.

Like the Lundell Direct Current Motors, they are superbly finished in rich black japanning with gilt stripings. All outside brass fittings, fans and guards are either polished brass or nickel-plated. Self-oiling and self-aligning bearings and a regulating switch giving three speeds are also features.

These motors are manufactured under the patents of Robert Lundell by the Interior Conduit and Insulation Company of New York City.

Phœnix Interior Telephones.

The Phœnix Interior Telephone Company, 131 Liberty street, New York, has just recently closed contracts for the installation of seventeen Inter-Connecting 'Phones in the publishing house of McLaughlin Bros., Brooklyn, and for nine instruments of the same class for Flint, Eddy & Co., of New York. Among the recent installations by this company are: Royal Baking Powder Company, J. C. Hoglan, Wall street; Passavant & Co., Church and Lispenard streets; Metropolitan Rubber Company, Colored Orphan Asylum, House of Good Shepherd, Brooklyn, and numerous other smaller contracts.

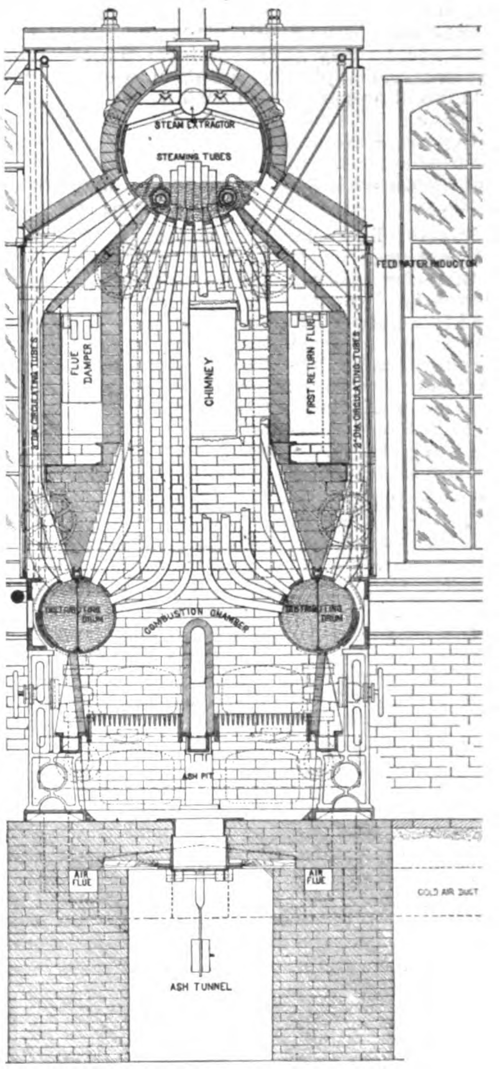
Keystone Electric Motors.

The Keystone Electric Company of Erie, Pa., has issued a very handsomely printed catalogue giving valuable information concerning their well-known Reversible Motor for elevator use. The company is doing a profitable business, with daily increasing sales.

This company has recently closed one of the largest contracts on record in their special line—for 150 motors of different sizes for elevator service.

The Hogan Boiler.

The construction of a boiler which maintains a high evaporative efficiency under minimum, maximum and excessive demands for steam; which produces a positive and continuous circulation; which insures dry steam at all times regardless of the conditions of firing or use; in which there is instant and continuous precipitation of all sediment in the water; in which no joints are exposed to the fire; in which the tubes are not liable to injury from expansion, sagging, accumulations of sediment, internal or external, or overheating; which is adapted to all kinds of fuel; which is applicable alike to land and marine uses, has long been sought for by both boiler designers and steam users. For two years past the Hogan Boiler Company, of Middletown, N.Y., have been working on this problem, and the success with which they have met, and the manner of overcoming all the attendant difficulties in its solution, were ably and satisfactorily demonstrated by a public test at the works of the company on Tuesday last. In the presence of a number of prominent members of the engineering societies of New York and elsewhere, of representative manufacturers and steam users, and representatives of the trade press, a 100 horse power boiler was exhibited in operation, and an inspection of the company's works was made by the visiting delegations. The company has installed two boilers. The first was put in operation at the State Homœopathic Asylum at Middletown, N. Y., last June. The nominal rating of this boiler is 350 horse power. The general average of a series of tests, conducted in person by Prof. R. C. Carpenter and W. R. Eckart, Jr., of Cornell University—the tests numbering twenty-three in all—show that the evaporative efficiency of this boiler running on steam coal was 13.68 lbs of water; with ordinary soft coal 12.30 lbs., and with anthracite pea coal 12.65 lbs. of water per pound of combustible. In these tests, designated "running tests," the starting and dumping of fires were eliminated. During one of the tests a maximum horse power of 665 was attained for a period of two hours, the average for the entire test being 418.04, and the evaporative efficiency, based upon the theoretical power of one pound of combustible as sufficient to evaporate fourteen pounds of water, was 83 per cent. "This high result," Prof. Carpenter says, "has seldom been obtained in any boiler, even under the most favorable conditions."



HOGAN BOILER.—SECTIONAL ELEVATION.

Boiler No. 2 is rated at 100 horse power, and is installed at the company's works. This boiler was subjected to the public test, a committee consisting of Paul Grimm, M. E., M. N. Forney, of the *American Engineer and Railroad Journal*, and John Hopson, of New Britain, Conn., conducting the tests. Their report has not yet been tabulated, but it can safely be said that it establishes the truthfulness of the remarkable statements the company have made concerning the performance of their boilers.

The boiler consists of two horizontal steam drums, each connected by 2-inch boiler tubes with vertical manifolds. The manifolds are in two rows, one on each side of the combustion chamber. The tubes are expanded in the usual way into the manifolds and the steam drum, the joints being so placed that the direct action of the heat of the fire does not affect them. The tubes constitute all the heat-absorbing surfaces of the boiler, and are the only parts exposed to the fire, and they are placed directly over the grate. Ouside of the furnace side walls are placed the distributing drums, to the upper side of which all the manifolds are connected. The front end of the distributing and steam drums are connected by 6 and 10 inch. pipe. In the latter are placed the feed-water heaters. The back ends of the distributing drums are connected to the circulating drums, the lower part of the back end to the mud drum. The mud drum is placed outside of the back wall of the furnace, wholly removed from the flues and heated gases. The upper sides and also the tops of the circulating drums are connected to the lower ends of the steam drums.

By reference to the accompanying cut, showing sectional elevation of the boiler, the circulation of the water will be observed to take the following course: In the feed-water inductor, the cold water passes down and up, absorbing heat from the descending current from the steam drum and becoming a part of this current on passing through a series of perforations near the top of the 10-inch pipe which connects the steam and distributing drum.

The descending currents pass through the circulating drum to the distributing drum; the latter receiving the impurities of the water and discharging them into the mud drum. The ascending currents pass from the distributing drum to the manifolds, thence through the 2-inch steaming tubes to the steam drum. From the steam drum a row of 8-inch internal circulation tubes extends to the circulating drum through which the descending current passes on its perpetual round of circulation. These tubes are insulated from the heat of the furnace and their use entirely prevents the mixing of the water with the steam as it is produced.

The steaming tubes exposed to the greatest heat of the furnace are extended into the steam drum, and discharge their contents entirely above the water level. It follows, therefore, that the water to supply the circulation must come from the bottom of the steam drum, and consequently the current must always be in one direction. The tubes receiving less heat are submerged in the water of the steam drum and are denominated water-heating tubes. The tubes entirely removed from the heat are connected to the lower sides of the steam drum and from the path for the descending discharge into the circulating drums. In the steam drum the splashing of water by active circulation from the steaming tubes into the steam space is prevented by a perforated plate placed above the tube openings. Dry steam is thus constantly produced and without the necessity of superheating. Tests made by Prof. Carpenter show the percentage of moisture to have been as low as 0.58 per cent.

The Hogan Boiler Company is officered as follows President, N. D. Stratton; vice-president, Geo. N. Clemson; treasurer, C. Macardell; secretary, S. S. Mallett. J. J. Hogan, the inventor of the boiler, is mechanical engineer. Several large contracts have already been closed by the company.

Walker Company's Sales.

The Walker Manufacturing Company, Cleveland, Ohio, have closed the following contracts since April 1, 1895, all for speedy deliveries, which will show the popularity which their improved generators and motors are gaining. Their shops are now running both day and night;

St. Charles Street Railroad Company, New Orleans, La., three 200 K. W. direct-coupled generators.

Corning and Painted Post Street Railway Company, Corning, N. Y., two 125 K. W. direct-coupled generators.

Messrs. Channon & Wheeler, Quincy, Ill., one 75 K. W. belted power generator.

Manhattan Beach Hotel and Land Company, New York City, one 60 K. W. belted lighting generator.

Norfolk and Ocean View Railroad Company, Norfolk, Va., two 250 K. W. belted generators; three double car equipments, six 50 H. P. steel motors; two double car equipments, four 30 H. P. steel motors.

E. A. Darling, Superintendent Columbia College, New York City, one 50 K. W. belted lighting generator.

Buffalo, Kenmore and Tonawanda Electric Railway Company, Buffalo, N. Y., two double car equipments, four 25 H. P. steel motors.

Stern & Silverman, Philadelphia, Pa., for Rapid Railway Company, Detroit, Mich., two 200 K. W. belted generators; eight double car equipments, sixteen 50 H. P. steel motors.

Dunkirk and Fredonia Railroad Company, Fredonia, N. Y., one double car equipment, two 25 H. P. steel motors.

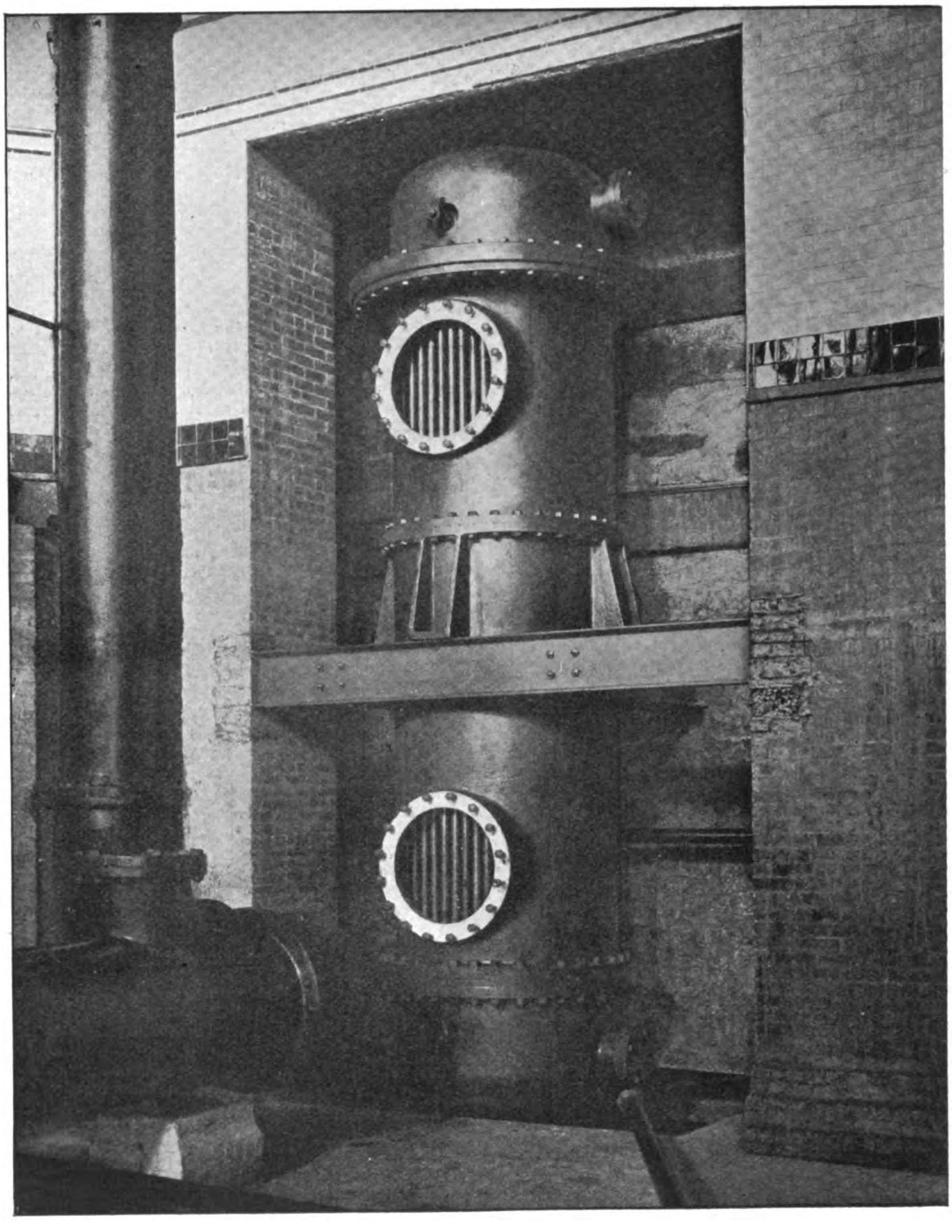
Schenley Park and Highlands Railway Company, Pittsburg, Pa., three double car equipments, six 30 H. P. steel motors.

There has also been a marked increase in their orders for general work as well as electrical work.

A 4,000 Horse-Power Goubert Heater.

The Goubert Manufacturing Company, located at 14 and 16 Church street, New York City, have recently installed at the First District Station of the Edison Electric Illuminating Company, Pearl street, Brooklyn, N.Y., a 4,000 H. P. vertical Goubert Feed Water Heater. A good view of this immense heater—one of the largest ever built—is shown in the engraving on this page. It is a most perfect piece of work and designed expressly to fit into the limited space available.

The heater is made entirely of cast-iron and brass, and is of the latest improved Goubert type, with curved upper and lower tube plates and patent flexible expansion joint. This is the only joint in the heater that is not rigid, the differential expansion between the shell and the brass tubes being taken care of at this point.



4,000 Horse-Power Goubert Heater.

The Goubert Heater is especially desirable in connection with plants of magnitude and heavy duty; in fact it is the only one made for the high pressures that are now so frequently used.

The Goubert Manufacturing Company is doing an extensive business in large units, especially for electric plants, both lighting and traction, operated by the principal companies throughout the country. It now has branch offices in many of the principal cities.

Mather Electric Company.

The Mather Electric Company of Manchester, Conn., report a continuation of the large amount of new business which has been secured. The following sales were made last week:

The C. Weyand Brewing Company, Buffalo, N. Y., one 40 K. W. Direct Connected Generator.

Robert Walker, M. D., Warnerville, Pa., one 100 Light and one 250 Light Ring Type Dynamo.

G. M. Angier & Co., Boston, Mass., one 8 H. P. Manchester Motor and one 250 Light Ring Type Dynamo.

William Oswald, New Orleans, La., three 5 H. P., one 10 H. P., one 15 H. P. and one 30 H. P. Manchester Type Motors.

Through J. Holt Gates, of Chicago, Western contractor, one 60 K. W. 220 volt Multipolar Generator to be direct connected to Ideal engine, Westville Coal Company, Danville, Ill.; also one 60 K. W. 220 volt Multipolar Generator and one 85 K. W. 220 volt for other electric coal mining works, of which class of work the Mather Company is making a specialty; also one 30 K. W. and one 45 K. W. Multipolar Generator for isolated lighting works.

B. F. Sturtevant & Co., Chicago, two 20 H. P. Manchester Type Motors.

Burtis & Howard, Minneapolis, Minn., one 250 Light Ring Type Dynamo, third order.

A Catalogue of House Goods, Etc.

Messrs. Partrick & Carter, one of the oldest electrical supply concerns in the country, have issued an elaborate catalogue of House Goods and General Electrical Supplies which ought to be appreciated by dealers in every community.

They carry a complete line, not equalled by any other concern in the country. As an evidence of the popularity of the Hotel Annunciators made by them, it takes eleven pages of the catalogue to enumerate the hotels in which they are in use.

Prices, terms of sale, discounts, etc., are all plainly given. Four pages are required for the index, which shows the comprehensive character of the catalogue.

An Attractive Folder.

The Beacon Lamp Company of Boston are sending out an attractive folder, giving the special points of merit claimed for the Beacon Lamp, with prices.

INCORPORATIONS.

The Mascot Electric Light, Heat and Power Company, Ouray, Col.—to produce electric current for furnishing light, heat and power to the town of Ouray, Col. Capital stock, $100,000. Promoters: B B. Clauson, Chas. A. Armstrong, T. W. Emerson, all of Ouray, Col.

The Kelly Watch Company, Chicago, Ill.—to manufacture and sell time-pieces, electric and automatic devices and all kindred mechanisms. Capital stock, $20,000. Promoters: Thos. F. Kelly, Thos. J. O'Hare, Robt. J. Bieg.

The Atlantic Highlands, Red Bank and Long Branch Electric Railway Company, Red Bank, N. J.—to construct and operate motors, cables and other machinery for supplying motive power to street railroads, and to construct and operate street railways. Capital stock, $500,000. Promoters: David S. Arnott, Wm. H. Hazard, Silas B. Dutcher, Sam'l S. Whitehouse, Brooklyn, N. Y.

The Seattle and Alaska Mining and Milling Company, Seattle, Wash.—to erect and maintain water and electric power, mine and market ores of precious metals, etc. Capital stock, $250,000. Promoters: Wm. M. Ebner, W. E. Crews, J. E. Fox, W. D. O'Toole, P. F. Smith.

San Joaquin Electric Company, Fresno, Cal.—to buy, sell and deal in electrical inventions, patents, etc.; buy, sell, lease, maintain and operate electrical plants of all kinds; manufacture and sell electricity; deal in real and personal property. Capital stock, $800,000. Promoters: John J. Seymore, John S. Eastwood, Henry Sherwood, O. W. Woodward, L. L. Cory, of Fresno.

The Taylor Electric Light Company, Taylor, Tex.—to manufacture and supply gas, electric light, heat and power to the public. Capital stock, $20,000. Promoters: Hugh Burns, F. L. Welch, Bernard Garry, of Taylor.

The Denison Street and Electric Railway Company, Denison, Tex.—to construct and operate street railways and suburban or belt lines of railway in or near Denison, etc. Capital stock, $50,000. Promoters: A. F. Platter, G. McKegan, P. H. Tobin, T. Murphy, E. H. Lingo, of Denison.

The Belle Vernon Electric Light and Power Company, Belle Vernon, Pa.—to generate light and power by means of electricity. Capital stock, $1,000. Promoters: Sam'l M. Graham, C. F. Eggers, Adolph C. Hamm, Belle Vernon.

The Waco Electrical Supply and Construction Company, Waco, Tex.—to buy and sell goods, wares and merchandise by wholesale. Capital stock, $10,000. Promoters: W. W. Seley, S. A. Hobson, A. P. Moore, Waco.

The Hartford Light and Power Company, Hartford City, Ind. Capital stock, $30,000. Promoters: Wm. N. Forbis, Monticello, Ind.; Milton H. Forbis, Cincinnati, Ohio; Albert Reynolds, Guy E. Reynolds, Hartford City, Ind.

The Adams-Bagnall Electric Company, Cleveland, Ohio—to manufacture, sell and deal in electric lamps, electric railway motors, electrical machinery, etc. Capital stock, $150,000. Promoters: Thos. E. Adams, E. J. Bagnall, Chas. C. Hickox.

The Iowa Falls Electric Light and Power Company, Iowa Falls, Iowa—to erect, maintain and operate an electric power and light plant. Capital stock, $15,000. Promoters: L. B. Bradley, H. C. Miller, J. D. McKay, Z. K. Hoag, Iowa Falls.

The Bridgeport Railroad Company, of Montgomery County, Pa.—to build an electric line from Swedesburg to Swedeland. Capital stock, $15,000. Incorporators: Daniel B. Shepp, J. W. Shepp, Edgar A. Murphy, Henry Parker, Robert L. Parkinson, Philadelphia; N. H. Larzelere, Norristown: W. B. Krick, Reading.

The Los Angeles and Santa Monica Electric Railway Company, Los Angeles, Cal.—to build and operate a railroad for freight and passengers between the points named by means of electricity, compressed air or other suitable power. Capital stock, $500,000. Directors: C. B. Van Avery, V. H. Raleigh, J. J. O'Brien, A. W. Eames, and James P. Montgomery, all of Los Angeles.

The Excelsior Novelty Company, Louisville, Ky.—to do a general electroplating business. Capital stock, $5,000. Incoporators: Geo. F. Porter, James L. B. Stinger and James R. Jackman, Jr.

The Globe Electric Construction Company of New York City—to sell and install electric equipment apparatus, appliances, etc. Capital stock, $20,000. Directors; J. J. Clark, F. F. Coen, of New York City; H. C. Mackenzie, of Roseville, N. J.; P. M. Mowrey, of Upper Montclair, N. J.

The Middletown and Bloomingburg Electric Railway Company—to operate a street railroad from Middletown, N. Y., to Bloomingburg, a distance of ten miles. Capital stock, $200,000. Directors: J. C. Hinchcliffe. John Hinchcliffe, of Paterson, N. J.; W. B. Rockwell, of Scranton, Pa.; and E. G. Wightman, F. D. La Bar, C. H. Smith, A. F. McIntyre, W. B. Royce and W. H. Wiggins, of Middletown.

The Coty and Albertson Company, Atlantic City, N. J.—to lease, buy, build and erect buildings, structures and machinery; operate and maintain the same for conducting the plumbing, gasfitting, roofing, electrical, hardware, tinware, etc., that pertains to general hardware business. Capital stock, $10,000. Promoters: Richard R. Albertson, Jos. Young, Clifton C. Shinn, Atlantic City, N. J.

The Electrolytic Insulating and Conduit Company, Springfield, Ill.—to manufacture, use and sell electric ducts, cables and all electric apparatus for transmission of power, light, heat and communication. Capital stock, $5,000,000. Promoters: H. Clay Wilson, Benj. Knudson, Jas. E. Henderson.

The City Street Railway Company, of Savanna, Ill., Savanna, Ill.—to construct, maintain and operate a street railway by animal, electric or pneumatic power. Capital stock, $25,000. Promoters: W. W. Cargill, J. B. Canterbury, Edwin B. Magill, A. D. Appleby, B. Pulford.

The Universal Telephone Company, Indianapolis, Ind.—to manufacture and sell telephones, telephone devices, electrical supplies, etc. Capital stock, $25,000. Promoters: E. B. Martindale, Chas. Martindale, Robert Martindale, Indianapolis.

The Venice, Madison and Granite City Railway Company, Venice, Ill.—to operate street railway, electric light plant, etc. Capital stock, $60,000. Incorporators: C. H. Sharman, Fred E. Allen and E. J. Spencer.

The Rockford Telephone Company, Rockford, Ill.—to construct telephone and telegraph plants, etc. Capital stock, $60,000. Incorporators: John Rames, Joel B. Whitehead, William L. Eaton and Hiram W. Buckbee.

The Rondout and Eddyville Railway Company—to build and operate a street railway by animal power, cable or electricity. Capital stock, $30,000. Directors: William T. Hiscox, Percival C. Smith, Gardner D. Hiscox, Edward B. Gallaher and Frederick C. Beach, of New York City; Joseph F. Wilson, of Brooklyn; Albert Terry, Robert F. Tompkins and John N. Cordts, of Kingston, N. Y.

The Price Hill Electric Building and Loan Association, Cincinnati. Capital stock, $500,000. Incorporators: Joseph Braner, Charles Blanchard, Heinrig Sutkamp, Thos. H. Wright and Edwin Chambers.

The W. H. Elliott Electric Company, Cleveland, Ohio. Capital stock, $10,000.

The Dover Electric Light and Power Company, Dover, N. Y.—to furnish light and power in the towns of Dover, Amenia, Washington and Pawling. Capital stock, $10,000. Directors: Adolph Reimer and Catharine Reimer, of Dover Plains, and Julius C. Minck, of Brooklyn, N. Y.

The Empire State Electric Forging Company, Syracuse, N. Y.—to manufacture electric welding, forging and smelting apparatus. Capital stock, $300,000. Directors: L. H. Gooesbeck and C. M. Warner, of Syracuse; J. O. Adsit, of Hornellsville; D. E. Mosely, of Rochester, and E. E. Woodruff, of Auburn.

The New York Electric Motor and Ventilator Company, New York City. Capital stock, $30,000. Directors: Sidney Green, of New York City, and C. A. Sherman and Lincoln Vancott, of Brooklyn.

The Tacoma Gas and Electric Company, Tacoma, Wash.—to conduct a gas and electric lighting plant, transportation lines, open and operate coal mines, etc. Capital stock, $350,000. Incorporators: C. B. Hurley, Edmund Seymour, Alfred E. Buell, C. P. Masterson, W. G. Hellar, John F. Dillon and Frederick E. Watson.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED APRIL 9, 1895

ELECTRIC RAILROADS AND APPLIANCES.

537,194. Conduit Electric Railway. John H. Guest, Boston, Mass. Filed June 18, 1894.

537,195. Conduit Electric Railway. John H. Guest, Boston, Mass. Filed April 14, 1894.

537,196. Supply System for Electric Railways. John H. Guest, Boston, Mass. Filed June 18, 1894.

537,197. Supply System for Electric Railways. John H. Guest, Boston, Mass. Filed Nov. 3, 1893.

537,198. Electric Railway. John H. Guest, Boston, Mass Filed Aug. 9, 1894.

537,199. Electric-Railway Supply System. John H. Guest, Boston, Mass. Filed Feb. 20, 1894. Renewed Feb. 2, 1895.

537,200. Closed-Conduit Electric Railway. John H. Guest, Boston, Mass. Filed April 10, 1894.

537,283. Trolley. Zachry T. Furbish and George A. Staples, Augusta, Me., assignors of one-third to P. M. Fogler, same place. Filed Sept. 24, 1894.

537,414. Closed-Conduit Electric Railway. John H. Guest, Brooklyn, N. Y. Filed Feb. 17, 1893.

537,416. Supply System for Electric Railways. John H. Guest, Boston, Mass. Filed July 6, 1893.

ELECTRIC LIGHTS AND APPLIANCES.

537,058. Incandescent Lamp. Charles A. Merritt, Birmingham, Ala. Filed Sept. 17, 1894.

537,209. Lamp. John Kirby, Jr., Dayton, Ohio, assignor to the Dayton Manufacturing Company, same place. Filed Oct. 16, 1893.

537,271. Incandescent-Lamp Base. Waldo C. Bryant, Bridgeport, Conn. Filed Dec. 20, 1894.

DYNAMO ELECTRIC MACHINERY.

537,010. Ventilating Apparatus for Dynamo-Electric Machines. George D. Burton, Boston, and Edwin E. Angell, Somerville Mass., assignors, by mesne assignments, to said Burton. Filed Dec. 7, 1892.

537,354. Traversing Apparatus for Commutators. John Pease, Apperley Bridge, England. Filed July 28, 1884.

537,412. Rheostat. John C. Fyfe, Chicago, Ill., assignor of one-half to James Hayes, same place. Filed Jan. 24, 1895.

APPARATUS FOR METAL HEATING, WELDING, ETC.

537,004. Electric Metal-Heating Process. George D. Burton, Boston, Mass. Filed Dec. 11, 1893.

537,005. Art of and Apparatus for Electrically Smelting Ore. George D. Burton, Boston, Mass. Filed April 26, 1894.

537,006. Electric-Bath Metal-Heating Apparatus. George D. Burton, Boston, Mass. Filed Aug. 24, 1893. Renewed Sept. 10, 1894.

537,007. Method of and Apparatus for Electrically Heating Metal. George D. Burton, Boston, Mass. Filed Jan. 23, 1895.

537,008. Electric Metal-Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Original application filed Sept. 5, 1892. Divided and this application filed Oct. 11, 1894.

537,009. Method and Apparatus for Electric Metal Heating. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Filed Aug. 30, 1892.

537,011. Electric-Bath Metal-Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Filed Dec. 7, 1892.

537,012. Electrical Welding Apparatus. George D. Burton, Boston, and Edwin E. Angel, Somerville, Mass., assignors, by mesne assignments, to said Burton. Filed March 3, 1893.

537,013. Apparatus for Brazing Metals by Electricity. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Filed April 17, 1893.

537,017. Machine for Closing Ends of Tubes. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Filed May 4, 1893.

537,402. Electric-Bath Metal-Heating Apparatus. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors, by mesne assignments, to said Burton. Original application filed Sept. 5, 1892. Divided and this application filed Oct. 11, 1894.

537,404. Apparatus for Electrically Heating Metal. George D. Burton, Boston, Mass. Filed Nov. 6, 1894.

537,405. Apparatus for Electrically Heating Metal. George D. Burton, Boston, Mass. Filed March 16, 1895.

SIGNALS AND SIGNALING APPARATUS.

537,133. Electric Railway Signal Apparatus. George L. Thomas, Brooklyn, assignor to the Hasell Perfected Railway Signal Company, New York, N. Y. Filed April 23, 1894.

537,161. Police-Signaling Apparatus. William H. Kirnan, Bayonne, N. J., assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed Dec. 28 1892.

MISCELLANEOUS.

536,996. Electrode. Harry T. Barnett, London, England. Filed Dec. 27, 1893.

537,032. Electric Clock. Fred L. Gregory, Chicago, Ill. Filed Jan. 30, 1894.

537,118. Electrical Indicator. Edward H. Johnson, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Filed Oct. 1, 1891.

537,124. Electrical Steering-Gear. Rodolphe Noury, Nouveau Phalere, Greece. Filed March 12, 1894.

537,130. Arc-Rupturing Device. Elmer A. Sperry, Cleveland, Ohio, assignor to James Parmelee, New York, N. Y. Filed Oct. 16, 1894.

537,149. Demagnetizer. Edward F. Gooding and George W. Scovil, Elgin, Ill. Filed Dec. 29, 1894.

537,179. Electrolysis. Henry Blumenberg, Jr., Mount Vernon, N. Y. Filed March 30, 1894.

537,228. Cut-Off or Safety Attachment for Electrical Conductors. James Parkinson, Maurice Springfield, and Charles Mills, Philadelphia, Pa. Filed Oct. 10, 1894.

537,242. Pyrometer. Alvin A. Simonds, Dayton, Ohio. Filed Dec. 13, 1894.

537,259. Non-Arcing Switch. Alexander Wurts, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed April 14, 1893.

537,282. Telephony. Ellis F. Frost, Washington, D. C. Filed Dec. 20, 1894.

537,321 Insulating Compound. Alexander C. Thompson. St. Louis, Mo. Filed July 30, 1894.

537,343. Electrical Measuring-Instrument. Eugen Hartmann and Wunibald Braun, Bockenheim, Germany. Filed Nov. 27, 1891.

537,358. Electric-Battery System. Adoniram J. Powell and William H. Hall, Brooklyn, N. Y. Filed Nov. 13, 1894.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

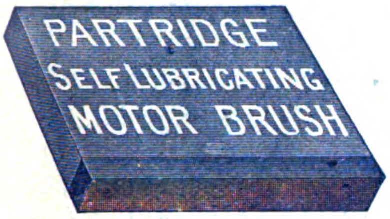
(Issued by the Washington Carbon Company.)

APRIL, 1895.

Day of Mo.	Light. H.M.	Day of Mo.	Extinguish. H.M.	No. of Hours. H.M.
1	P. M. 11.20	-		5.20
2		2	A. M. 4.40	
3	A. M. 1.20	3	" 4.40	3.20
4	" 2.00	4	" 4.40	2.40
5	" 2.40	5	" 4.40	2.00
6	" 3.00	6	" 4.40	1.40
7	No light.	7	No light.	
8	No light.	8	No light.	
9	No light.	9	No light.	
10	P. M. 7.00	10	P. M. 9.20	2.20
11	" 7.00	11	" 10.30	3.30
12	" 7.00	12	" 11.40	4.40
13	" 7.00	14	A. M. 1.00	6.00
14	" 7.10	15	" 1.40	6.30
15	" 7.10	16	" 2.30	7.20
16	" 7.10	17	" 3.00	7.50
17	" 7.10	18	" 3.30	8.20
18	" 7.10	19	" 4.00	8.50
19	" 7.10	20	" 4.20	10.10
20	" 7.10	21	" 4.20	10.10
21	" 7.10	22	" 4.10	10.00
22	" 7.20	23	" 4.10	9.50
23	" 7.20	24	" 4.10	9.50
24	" 7.20	25	" 4.10	9.50
25	" 7.20	26	" 4.10	9.50
26	" 8.00	27	" 4.00	8.00
27	" 9.10	28	" 4.00	6.50
28	" 10.20	29	" 4.00	5.40
29	" 11.00	30	" 4.00	5.00
30	" 11.20	May 1.	" 4.00	4.40
Total				170.10

ELECTRICITY.

VOL. VIII. NEW YORK, APRIL 17, 1895. No. 14



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FOR ALL PURPOSES,
Bradbury-Stone Electric
Storage Co.,
LOWELL, - MASS.

McINTIRE'S
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CONNECTORS AND TERMINALS
FOR ALL ELECTRICAL PURPOSES.
Incandescent Lamp and Cutout Terminals
for all makes of Lamps.
GENERAL ELECTRICAL SUPPLIES.
THE C. McINTIRE CO.,
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STAMPED SOLID SHEET MICA SEGMENTS AND RHEOSTATS.
Large Stock. Prompt Shipment. Lowest Prices
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New York Office, 121 Liberty Street.

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TRADE MARK.
INSULATED WIRES AND CABLES.
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QUALITY IS THE FIRST CONSIDERATION
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INCANDESCENT LAMP
Prices Based on this Standard.
We guarantee quality, but cannot guarantee lowest first cost. No catchpenny rebate system. Each transaction complete in itself. Do these conditions suit you? If so, write for prices. Lamps in stock at branch offices.
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FROM YOUR CENTRAL STATION.
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Joints made absolutely tight and durable
by Patent Corrugated
Copper Gaskets.
Furnished in all shapes and sizes for flanged PIPES, CYLINDERS, CHESTS, etc. *Price List and Sample Free.*
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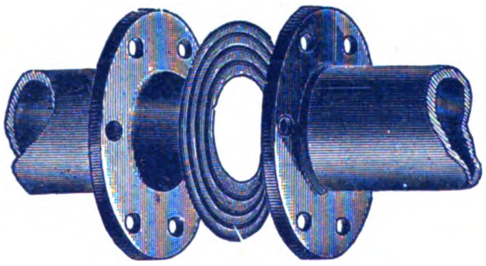

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Premier Products.

PREMIER MOTORS.

Our Baby	$1.50
No. 1 and Fan	3.00
No. 2 " "	4.75
No. 3 " "	6.75
No. 3 " 10" Fan	8.50

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WIRES AND CABLES.
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16 C. P. (Bbl. Lots) SPECIAL PRICES will be made to Large Consumers. **22c.** **"BEACON" INCANDESCENT LAMPS.**
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ELECTRIC WIRES AND CABLES FOR ALL CLASSES OF SERVICE
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Sawyer-Man Incandescent Lamps,

WITH BASES TO FIT ANY SOCKET.

We have now resumed the manufacture of the well known Sawyer-Man lamps, on a scale to meet any possible demand.

We have adopted new methods of manufacture which add to the appearance and quality of our lamps, and make them by reason of their efficiency and long life, the cheapest and best lamps ever offered.

PRICES.

PLAIN LAMPS.

8, 10 and 16 candle-power lamps,	25 cents each
20 and 25 " "	30 " "
32 " "	38 " "
16 c. p. street car lamps,	25 " "
16 " " " anchored,	32 " "

ORNAMENTAL LAMPS.

8, 10 and 16 candle-power lamps,	30 cents each.
20 and 25 " "	35 " "

Discounts According to Quantity.

FOR ETCHING THE PLAIN OR ORNAMENTAL LAMPS, 3 1-2 cents each, net.

COLORED LAMPS.

"Dipped" Lamps in red, blue or green, 5 cents each net additional. Lamps with bases to fit Thomson-Houston Sockets, 3 cents extra.

Boxing and Packing at cost. Prices are subject to change without notice.

WESTINGHOUSE ELECTRIC AND MFG. COMPANY, Pittsburg, Pa.

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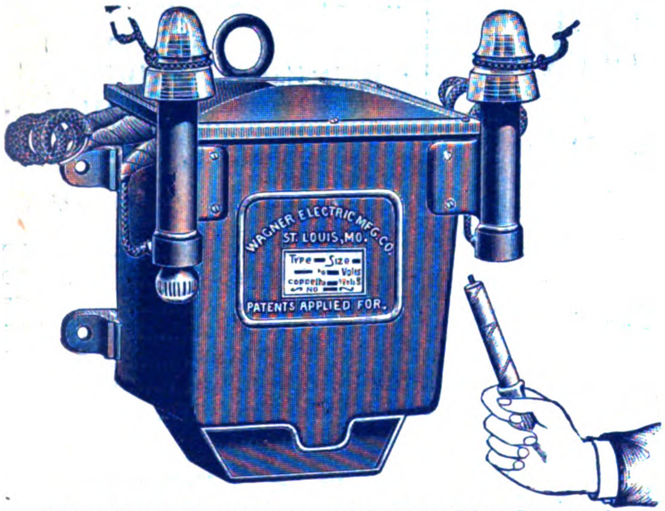
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ST. LOUIS, MO.
Type Size
Volts
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Type "D" Transformer with Fuse Plug Removed.

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A New Type: *Transformer, Primary Cut-outs and Insulator Brackets, all combined.*

No more Brackets pulling off walls.

With our wall or cross-arm hooks, transformer may be *Hung* and *Connected* in *Five Minutes.*

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Our Transformers are acknowledged by all experts to be the *Highest* in *Efficiency* ever made.

Adopted by the largest stations in the country.

We Challenge Competition in any form of test in laboratory or practical use.

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ST. LOUIS, MO.

1564 Monadnock Block,
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BUCKEYE Incandescent LAMPS.

Quality Unequalled.

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ELECTRIC LIGHTING MATERIAL.
ELECTRICAL HOUSE GOODS.

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Marine Core Blue Core

The Wirt Dynamo Brush, Wood's Pole Ratchet, Wood's Flexible Pole Bracket, the W. W. Lightning Arrester, the Whittingham Electric Car Heater, E. C. & S. Co.'s Arc Lamp, Iona Sockets and Switches, Electric Light and Power Controllers, Hope Arc Cut-Outs,
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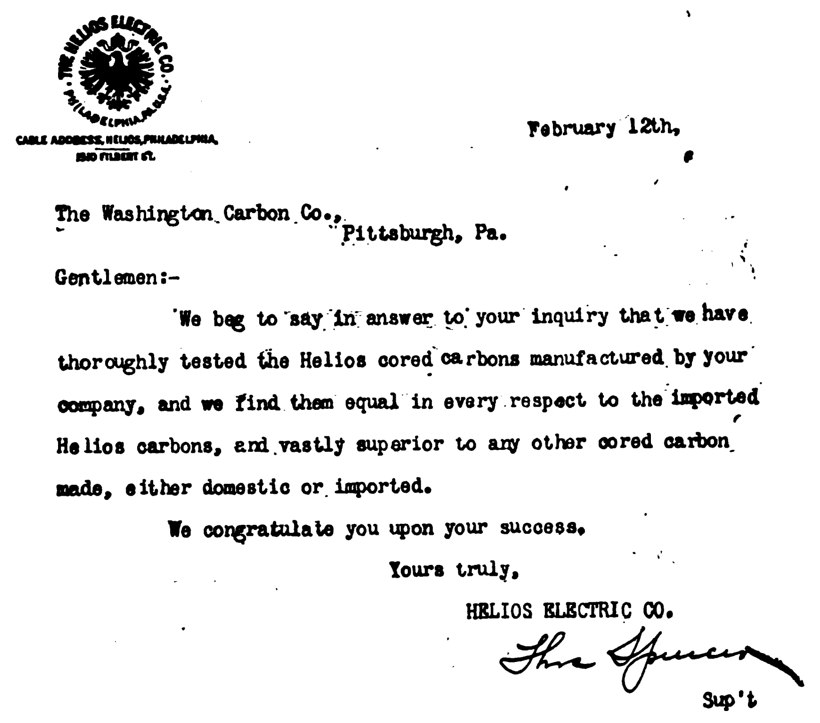
1-2 to 500 Candle Power. 1, 2, 2.5, 3, 3.5 or 4 Watts per Candle Power.

OFFICE: *136 Liberty St., New York.* FACTORY: *Marlboro, Mass.*



THE HELIOS ELECTRIC CO. PHILADELPHIA, PA. U.S.A.
CABLE ADDRESS, HELIOS, PHILADELPHIA,
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February 12th,

The Washington Carbon Co.,
Pittsburgh, Pa.

Gentlemen:-

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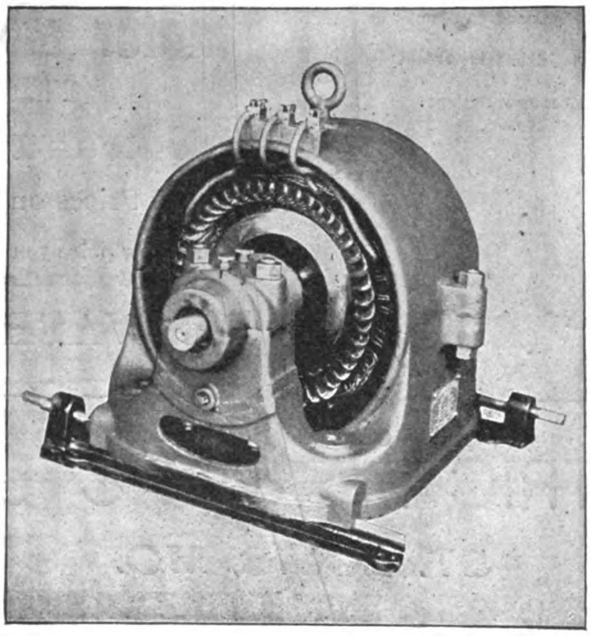

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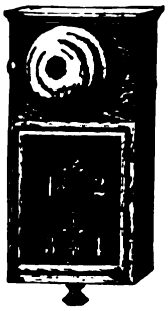

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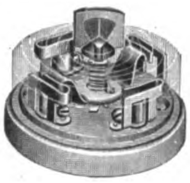

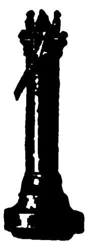

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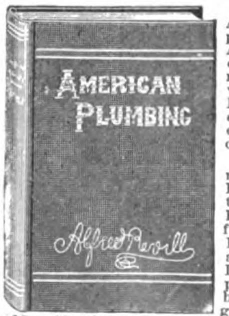

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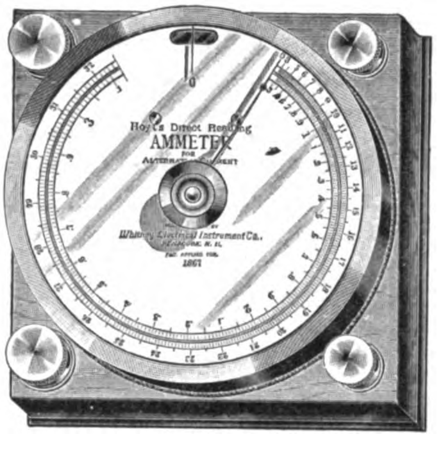

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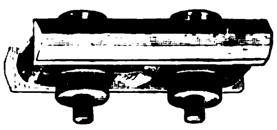

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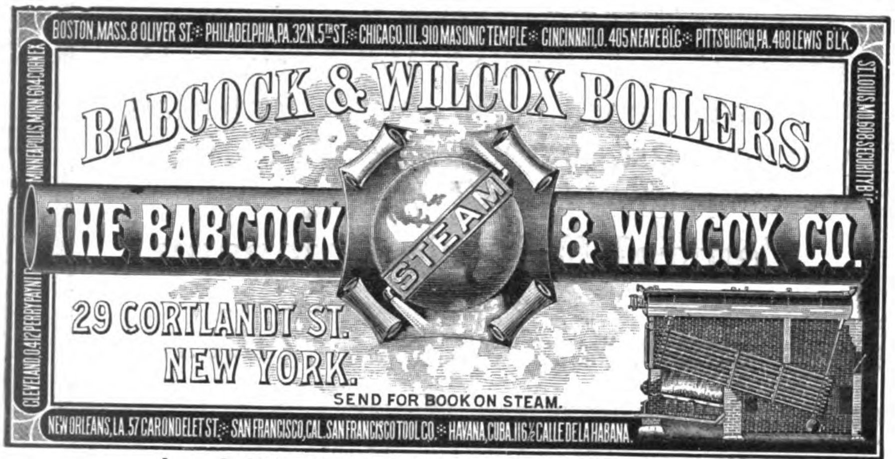

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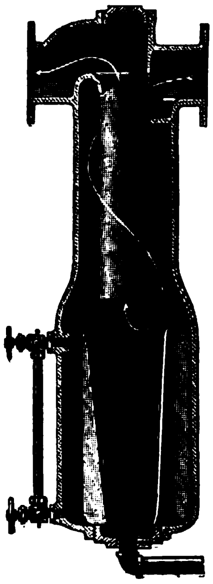

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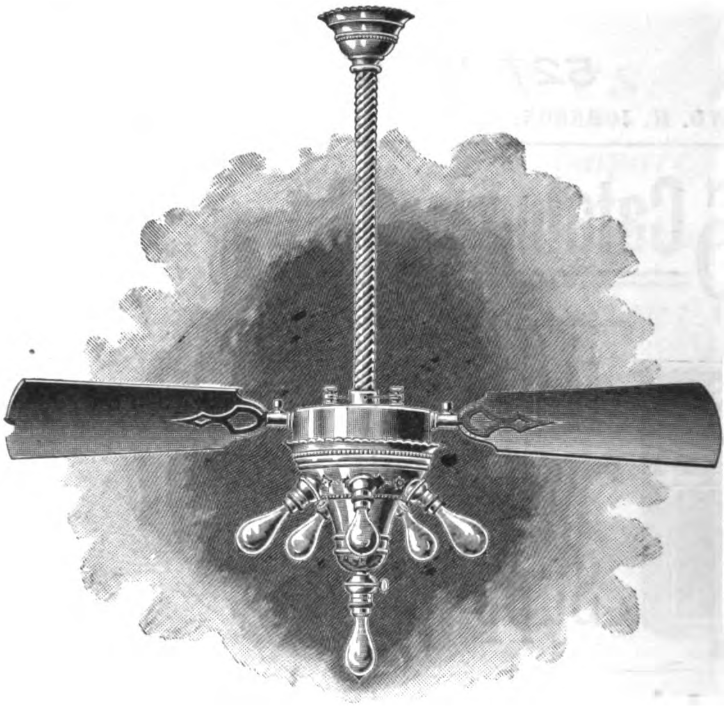

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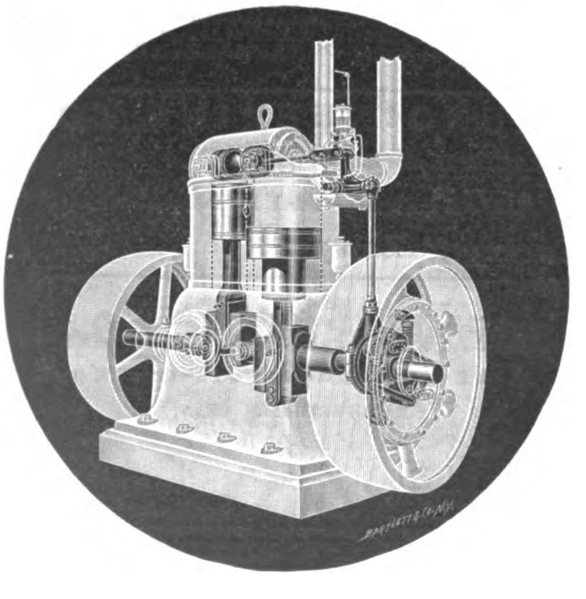

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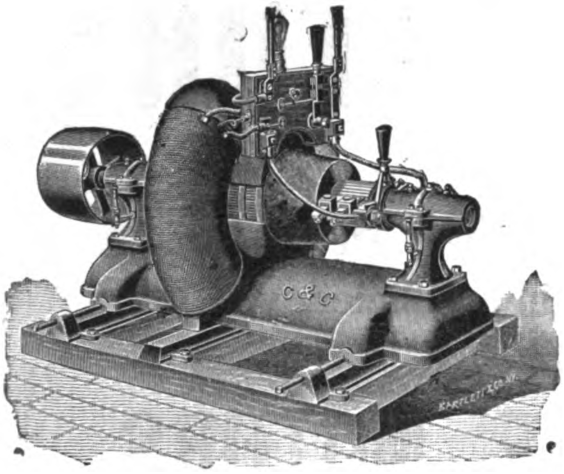

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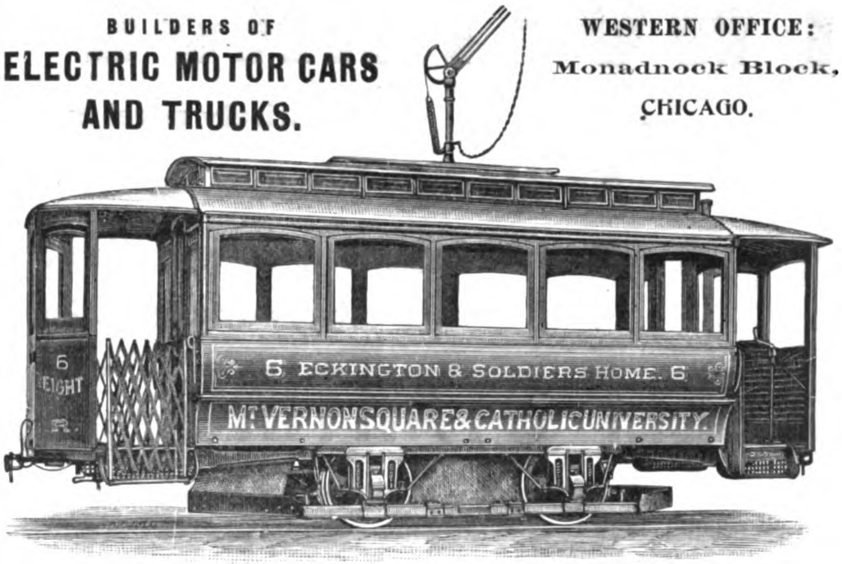
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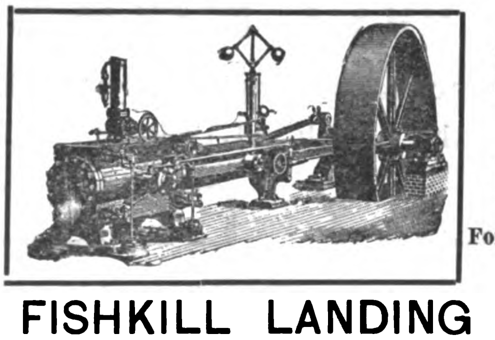

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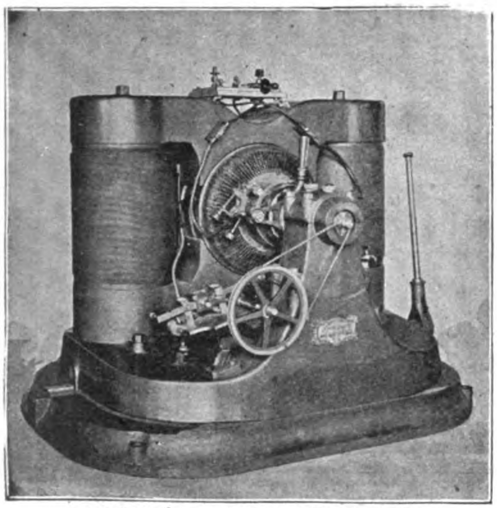

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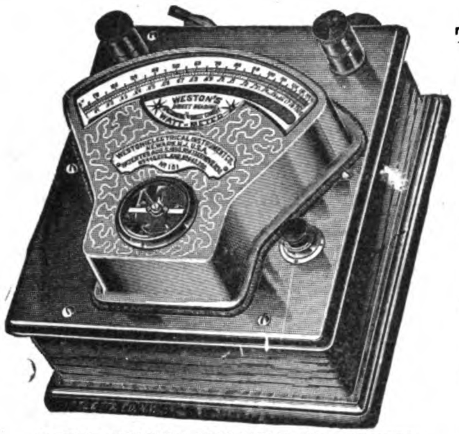

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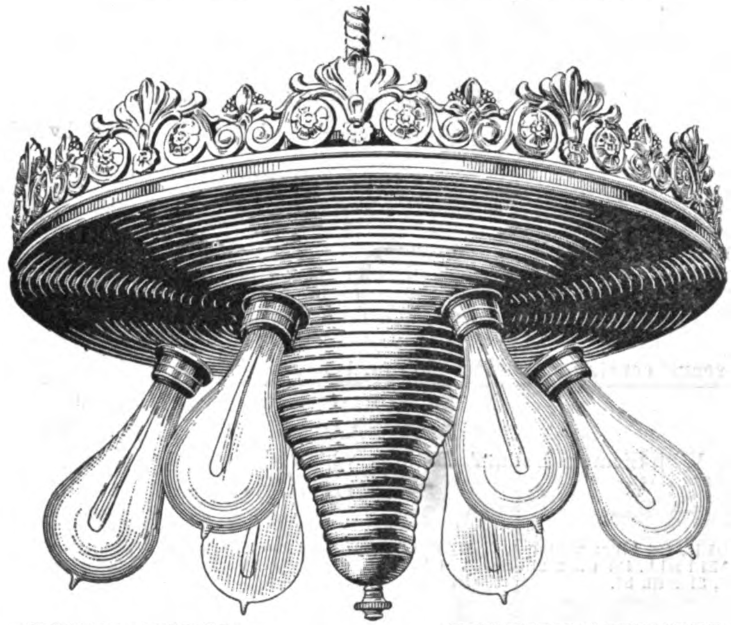

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EDITORIAL NOTES.

Resonance in Alternating Current Lines. The electrical fraternity are much indebted to Mr. A. E. Kennelly for the clearing up of many dubious points in regard to impedance, which he so ably accomplished in a paper on that subject read before the American Institute of Electrical Engineers on April 18, 1893. That paper indeed was a most noteworthy event in alternating current literature, and brought a subject of which the majority had little definite knowledge within the grasp of all. So full and complete and clear was this paper that although much progress in the way of simplification of other branches of knowledge in the alternating current field has been made during the two years that have elapsed, scarcely anything has been added in the line of this paper. Since that time, however, a growing interest has been aroused in the phenomena of electrical resonance, in which field Dr. Pupin in this country, and Rayleigh, Thompson and others abroad, have done pioneer and valuable work.

The commercial value of these phenomena is realized when it is understood that the possibilities of extending the efficiencies of submarine telegraph and telephone cables, and the attainment of a more economical light, seem to rest upon their intelligent application. But the greatest theoretical interest in electrical resonance was aroused by Hertz's great work, which was epochal in experimental physics and linked his name with that of Fresnel, Carnot and Clifford, and identified the science of electricity with that of optics. In fact, Hertz's work was but the sprouting of the seeds sown by Faraday, Kelvin, Helmholtz, Maxwell, Stokes and Weber.

The more practical applications of these phenomena, however, have remained for the present time and the future, and with a better understanding of them the growth of science in this direction will be much stimulated.

The paper on "Resonance in Alternating Current Lines," by Messrs. Houston and Kennelly, read before the Institute at the April meeting, was therefore most timely. In this was given a most exhaustive analytical treatment of the phenomena in question which is likely to give it a rank on the same plane with Mr. Kennelly's paper on Inductance, already referred to. The paper, while clear to those versed in the technology of electrics, is too long and too technical for reproduction in these columns, and readers desiring to go more deeply into the subject are referred to the Transactions for the full paper.

The object of the paper as stated by the authors was:

(1) To present the formula expressing the variation of electric current and pressure in an alternating current circuit under the most general conditions, and in its simplest form.

(2) To present calculations for the pressure and current in any alternating current circuit by a graphical method.

(3) To investigate the effects of static capacity in an alternating current circuit.

(4) To investigate the effects of capacity and inductance on the delivery of energy at the distant end of a circuit.

And their conclusions as summarized were:

(1) The combined effect of capacity and inductance is to produce a tendency to resonance.

(2) The tendency to resonance is favored by high frequency, high insulation, high inductance, high capacity and high conductance.

(3) When the line is free at the distant end, the resonant effects are more pronounced at that end than at the generator.

(4) The determining factor for the production of resonance is the angle of the vector geometric mean C. I. D. A., and rapidly increases with the same.

(5) The complete wave-length in a resonant line is 2π times the length in which the reactances of the inductance and the capacity are equal, the maximum difference of pressure or current strength being exhibited in one-quarter of this wave-length.

(6) When resonance occurs, the current and pressure in the circuit are not in phase except at their maximum and minimum values, i. e., at the crests and troughs of the waves.

(7) In resonant circuits, the lag of the pressure and current is 90 degs. between any successive pair of maximum and minimum values.

(8) In ordinary lines, worked sinusoidally at ordinary frequencies, resonant effects are practically negligible.

(9) Prominent upper harmonics in the E. M. F. of the generator may sometimes give rise to appreciable resonant effects, although the resonance to the fundamental frequency may be inappreciable.

(10) A certain amount of capacity tends to increase the plant efficiency of the generator, and is therefore economical, but marked resonance in a line not only ceases to be economical, but is actually wasteful.

(11) Although, on a large scale, less energy can be delivered at the distant end of a powerfully resonant line than on a non-resonant line, yet a greater current strength can in some cases be delivered over a powerfully resonant line.

* * *

Hous-Kennoolyism Run Wild. Much as we are inclined to praise the substance of the paper and the exhaustive manner of treatment, we cannot refrain from criticising in the severest manner the language used. The paper was made the occasion of exhibiting in its most offensive form an aggravated type of Hous-Kennoolyism. It is very much regretted that two men whose personal and scientific qualifications so fully entitle them to the respect and honor which are everywhere accorded them should seek a cheap notoriety by striving to force down the throats of an unwilling public so many new words. This is not a new offence by any means, but to the contrary, has been repeated so often as to require the coinage of a new word for its proper designation. And this new word, which has already gained acceptance, is "Hous-Kennoolyism." Prof. A. G. Webster, of Clarke University, who took a leading part in the discussion of the paper, thought it necessary to animadvert rather severely upon this puerility or senility (whichever it may be), and if outward manifestations are a fair criterion to judge by, his remarks met the approval of the audience. He certainly made Mr. Kennelly appear in a very ridiculous light, and it is not too much for his friends to hope, as they *do* hope, that he will not again indulge in the illegitimate coinage of offensive words. The termination *ance*, has long been a favorite with Mr. Kennelly, and in this paper he freely used such terms as *susceptance*, *admittance*, dielectric-admittance, etc., etc. The term *mho* was also used as an accepted term, and the hyperbolic functions were given strange and weird names, which made us shudder, but

> "Strange things come in with the tide in the ungodly hours of the night, and in the stillness of the night strange things follow them."

Thus the hyperbolic tangent written *tan*h, was pronounced *tans*h, and the strange thing following this was the attempt to pronounce *sin*h in the same way, but without the sibilant. The hyperbolic cosine written *cosh* was pronounced as written, but everyone felt that by a typographical error the initial letter had been changed from a *g* to a *c*, and that it should read *gosh*.

A new symbolism was also at times introduced, which may have been, and doubtless was, satisfactory to the authors, but was unintelligible to their audience until translated and explained. We think this is Hous-Kennoolyism with a vengeance, and we hope that it has been made so obnoxious in this paper as to prevent its repetition.

* * *

Raising the Load Factor. It is now pretty generally understood that the discrepancy between what the electric light costs and what it ought to cost with the means at our disposal is due to the load factor of the station. Electric light men realize that if they could but employ their machinery to advantage they could produce light at but a fraction of what it now costs, and that it is the load factor of the station and not the machinery that requires improvement. Mr. H. Ward Leonard called attention to one way of accomplishing this improvement, which involved a charge for service increasing rapidly as the customer's load factor decreased. This sliding scale of charges has been tried in a number of instances abroad and the results will prove of interest whenever they can be obtained. In this issue we reprint from the *Electrician* an article by Mr. Arthur Wright, which not only gives the results of the adoption of this system by the Brighton station (London), but also gives some valuable suggestions drawn from experience, which our central station men will find interesting and instructive reading.

* * *

The Situation. Some of our esteemed contemporaries of the daily press affect surprise at the game which has been played in Wall Street during the past sixty days with G. E. stock. The stock was advanced ten points upon the report that a deal was in progress between the Westinghouse and General Electric interests, and has now lost five points upon the fact that such trade is not officially confirmed. It has not declined upon the announcement that the trade was off, because there has been no such announcement from any man in position to know, who has made any statement over his own signature.

Until such statement is made ELECTRICITY will refuse to believe that a trade has not been made. Wall Street may be fooled, but not so ELECTRICITY. We may stumble, but we never tumble. Closely in line with our information that the trade is as much alive as ever comes the well-authenticated rumor that a new issue of securities is to be put out by one of the companies. What they can cover to make them salable the Lord only knows, but that it is intended to issue them we fully believe.

It would be idle to consider in detail a subject of this nature until the world is more fully advised.

The trade is in a state of ferment; every man in the business with head enough to think is on the anxious seat, and our mail contains dozens of letters asking for private information and what our policy will be in certain contingencies.

Of the latter there ought to be no doubt. We shall continue to fight for the purification of the business, the banishment of stock-jobbing methods from any or all companies, for the end of bribery and corrupt methods in the sale of goods, for the general revolutionizing of the entire trade, until the invested dollar of the honest man will have as good a chance as that of the trickster. We shall oppose and criticise everybody and every company who stand in the way of the revolution which ELECTRICITY started in 1892. We will continue to show to stockholders that their money has been wasted by rogues who ought to be behind prison bars; that the hundreds of thousands spent for bribery had not even the justification of being applied to the corrupt purposes intended, but often remained in the pockets of officers and others trusted in the management; we will show them that their interests have not been considered, that unearned dividends have been paid to humbug them, that while their business was being conducted at a loss the rings of insiders have made fabulous amounts of money in stock-jobbing operations.

This and more we will continue to do, and nothing can stand in our way. No combination could intimidate us, and none can be formed which cannot be exploded in six months. Money must be raised for all such schemes, and ELECTRICITY may be relied on to knock the underpinning out of any one, either present or to come, before it has much success in this line. The curse of the business from the start has been the swindling of investors by specious misrepresentations and the utter disregard of investors' rights. These features are gradually dying out, and the sooner they are killed the better. That they are not dead is evidenced by the attempt now being made to float millions of securities by a storage battery concern which cannot hope to pay a 1 per cent. dividend on its capitalization in ten years except directly from the sale of stock, and by numerous less prominent examples of the same old idea. It is kept perpetually in sight by such disreputable games as have just been played in G. E. stock, and is emphasized by the fact that while the public were being scorched at the rate of $50,000 to $100,000 a day not one director of either the G. E. or Westinghouse Company has had the moral courage to come to the front with the truth and stop the robbery. And while the insiders are fattening, the money of the stockholder is disappearing, goods are being sold at a loss; while the lying claim is made that the G. E. Company's next statement will show a profit of $1,800,000, the price of incandescent lamps is reduced to a figure ensuring a loss of three cents on every lamp. But enough. The electrical industry is established to stay. There is demand enough to make a fair profit for every man engaged and every honest dollar invested in it.

The way to place it upon a sound commercial basis is not through stock-jobbing combinations, but through the extermination of those who have bedeviled it.

* * *

Opportunities in Electrical Engineering. During the past year or more much has been written on the subject of the prospects afforded the young man by an electrical career. The subject has been presented in both a favorable and an unfavorable light, but perhaps the *best written* articles have presented the view that the electrical profession was already crowded and offered little inducement in the way of emoluments to those about to enter. Some of these have been decidedly pessimistic in tone, and were it not for the recognized standing of their authors, which would preclude such a thought, would be open to a much harsher characterization. Contributions of this character have appeared in the columns of a number of our contemporaries and also in the daily press and have been widely copied and commented upon. We have read all these with feelings of pain, and are glad to present and to commend to our readers the paper by Prof. Atkinson, which presents a view more fully in accord with our own and the facts as we believe them to exist. We would, in fact, go considerably further than our contributor and say, not that an electrical career presents to-day as many opportunities as other careers, but that it presents far more. We think that one not acquainted with the situation would easily come to this conclusion from Prof. Atkinson's own arguments, and one only needs to be familiar with the situation to know that his arguments are based on facts. We think this present presentation of the case is by far the fairest and most reasonable one that has as yet appeared, and trust that it will be widely read and thoroughly digested.

Under the Searchlight.

Views and Opinions on Timely Topics.

Edison licensees are now buying Edison 16 c. p. lamps at 13 cents net.

* * *

Electricity will send the address of an A 1 station manager seeking a situation to any one having a place for him. He is one of the old-timers, and ought to turn a losing station into a paying one if he had the chance.

* * *

If a grand jury were to investigate the connection of the G. E. Company with Brooklyn railroad matters and with the St. Johnland lighting plant, the chances are ten to one that C. A. Coffin and one or more of his subordinates would land in the penitentiary. Work so dangerous and so corrupt, in the procurement of franchises, that even the railroad men themselves were afraid to do it directly, was cheerfully done by Mr. Coffin's henchmen, the G. E. Company having made a flat bargain to handle the bribery business in exchange for a sure thing on the contract for equipment. These facts are susceptible of proof. The man who left Boston with $65,000 sewed in the lining of his vest, reported to Mr. Coffin in New York, then went to the New Jersey side and paid out the money, would not be hard to locate, even now. Besides, there are others.

* * *

It is believed that the G. E. statement will contain a proposition to scale down the stock one-half, including the preferred. Of course the latter *can not* be scaled down, but it is argued that a proposition to do it will frighten the ignorant, and that there would be a chance for a ten-point movement down, and up again to somewhere near par.

* * *

The largest claim now made for the G. E. gross business for the last year is $12,000,000. This is $3,000,000 too high. A "profit" is claimed of $1,800,000, while the actual loss on manufacture and sales has been over $900,000, to say nothing of shrinkage.

* * *

We suppose we may now have a little peace. Brother Johnston has given up killing his distinctly electrical contemporaries, and will now take a few rounds out of the *Street Railway Journal and Review*. We shall enjoy it, and so will he, while his money lasts.

* * *

Profits are Not Considered.

(From the U. S. Investor.)

The control of the [G. E.] company is in the hands of New York bankers, who have delegated Mr. Ord to exercise the active management.

We are credibly informed that the one aim of the company now is to convert everything into cash. Prices are utterly demoralized, we are informed. It is intimated that the prospect of obtaining cash will cause the management to sell at less than cost. Repeated instances of this sort of thing have been brought to our notice. The company's competitors do not know where they stand, for the reason that prices are forever shifting.

Can the General Electric Company seriously contemplate remaining in business any length of time with this policy?

ANOTHER ELECTRO-MEDICAL FRAUD.

The Earth-Magneto.

Some weeks since, the editors of Electricity received a circular announcing "The Greatest of all Electrical Discoveries," the so-called "Earth-Magneto," which claims to be "purely scientific" and warranted to cure a lot of human diseases "in one night." The circular states that the appliance "stands by itself, unrelated to any electro-medical batteries or appliances the world has ever produced; has three separate and distinct electrical actions upon the body—galvanic, static, magnetic," and that "by the combination of these actions an effect is produced upon the body which cannot be produced by any other electrical appliance or medical machine in the world."

The circular concludes as follows:

"In order to prove the value of our invention we will do what no makers of electrical batteries or appliances have ever dared to do. We will prove the truth of our statements. We will deliver at your residence on three days' trial, FREE FROM ANY COST OR EXPENSE, one of the Earth-Magnetos with full directions for using."

Availing ourselves of this kind invitation, we sent for one of the instruments for investigation and in due time it was delivered. It is still in our office awaiting the orders of the Earth-Magneto Company of 61 East 12th street, New York, who are the promoters of the scheme.

Upon opening the package we found a very handsomely gotten-up mahogany box 8 inches long by 3⅝ inches wide and 5⅞ inches high, closed with a metal clasp. Opening the box we found the binding posts, etc., in nickel—the whole being very attractively arranged. There was a little switch by means of which the current could be turned on; there was a little compass and a mother-of-pearl push button by which to indicate whether the Earth-Magneto required recharging or not; there were two binding posts to which the electrodes were to be attached, and another one by which a third wire leading to the ground could be attached, and a very pretty nickel-plated permanent horseshoe magnet, worth ten or fifteen cents in the open market.

On the inside of the lid were the following

DIRECTIONS:

1. Open the box and take out the *Electrodes*.

2. Connect the *tips* on the ends of the cords to the Binding Posts.

Each Binding Post is marked respectively P, N and G, meaning Positive, Negative and Ground.

On the tips of each cord there is a corresponding letter, P, N and G.

Connect the tip marked P to the Binding Post marked P.
Connect the tip marked N " " " " N.
Connect the tip marked G " " " " G.

3. Turn the switch until the blade rests on the button marked ON.

4. Place the box on the floor or stand near the bed or couch.

Attach the long single wire attached to Binding Post marked G to either the gas fixture or water pipe, which substitutes a conductor to the ground.

In case of not having gas or water pipes in the house an additional wire will have to be run to the ground.

The Earth-Magneto is then ready for use.

Place the electrode marked P on the wrist.
Place the " " N " ankle.

Keep the electrodes on all night. In case of being used during the day, leave them on at least *ten hours*.

Always turn off the switch when not using the Earth-Magneto.

By pressing the pearl button, it will cause the hand on the dial to point in an opposite direction.

When the hand fails to show any movement or vibration upon pressing the button, the Earth-Magneto will then have to be re-charged. This can be done by sending the Earth-Magneto to the Laboratory of the Earth Magneto Co., where it will be re-charged at the cost price, which is One Dollar.

The Earth Magneto Co., 61 East 12th St., New York.

Our curiosity being aroused as to how the instrument operated we took off the bottom of the box so as to get at its internal mechanism. Nicely packed in excelsior, we found a cell of Mesco dry battery with two wires leading from one pole and three leading from the other, the accompanying cut representing diagrammatically these connections and their relations to the fixtures on the face of the instrument. It will be seen that the carbon and zinc elements are connected with the binding posts P and N through a switch which, when in the position marked ON, connects the electrodes, so that when the latter are applied according to directions the battery circuit is closed. There is also a second circuit, as shown, which may be closed by pressing the push-button marked K. In this latter circuit is a small electro-magnet, marked E M, so situated with regard to the little compass marked C that when this local circuit is closed the magnet being energized will deviate the compass needle.

The fifth wire runs from the zn. pole of the battery and is electrically connected through the permanent magnet and its armature to the binding post G by which an earth connection may be made. It will be perfectly evident from the diagram that this last connection can have no possible effect upon the battery current and is simply introduced for purposes of mystification. It will also be perfectly evident that this appliance, which is sold at $15, is nothing more nor less than a simple galvanic cell, attractively housed-in and given convenient connections. The Mesco cell, which is a good one, can be bought anywhere at retail for 35 cents, and anyone desiring to avail himself of the peculiar virtues of the Earth-Magneto can do so by investing 35 cents or half a dollar in any good galvanic cell, being sure of obtaining all of the results possible from the higher priced box and have $14.50 left over for charity.

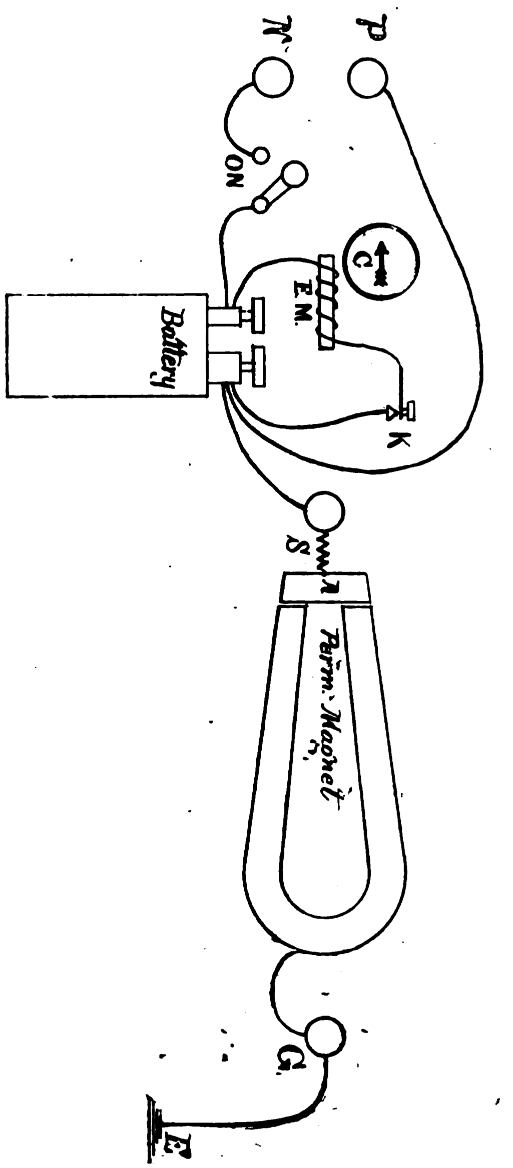

Diagram of Earth-Magneto Connections.

The fraud in this case, as in many others, lies in the gross misrepresentations made as to the merits claimed to be peculiar to the Earth-Magneto. The only peculiar thing about it is the name, which implies something which does not exist.

OPPORTUNITIES IN ELECTRICAL ENGINEERING.

BY A. A. ATKINSON.

Papers have frequently been published in the electrical journals deprecating the over-popularity of the electrical business in its various phases, claiming that the profession is already overcrowded, and upon this ground offering discouragement, sometimes in very strong terms, to the aspiring engineer. Among those in mind who have written in this strain are Mr. Henry Floy in the *Electrical World* a year ago, and Mr. James B. Cahoon in *Electric Power* quite recently. The latter, however, had special reference to factory courses.

It is only fair, of course, that an attempt be made to present the other side of the question. To this end this paper is written. For I cannot help seeing much encouragement in the outlook. Everything considered, I find electrical engineering in the broad acceptation of the words, if not on a flattering, at least on a very favorable basis as compared with other professions in regard to attractiveness, educational value and money return. In this it will be apparent that I am not at all Malthusiastic. I believe there is room and to spare.

Why should young men be discouraged from preparing themselves in a business and an electrical way to take charge of lighting stations and power plants, or any other practical applications, "because the growth of this business is not likely to be either sudden or rapid, or the opportunities offered particularly brilliant"? Should we say to the young man that has the aptitude and inclination for something else, "stay on the farm, or in the shop, or in the store at $25 or $30 a month, because if you go into the electrical business, for instance, you cannot get more than $40 to $60 a month"?

Is it any more of an argument for the opposition to state that "the electrical railways at present do not seem to appreciate the need of trained men, and most of them are satisfied with their horse railway superintendents who have picked up enough of electrical information to make the cars run whether a dividend is paid or money sunk"? The statement refutes itself, for it certifies to the very conditions that do demand the right kind of men. Let the men proper prepare themselves and prove their necessity to owners of electrical stock. The only reason that such a condition exists is on account of the paucity of the men who are able by training to bring the business out of its present status. These and similar positions are not open to the merely technical and high-priced theorists. They belong to those who have been advised in the course of their instruction of the exact conditions and practically prepared for what *is* not taught to expect big salaries and find or make positions to suit them. One of the things I also believe that often cast discredit upon the value of a college preparation is the lamentable failures of some technical graduates in attempting to manage practical electrical matters. And these conditions are not at all fanciful. Just such bad management is very easy to find in lighting and in power transmission in all too many places. Just these conditions are the argument for better men trained for the right thing.

I grant that there are too many who enter the profession with the purpose of "making their mark"—just the kind that are most apt to meet with failure. But as much can be said of any profession under the sun. I believe, also, that as the term "electrician" ought to be understood—not the electric bell and annunciator fiend—but few are needed. I grant again, that many applications are being refused by manufacturing firms—they, themselves, even failing and going out of business. Granted, that many classical graduates enter engineering schools to swell the ranks of that profession. All this admitted, I still contend that there are abundant opportunities for the pushing men who understand their business. Leaving out of consideration for the present the character of the positions offered in the various lines of professional and practical work, and looking only at the numbers studying for engineering in one or two instances, I know personally that in one or two institutions whose catalogues were quoted by Mr. Floy to show the great number of students of engineering, at least six to eight times as many are at the same time registered in the law departments alone, to say nothing of the medical and other professional departments, aside from the single professional schools in cities everywhere. Even if we should admit that only one-eighth as many men are required in the varied lines of electrical work as in the legal pursuits, still we are on favorable ground, with not the least reason to deprecate the number.

The value of the electrical engineer, and hence his success in the business undertaken, will depend on three things: namely, natural ability and aptitude of the individual, the character of his course of training, and the general view of the situation with which he leaves college. And this will lead us to consider the relative advantages of a purely technical and a practical education. Of course the third condition of success may result from either of these. But before undertaking either course the individual must satisfy himself by a study of his proclivities, so to speak, whether he has any ability and inclination in the direction of electrical engineering. He need not enter the profession for money or fame if he does not like to work out the course, practice and theory almost as well as to eat. Certainly, if he study only for the mental discipline and for a personal knowledge of the subject, this would not be true to the same extent. Or if his desires run toward business, law, medicine, sport or idleness, he will not succeed as an electrical engineer. But supposing that we have to deal with those only who should properly be engineers, so far as opportunties in life suggest, what kind of course shall be selected?

There has been a great deal said by way of discussion as to whether it will be most in accord with the fitness of things to educate the student along broad and general lines as a basis, and allow him afterwards to specialize in any direction he may wish, or to train him directly in the applications with which he must have to do, only giving him enough of the technicalities to serve as a basis for future work in case he should have the opportunity or inclination to pursue such a course. These may properly be classed as technical and as practical courses. In other words, I shall call technical that course of study in which are included a rigid course in higher mathematics, advanced mathematical physics, the higher mathematical theory of electricity and much mechanical engineering. These fill up most of the first three years of the course. The fourth is devoted to laboratory work in measurements, dynamo tests, engine tests, lectures on the telegraph, turbines, heat engines, and finally a thesis. The entrance to such a course generally requires of the student qualifications such as would admit him to the freshman classes in any literary or scientific course. On the other hand, I shall call practical that course of training in which the mathematics, physics, chemistry and mechanical training all look toward the engineer in practice, and which includes such parts as will be directly available for him in his everyday work, leaving the refinements for his own individual filling in afterwards, instead of teaching him the refinements and sending him out to fit some of it, if he can, to whatever application he may.

By way of further suggestion of the distinction from the purely technical, let me say that the practical course will include lectures and practice in wiring for the various kinds of distribution for lighting and power; calculations for alternating and direct current wiring under various conditions; the theory and application of electricity for railways, stationary power, lighting purposes, including the modern types of machines, direct, alternating and polyphase; designing and calculations for the winding of dynamos and motors; theory of steam with practical instruction in the care and operation of boilers and engines, dynamos and motors. His knowledge of lighting and power distribution will be enlarged by model plans and specifications drawn up by him to meet certain requirements in railway and central and isolated station work. More and more detail will be required in this as the student progresses until he is able to draw and specify for actual work. We could go on further in contrasting the two lines of study, but it will be apparent to almost any one stopping to give the matter any consideration what their distinctive features must be. The one a very general basis upon which any application may be built by a sort of second experimental training, while the other is intensely practical in all its aims and work. The one may develop the theorist, the electrical investigator, the electrician; but even here real practice in the bone labor of the profession would be of much benefit. The other will produce the artisan, the superintendent, the installing and consulting engineer. So that, assuming in both cases that the student has been apprised of the difficulties and necessities—in short, the real situation confronting him—in order that he may not go out with puffed or false ideas, each course prepares for a different line of work. Of course the one line may develop afterwards into the other.

(*To be continued.*)

Extraordinary Accumulator.

Our contemporary *L'Industrie Electrique* has actually unearthed from the columns of a French medical journal a brilliant accumulator, which it has added to its "Old Curiosity Shop.' But let this specimen speak for itself; it would be a pity to destroy the lucidity and scientific accuracy of the text:

"The new pamphlet concerning the accumulators is on sale at our offices, where our Paris readers can obtain it by sending one franc. Nothing has been neglected theoretically to explain clearly the object and advantages and to give readers the most detailed explanations about this new apparatus. Our experimental batteries have given such results that we have no hesitation in stating that we have ourselves been surprised at the quality of formation and duration. The accumulation increases, so to say, at a glance. One of the things which have most surprised the engineers who recently witnessed the erection of the accumulators is their immediate working, even before being charged with electricity. In effect, their sole manufacture contains the necessary materials for the production of electricity; this, notwithstanding all ancient theories, constitutes a powerful grate of reconstitution struggling against the losses of fluid. Nevertheless, we have desired to leave nothing to chance and reckon even for that loss which seems every day to become less." As the Brothers Griffiths would say, "Chose extraordinaire." We would recommend this masterpiece to the conductors of *Tid-Bits* or *Answers.—The Electrical Engineer* (London).

[We respectfully call Mr. Herbert Lloyd's attention to this, also.—ED.]

THE VARYING COST OF ELECTRICITY SUPPLY.†

BY ARTHUR WRIGHT.

After Mr. Ward Leonard's very clear exposition of the intimate relation of the load factor to the ~~cost~~ of supplying electricity, it may interest your readers to learn how this cost actually varies in practice according to the number of hours per day the consumers use their demand on the generating plant, and some of the results obtained at Brighton after two years' use of a sliding scale based on this relation.

That the main object of the adoption of the system at Brighton, viz., the improvement of the load factor, has been attained, is most readily seen from the curve (Fig. 1), where the upper line represents the various monthly load factors after the system has been in use for some considerable time, and the lower curve the load factor for the corresponding months before the system was introduced.

By monthly load factor I mean the ratio of the electricity actually registered by the consumers' meters to that which could have been sold had the greatest rate of consumption from the mains been maintained for 24 hours per day during the whole month.

In a rapidly-growing undertaking it is evidently difficult to ascertain the actual annual load factor, but the following figures will show in a striking manner how much better use is now made by the customers of the capital laid out in plant and mains than before the adoption of the system :

—	Uniform charge, 1892.	Sliding scale, 1894	Improvement since adoption of system.
*Annual sale of electricity per maximum kilowatt taken from the mains	711 units	888 units	Nearly 25 per cent.
Revenue derived per maximum kilowatt.	£20 14 0	£22 14 0	About 10 per cent., although average price obtained had fallen more than 12 per cent.

The true value of the fact that the sale of electricity has nearly quadrupled since the adoption of the system, while the maximum load observed at the generator station has only increased threefold, will be appreciated by the commercial station engineer when he remembers that, in stations of about the capacity of that at Brighton, that part of the annual expenditure which, in a given station, is independent of the sale of electricity, is generally 80 per cent. of the total expenditure.

Another object of the sliding scale has been attained, viz., to get the electric light introduced into basements, kitchens and other places, which, under the uniform system of charging, would be the last to be so lighted. This is shown by the fact that the average number of units consumed per lamp installed has increased from 19·5 to 22·45, or 15 per cent. This, I need hardly point out, is the reverse of the general experience elsewhere.

It will now be interesting to compare Mr. Leonard's table of the estimated proper charges for electricity on the sliding scale system to the figures which I have reason to expect will represent the cost of supplying it from the Brighton station in the present year, and with the present tariff, based on the use of one hour per day of the consumers' demands being charged at 7d., and the remainder at 3d. By consumers' demands I mean their greatest call made on the generating plant and mains, as measured by a maximum recording indicator:

Consumers' load factor.	Average hours use per day.	The probable cost of supplying electricity from the Brighton station in 1895.	The average charge at Brighton in 1895 per unit.	Mr. Ward Leonard's suggested tariff.
		d.	d.	d.
5	1·2	6	6·32	13
10	2·4	3·5	4·66	10
15	3·6	2·66	4·12	8
20	4·8	2·25	3·83	6½
30	7·2	1·83	3·56	5
50	12	1·5	3·33	3½
100	24	1·25	3·16	2

In order to arrive at the varying cost of supplying consumers who use their maximum demand on the plant for varying periods per day, it is necessary to find out how much the standing charges will amount to in the year; this, in a station having supplied electricity for more than two years, can be fairly accurately ascertained, as also can the approximate cost of supplying the electricity after everything has been put or placed in readiness to do so. The next item necessary to know is the sum of all the customers' demands in kilowatts the station with the existing plant and mains will safely supply while retaining a proper margin in reserve. The standing charges per day, divided by the total kilowatts severally demanded by all the consumers, will give the actual daily charge per kilowatt demanded that must be made to just cover the standing charges. This, in addition to the running cost per unit, gives the only possible basis for ascertaining the actual costs of producing electricity in accordance with the true Hopkinson principle.

In the year 1895 these figures for the Brighton station are estimated to work out at the rate of 6d. per day per kilowatt demanded, and 1d. for running costs.

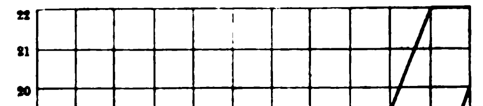

FIGURE 1.—IMPROVEMENT OF MONTHLY LOAD FACTOR.

While granting that the above is the true theoretical basis on which the charge for electricity should be made, I recognized in 1884 the fact that the more popular way of carrying out its principles would be to charge a high rate per unit consumed until each consumer's proper proportion of the standing charges had been met, and after that to make a considerable reduction, and I still think the highest admissible rate per unit should be maintained as long as it is necessary to cover the standing charges, plus the costs for running for that time. Until these costs are covered, obviously no profit can be made or reduction equitably allowed.

The estimated figures for Brighton in 1895 show that these costs will be about met by the consumers using their demand on the average one hour per day, and paying during that first hour 7d. per unit. After this time it can be fairly assumed that the cost of supplying each unit will not exceed 1d. As the highest allowable rate at Brighton is 7d. per unit, it follows that no profit can be made on consumers who only use their demand one hour per day, and that the actual loss incurred in having to supply those consumers who do not average one hour per day has to be unfairly met by charging the profitable consumers a greater rate of profit, and for this reason it has been decided that in 1895 all electricity consumed after the first hour is to be charged at the comparatively high rate of 3d. per unit. The fact that there can be a loss in supplying some short-hour consumers at 7d. per unit from a large station will be clear when it is recognized that if it were not for some 18 per cent. of the present consumers, and who only use the light at all about three months in the year, or less than one hour per day on the average, our present plant, station and feeders could go on supplying the increasing business for one or two more years, whereas, owing to their existence, it is necessary to put down fresh plant this summer for the ensuing winter's load, which could be entirely dispensed with for nine months in each of the next two years.

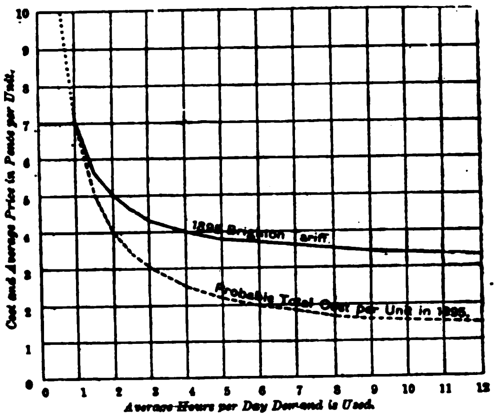

FIG. 2.

The curves in Fig. 2, illustrating the estimated cost and the present tariff, demonstrate how rapidly the cost of supplying electricity at Brighton in 1895 will diminish with the lengthened use of the plant, and how the 1895 charge actually varies with the lengthened use of the consumers' demand.

As there are only two real divisions in the items constituting the cost of supplying electricity, viz., standing and running cost, it may be well to remind the readers that it is therefore only necessary to have two rates of charge for the supply in order to obtain a perfectly equitable form of sliding scale of rebates, and that this involves hardly any more clerical work than does a uniform price system.

I am inclined to think that the fact that Brighton probably is this year the record station, both for lowest cost of production and greatest sale per inhabitant, is in no little way attributable to the "sweet simplicity" of the sliding scale used, and the adoption of Prof. Kennedy's suggested demand indicator.

Too much importance, in my opinion, cannot be attached to the superiority of a sytem giving rebates based on a consumer's actual use of the generating plant and mains, over one based on the more or less prolonged use of all the lamps installed. The former, if properly understood, actually encourages the general use of the electric light in a house, whereas the latter must necessarily have the reverse effect, and, moreover, is not based on any sound principle, as the preponderating standing charges are not altered in any way by the proportion of the total number of lamps in a house that remain unlighted.

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† *The Electrician* (London).

* The meaning of this expression may perhaps be clearer if I explain that the figures given are arrived at by dividing the kilowatt hours sold by the greatest demand (in kilowatts) experienced at any moment. The improvement of the 1894 figure over that of the 1892 figure is an evidence that the average demand and the maximum demand have been brought more nearly to coincidence.

The following figures, obtained by means of the demand indicators, may be of service to central station engineers, and as they are derived from the records of nearly 1 000 customers, may be taken as fairly representative of any average town :

—	Less than one hour per day.	More than one and less than two hours.	More than two and less than three hours.	More than three hours.
Percentage of consumers who use their demand on the average.	13·6 %	38·6 %	32·1 %	15·8 %

Fromthis and the previous table of the 1895 Brighton tariff it will be seen that nearly 50 per cent. of the consumers will pay about 5d. per unit, or actually less tor electricity in 1895 than for the equivalent amount of Brighton gas, taking 1,000 feet of this as being equal to seven units of electricity.

UNDERWRITERS' RULES.*

BY WILLIAM A. ANTHONY.

A recent controversy in relation to inside wiring for incandescent lighting has suggested to me the importance of bringing out a full and free expression upon the subject from those whose experience gives them the best right to speak; and I venture to bring the matter before the Institute in the hope that it may provoke such an expression as may have some influence in determining the character of any changes in the rules for construction that may be proposed, or in fixing the interpretation to the rules now in force. The present rules are, of course, the result of a process of evolution, and I think every one will admit that the process has been one of progress. In early days of electric lighting, the desire to conceal the wires led to fishing them in between floor and ceiling and between plastered walls, as has been done with electric bell and burglar-alarm wires. Fires occurred, and were ascribed to the electric wires, sometimes rightfully, but no doubt sometimes wrongfully.

Insurance companies took up the matter, passed rules and appointed inspectors. Many of the rules were good, some were only an annoyance to the construction companies. Different boards adopted different rules, and often the inspector was a law unto himself.

Wishing to assist in securing uniformity, and feeling that electrical engineers, who have to do with the practical work of electrical installation, are best qualified to frame rules for electrical construction, the National Electric Light Association, in 1890, appointed a committee to take the matter in hand, and upon the report of this committee, in 1891, adopted a series of rules, which, with some amendments adopted at later meetings, may be assumed to represent fairly well the consensus of opinion among the electrical fraternity as to what constitutes a safe electrical installation.

Rules, substantially the same as those, have been adopted by the National Board and various local boards of fire underwriters, and are the recognized rules in force at the present time.

The object of all rules is, first, to secure a safe and permanent installation; second, to provide for the repair or renewal of conductors in case of failure. It may be said that from the standpoint of the insurance companies the first is the only object, but surely conductors so installed that they can be easily overhauled and replaced in case leakage is discovered are safer for the very reason that a fault is likely to be repaired before any serious damage has occurred.

When highly insulated wires, whose insulation resistance was measured in megohms per mile after immersion in water for weeks, came into use for electric lighting plants, it was natural to suppose that they could be put anywhere, and would last indefinitely. They were put in all sorts of inaccessible places—on the beams before floors were laid, in partitions before plastering, on the lath with iron staples to be covered with mortar. Some such circuits are no doubt in existence to-day as perfect in insulation as when first put up; but numberless cases of failures of insulation occurred, and experience shows that such a construction is entirely unreliable. Then came the interior conduit, which it was assumed would serve both as a mechanical protection and as an insulator, but it was found not to be entirely reliable in either capacity. It was not impervious to moisture, it was subject to damage by nails, saws and chisels. It was found necessary to prescribe that wire of the highest insulation should be used in it, and that it should not be drawn in until all danger from mechanical injury was passed. Then came the brass-armored conduit; but that was not nail proof. Now we have the iron armored conduit, and it remains to be seen whether this will fulfil all requirements.

It has come to be pretty well recognized that no mode of electrical construction is absolutely proof against failure at some point, and that form of construction is best which affords the smallest chance for injury or depreciation, and offers the greatest facilities for repair or renewal in case of failure. There has been a uniform progress in the direction of greater safety and better facilities for repair, from the time when wires were put anywhere, to be covered by floors or mortar, or built into brick walls, to the iron-armored conduit which is offered to-day. To be sure, the cost of the installation has advanced, and the iron-armored conduit presents difficulties when alternating currents are employed. To me it seems that the advantages gained are worth the cost, and the difficulty with alternating currents disappears if the two conductors are placed in one conduit. To this I can see no possible objection when the conduit is iron armored.

In view of the fact that we cannot be absolutely certain that failures in insulation will not occur in any given installation, it seems to me that the foundation principle of all rules for the placing of conductors should be accessibility. Further, no conductor should be placed where its position or its relation to other conductors in any part of its length is unknown. This means that raceways must be provided, into which conductors may be drawn and from which they may be removed at pleasure, such raceways to serve as adequate protection from mechanical injury; or the conductors must be placed in moldings which are themselves accessible, or they must be supported by cleats or insulators in plain sight.

I believe that past experience would warrant the adoption of a rule that would require the use, for concealed work in buildings of fire-proof construction, where conductors must be carried up steel columns, over steel floor beams, in brick partitions, or in plastered walls, of a raceway or conduit, equal in its ability to afford mechanical protection to that known as iron-armored conduit, so installed that conductors could be drawn in or out at any time.

And now a word as to the controversy that suggested this paper :

A conductor has been put upon the market which consists of a standard Habirshaw wire with its covering of rubber and braid, having woven upon it two additional coverings of extra heavy braid. This additional covering, which is tightly woven on, and from which the wire can no more be removed than from its original covering of rubber and braid, the maker, by an extraordinary stretch of language, calls a tube, and claims for it the advantages of the conduit tube prescribed in the insurance rules. It goes without saying that this wire affords no means of replacing a damaged conductor, and therefore has not that advantage of the conduit. As to mechanical protection, it certainly is not superior to the unarmored conduit, and it has not the advantage that the conductor can be left out until the danger of injury is passed. As to insulation against moisture, the added coverings do not improve it, the insulation being entirely due to the rubber covering which is inside of all the braids.

And yet I have just learned that the New York Board of Fire Underwriters, on March 20, passed the following resolution :

> *Resolved*, That the Superintendent be authorized, until further notice, to approve the use of the Attix tube and wire, when equal in quality and insulation to the samples submitted to this Board and tested, under the same conditions where tubing would be permitted ; provided that there is no splicing or tapping of the wire, but that its introduction shall be in all cases by the loop system ; that in new buildings, when necessary to carry it between floors and plastering, it shall be through holes bored in the beams, not less than two inches apart, a single conductor in each hole, out of the reach of nails ; and in old buildings, where necessary to carry it within the reach of nails, it shall be protected by some device from perforation ; and provided further that the wire and tube be carried intact into the cut-out boxes, and that in no case shall the outer covering be removed before introducing the core wire into the cut-out box.

It will be noticed that the wire is called a "tube and wire," when it is no more a tube and wire than the Habirshaw which forms its basis. The tests referred to show that, after immersion in water or being imbedded in plaster, the insulation resistance was twenty megohms per mile. But the Habirshaw wire, without the Attix covering, would have shown the same. What then is the propriety of confining the operation of this resolution to the Attix wire ? Why not permit the use of any good highly insulated wire under the same conditions ?

It seems to me that this resolution is one of those reversions to an ancestral type which we find in all evolutionary development, which is off the general line of progress, and which is destined soon to become extinct.

Triplicate Cables and Tricycles.

The following is an extract from an Australian paper recently to hand, from which it appears that in spite of the much vaunted triplicate cable route communication between Australasia and the rest of the world by the present system has its weak points. During the recent breakdown of the Australian land lines the following message was sent by the Postmaster-General of South Australia to the Postmaster-General of New South Wales : "Have sent an operator on an engine to remove the fault between William Creek and Peake, taking all messages, and sending them to Oodnadatta, and will return with all outward messages, being met at the Peake by tricycle from Oodnadatta." We presume that had the lines to Australia only been duplicated a bicycle would have answered the purpose !—*The Electrical Review* (London).

Electric Fusion of Metals.

A Swiss paper states that Mr. Nicolai Slavianoff, a Russian engineer, has devised a method of welding metals similar to that of Benardos, and which can with advantage be substituted for the latter when repairs to pieces of metal are necessary. According to Mr. Lohmann, of the firm of Messrs. Pintsch, Berlin, the working of the system is as follows: The object to be dealt with is connected to one of the poles of the source of electricity, and the metal bar to be used in effecting the repairs is connected to the other pole. The two electrodes are approached so as to cause an arc to occur. The metal bar soon begins to melt and the liquid metal is allowed to fall upon the parts to be repaired. The electrodes are, of course, gradually moved towards each other as the bar is fused so as to obtain an uninterrupted arc.

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* A paper presented at the 96th Meeting of the American Institute of Electrical Engineers, New York and Chicago, April 17, 1895.

ARC CARBONS AND THE RATING OF ARC LAMPS.[*]

DISCUSSION.

Mr. Peck, of Brooklyn—The question of carbons is exceedingly interesting to me at present, as our company is in dispute with the authorities as to the candle power of our lamps versus the candle power of lamps furnished by a competing company. I had a letter from the inspector of gas asking me to have this Association give the companies a rating on lamps burning $\frac{7}{16}$, $\frac{1}{2}$ and $\frac{5}{8}$ carbons; and he also raised the question as to what is the proper size for a carbon to give a certain candle power at a given energy. I do not know whether this Association desires to put itself on record as giving standards for various sizes of carbons or not; but it seems to me the arrangement for a 2,000 candle-power light as given us at Washington really means nothing, as we find by experiment that we can get varying candle-power, using that amount of energy, by using different density of carbons and different size carbons. I would like to get information from some one here who has made experiments giving the candle-power by different size carbons, as to what the relative difference is in candle-power as governed by the size of the carbon?

Prof. Marks—In reply to Mr. Peck's question, I may say that the reference in the paper to current density partly answers his inquiry. It was stated there that within certain limits the candle-power varies inversely as the diameter of the carbon; that is in the assumption, of course, that the current be constant and the carbons be of the same batch and homogeneous.

You will remember that Mr. H. Nakano, now professor of electrical engineering in the University of Japan, deduced a law for the relation of efficiency of the carbon to diameter. His results confirmed the conclusion reached by Schreihage and indicate that the radiant efficiency is almost inversely proportional to the diameter.

Thus we see that as far as the operation of arc lamps at maximum efficiency is concerned, the limitations of life of the carbons would cut a very important figure with the central station man. It is well to remember that invariably a gain in light efficiency for a given grade of carbon is accompanied by a loss of longevity of the carbon points. You all know that ordinarily a soft carbon will give you a better light than a hard one of the same diameter. If you use a hard carbon of small diameter you may obtain the same efficiency as with a soft carbon of larger diameter. Again much depends upon the character of the basic material and the binder used in the manufacture of the pencils.

In the table which you have before you your attention has been called to the wide difference in the performance of chemical carbons operated under the same conditions. If you will refer to carbons numbers six and seven, which are made of lampblack, you will note that the latter, which has a molded structure, acts differently from the former, which is a squirted pencil, or one made by forcing the plastic mixture through a die. These carbons though made of the same material and carbonized in the same way, give quite different results in service, and I am quite sure if you decided that a $\frac{7}{16}$ inch pencil of the number seven type gave the best results as to candle-power for a given current and difference of potential, you would find that on substituting a pencil of the number six type a smaller diameter would be necessary to obtain the same light efficiency.

Again, though carbons of a certain diameter may be suitable for one purpose of illumination, change in the character of distribution of light desired may prove them to be less suitable for another. Even if the same current be used and the same watts expended in the lamp, it would be impossible to designate a particular size of carbon to meet all cases of distribution.

When we consider that variations are apt to creep in throughout the process of carbon making, we are brought face to face with another and graver obstacle in the way of considering a standard such as proposed. Variations in the character and size of grain of the pulverized crude material; in the nature of the binders; in the constituency of the mix; in the pressure in holding or squirting, as the case may be; in the duration and temperature of carbonization, etc.,—all these are more or less familiar to you and need no comment.

But after all why lay so much stress upon the diameter of the carbon or the candle-power of the arc? Does it make any difference to us whether an arc lamp gives 500 or 1,000 candle-power if the light is not available? As tersely stated by Prof. Houston the other day, what we want is a method of measuring illumination at the surface which is lighted and not at the source of illumination. And right here comes up another point bearing on the selection of a carbon for a special purpose. A carbon arc that may be well adapted to bringing out the colors of natural objects may fall somewhat short if the power of its illumination as applied to black and white be considered. For one purpose a carbon of particular structure, operated at a high voltage, may give best results, while for another a different structure and low voltage may be required. In fact, candle-power of an arc, per se, is in some respects a meaningless term and does not give a true expression of the value of the light.

As Dr. Edward L. Nichols has shown, "luminosity is the factor which we must take into account in seeking a complete expression for the efficiency of any source of illumination, and the method to be pursued in the determination of the luminosity must depend upon the use to which the light is to be applied. In a picture gallery, for instance, or upon the stage, the value of an illuminant increases with the temperature of the incandescent material out of all proportion to the candle-power, whereas candle-power affords an excellent measure of the light to be used in a reading room."

Thus it is clear that the quality of the light as distinguished from its candle-power must be carefully considered in the selection of a carbon and in the proper operation of a lamp intended for a particular kind of illumination. You are all familiar with the preponderance of the longer wave lengths, or those at the yellow end of the spectrum, in arcs operated on direct incandescent circuits. Contrasting these arcs with the constant current series arcs, the latter show a decided richness in the shorter wave lengths, or those at the violet end of the spectrum. In the former case cored carbons are used; in the latter, solid. The analysis of the core tells the story. If time permitted I should like to dwell on various phases of the subject other than those already taken up, but I trust what has already been said will cover the scope of Mr. Peck's inquiry.

(To be continued.)

LARGE ARC DYNAMOS.[*]

DISCUSSION.

The President called upon Mr. S. N. Hamill, who addressed the meeting on the subject of "Arc Dynamos." He said:

I have only a word to say, and that is that I naturally was very much interested in Mr. Black's paper. A man who sat for a number of years at the feet of such men as Prof. Brackett, of Princeton, and Mr. Brush, of Cleveland, ought to be able to write a pretty good paper. My interest in these large dynamos is purely from the standpoint of the manufacturer and seller. During the past year I think the Brush Company has built large arc dynamos from eight to ten thousand lights capacity. The inquiries concerning them do not come in from the new installation companies, but almost entirely from existing stations. This is natural, for the reason that nearly all our large electric light stations are quite centrally located in the large cities of the country, where real estate is expensive, where the business is growing, and where it is a question either of going away further from the center of the cities or purchasing additional real estate at great expense in order to increase the capacity or to exchange the small dynamos for larger ones. I have in my mind, for instance, one of the largest and best managed local companies in the country where they have two large stations quite near enough to each other in the center of the large city, stations that have been in existence thirteen to fourteen years, where last year they had 2,000 lights capacity and arc dynamos ranging from old ten-lighters up to sixty-lighters, using a tremendous amount of shafting and belting, and naturally they were inefficient dynamos. This company exchanged all their old dynamos, small and large, for a complete new outfit of twelve or thirteen large dynamos, and by so doing they obtained a great deal of space in existing stations for increasing their business without going to the expense of enlarging their areas. I have in mind another station where they had almost exclusively fifty to sixty light arc dynamos with a capacity of about 2,000 arc lights. This station changed from fifty to sixty light dynamos to 125-light dynamos, and saved a large amount of floor space and increased the efficiency of their machines, which is a very telling point. The field at the present time, as far as manufacturers are concerned, is almost entirely along the line of exchanges from the small to the large units, and there is very little profit in it for the manufacturer.

Prof. Thomson—I have been quite interested in listening to the paper, as I consider it a very true exposition of some points connected with the operation and design of arc dynamos. The development of the arc dynamo, it is true, has been somewhat backward; still I do recollect that machines were built far back in the early days which were capable of giving a curve similar to that which has been shown, a characteristic curve, but they were disadvantageous from the very large armature reaction, the size of the armature, the amount of wire, and the dead resistance of the wire used in the construction. The question as to whether open coil dynamos or closed coil dynamos are the best for arc lighting has been fully discussed in the literature of the subject for a long time. Considered purely as an electrical affair without reference to the practical uses, there can be no question but that the closed circuit dynamo is the better electrical structure. I say considering it simply as a dynamo; but when you come to use that dynamo in the conditions of practice there may be considerations which will modify that conclusion. I am really

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[*] A paper read before the N. E. L. A. at Cleveland by L. B. Marks.

[*] Paper read by C. N. Black before the N. E. L. A. at Cleveland.

sorry that Mr. Wood, the champion of the closed circuit dynamo, is not here. We might have had a discussion bringing out the strong points on the other side. When I first entered the business my object was to get that kind of a machine which, put into ordinary hands, men of no experience with machines of the kind, could be run successfully and keep the lights going, and the object was to reduce to the utmost simplicity those parts which were subject to wear and which could be injured by bad handling. Therefore the commutator was reduced to very few parts and it was constructed so that if anything happened to it, to injure the segments, it was a simple thing to take off the segments and put on others. That could not be done if the commutator contained from one to two hundred segments. In that case it would mean that you would have to take out the whole commutator and lay it aside and get a new one, and make all the connections before you could start the machine. In the early history of dynamos we did not have experienced men to handle them. The dynamos were not put in stations with a dynamo tender of experience in charge. They were in charge of an engineer, who might know how to run his engine but knew nothing of the dynamo, and who had a superstitious idea that that was a thing which he must not touch. We have had enough cases of this kind arise. In one case the brushes on the dynamo would not rest on the commutator and we had a communication that something was the matter with the machine and we were to send the best expert we had right along. The moment we go into a new field we have to educate men to understand how to handle the new structure on account of its peculiarities. The fact that an arc dynamo, when it has its circuit interrupted, will not give the rise of voltage which the continuous dynamo gives has been known for a long time.

The point of flashing was admirably brought out in the paper. The moment you begin to open the circuit of a machine it is the same thing as overloading, that is, you are putting in a high resistance. The arc follows, amounts to so many arcs put in resistance. The potential, on account of the self-induction of the wire coils, at once begins to rise with the attempt to hold a diminished current. If at that moment the commutator, owing to its arrangement and construction, flashes over, arcs across from one side to another, you have removed the E. M. F. of the armature, and if the machine, as is often the case, has a copper band in the field poles, then we have an inductive circuit parallel with the field winding which takes out the inductive E. M. F. from the field coils, and it is not surprising that there should not be a great rise in a case of this kind. Long ago the natural practice was that when we ruptured the circuit of the open coil the flashing did not extend any great distance, but it was a well-known fact if you had a close coil the circuit of flash was much longer.

Mr. Townley—There is one phase of the question which I should be glad to have the opportunity of stating to the members. It has been my fortune to be in a position where the demand for large units for lighting has been heard from very quickly, and I can confirm Mr. Hamill in his statement that the pressure is very strong for large units for arc lighting. The reason why arc lighting machines seem to have been made small for so long a time is possibly not easy to answer, but it may be found in the fact that until very recent times it has been very difficult to insulate for the corresponding potentials. Looking at the problem of furnishing a large number of arc lights to a community, from one of our central stations, it is evident that if the conditions were not so severe as to render it otherwise it would be advisable not only to use a machine as large as 100 or 125 lights, but in fact machines of larger capacity and insulation, of one, two or three thousand arc lights. We should manifestly have, if possible, units of larger capacity than 125 lights, and when we get down to 60, 75 or 80 lights the objections are greater. In some cases there have been established stations of units of two, three or four hundred lights in one machine, this being done, however, by the use of constant potential in place of constant current machinery. This is necessitated, apparently, by the use of alternating currents, and it possibly has not been brought into more general use on account of the lack of success in starting and operating the alternating current arc lamps. At the present time, however, that objection can hardly be said to exist, and the fact that they are now operating stations of considerable size using this system, practically demonstrated the success of it and is worthy of consideration. Of course with the introduction of the alternating lamp, and the ability to run power from apparatus of this character, there is a great point to be gained in large cities, particularly where underground work is necessary, when we can supply incandescent and arc lighting and power, in fact all classes of service, from the same unit; and if that unit be a large unit, we can take advantage of the best economy in steam practice and the higher efficiency in dynamo construction. It seems to me that the development is bound to be in future along the lines of these larger units and that as the electric lighting public, men who have their money and interests involved in this industry, come to know that this system is a profitable one, successful commercially and acceptable to municipalities, it is bound to be a very prominent factor in our interests hereafter.

Cathode Rays.

At a recent meeting of the Société Francaise de Physique M. de Kowalski read a paper on the conditions necessary for the production of cathode rays. Starting from an experiment due to Goldstein, in which in a vacuum tube having a constriction at its middle it is found that the cathode rays are formed not only at the negative electrode, but also at the constriction, the author has made several experiments, using tubes of different shapes. He finds that wherever the electric discharge is sufficiently dense, as near the electrodes, or in a capillary tube joining the two parts of a vacuum tube, cathode rays are produced. These rays are propagated in straight lines, are deviated by a magnet, and produce a bright patch where they strike the glass. The author has also succeeded in obtaining cathode rays in a tube without electrodes. This tube had somewhat the shape of an elongated hour-glass, and was placed alongside a discharger, through which "Tesla currents" were passed. Under these circumstances cathode rays are produced at either end of the capillary tube forming the central part of the vacuum tube. M. de Kowalski concludes from his experiments: (1) that the production of cathode rays is not connected with the disintegration of metallic electrodes in a rarefied gas; (2) that these rays are produced wherever the density of the discharge is sufficiently great; (3) that the direction of the rays is the same as that of the lines of flow of the current at the point where they are produced, and that they are propagated in the opposite direction to that in which positive electricity is supposed to flow.

Some years ago Prof. Ayrton pointed out that in the lead cell, "in consequence of its being slightly warmer than the air during charging and discharging, there is a loss of energy from radiation and convection equal to about 17 per cent. of the energy put into the cell."

COMMUNICATIONS.

THE TWO-PHASE SYSTEM.

To the Editor of ELECTRICITY.

DEAR SIR: In an editorial in your issue of April 10 you say in reference to the new Westinghouse shops: "Aside from all this, these new works undoubtedly constitute the most complete electrical shops in the world of any kind, and the only ones using the two-phase currents for all operations." As to the first part of this statement it is a matter of individual judgment and we have no comment to make; but we are certainly astonished at the latter part, as a reference to your own files would prove its inaccuracy. Our shops have long been operated by two-phase currents, and entirely so. There is not even a temporary use of direct current for elevators and cranes. The whole work is done by two-phase currents. Neither is our apparatus of such peculiar design that it can be operated only at an abnormally low frequency. All the apparatus in our shop is supplied from the central station of the town by a generator using the standard frequency of 16,000 alternations. It is not necessary for us to limit ourselves, therefore, saying that our apparatus could also be used at Niagara. It can be used in connection with any central station and is being used in connection with many. We are surprised above all that you should undertake to decide the legal question as to the right to use two or three-phase currents for transmission purposes. Surely an anti-monopoly journal need not start in to create a monopoly in advance of the decision of the courts. Had these statements appeared in a journal known to be biased or to be affected editorially by its advertising columns we should have passed them over in silence as of no importance. In the militant advocate of fair trade, however, they carry weight. We trust that, your attention having been called to their erroneous nature, in your usual spirit of fairness you will rectify them. JOHN F. KELLY.

Stanley Electric Manufacturing Co., Pittsfield, Mass.

[We thank Mr. Kelly for correcting us in making too sweeping a statement, as the Westinghouse shops are not "the only ones using the two-phase currents for all operations."

More than a year ago ELECTRICITY published a comprehensive write-up showing the application of the S. K. C. two-phase system in the Stanley works at Pittsfield, which, we believe, was the first extensive installation, and which has worked with perfect success. We regret the overstatement, which was purely inadvertent.

In regard to our remarks as to the legal questions involved, we made no attempt to anticipate the decisions of the courts, discussing merely the Westinghouse and Monocyclic systems, as a careful reading will show. We stated, what we knew to be a fact, that the G. E. people had *acknowledged* their Monocyclic system to be an infringement of the Tesla patents.]

THE ELECTROPOISE.

To the Editor of ELECTRICITY.

DEAR SIR: Your recent attacks on electro-medical frauds have been very interesting to me, and I congratulate you on your success in showing up the periodicals which are willing to lend themselves to the furtherance of such schemes. In your issue of April 10 you print in large type the names of three religious journals which deserve credit. Among these is the *Outlook*, which you state withdrew the advertisement after your expose. Now I have before me a copy of the *Outlook*, bearing date of March 30, 1895, in which is a one-third page advertisement of the Electropoise. If I am not mistaken, I have also a still later copy at my home which also contains this advertisement. This is certainly later than your exposition of the fraud, and I dislike to see any injustice done to the *Outlook*, so I put you in possession of these facts that you may make a proper apology for giving the *Outlook* a place with the sheep when it belongs with the goats. Yours very truly, CALVIN P. H. VARY.

Banking House of Vary & Sleight, Newark, N. Y.

[We do not scan the advertising pages of the *Outlook* every week, confining our attention chiefly to the comments of the Rev. Dr. Lyman Abbott. Our statement that the paper had discontinued the advertisement of the Electropoise was made upon the supposition that Mr. Howland, the publisher of the *Outlook*, told us the truth when he stated, after the publication of ELECTRICITY's first exposé of the Electropoise, that while he was personally inclined to believe in the Electropoise, he wanted to hold the advertising department of the *Outlook* up to the highest standard, and should not accept the advertisement again. We regret to know that the theory of Christianity as preached in the pulpit of Plymouth Church, and afterwards through the columns of the *Outlook*, is not practised in the business department of that journal.

For a journal to assist in the promotion of a gross swindle, and to accept the money of the swindler as a consideration for that assistance, precludes the possibility of such journal, or the clergyman conducting it, doing successful missionary work among those who know the facts, and there are thousands.

We may add that we have the names and addresses of six members of Plymouth congregation who state that they were humbugged out of the price of an Electropoise through seeing it advertised in the *Outlook* some months ago. —ED.]

Heat Imparted by the Electric Light.

A French contemporary, the *Moniteur Industriel*, states that Capt. Exler, of the Austrian army, has found that a 16 C. P. incandescent lamp gives off a maximum temperature of 94 degs. C., and a lamp of 25 C. P. 101 degs. C. Two lamps placed in a wooden receptacle yielded a temperature of 215 degs. C., decomposing explosives such as gunpowder, ecrasite, pyroxyline, etc., but without exploding them. The receptacle having been filled with water, the latter became in a state of ebullition at the end of fifteen minutes. In case of the breakage of the lamps, the powder and pyroxyline do not ignite, but this is not the case if an explosive gaseous mixture is present. The captain points out that too many precautions cannot be taken, notwithstanding the use of electric lamps, which, whilst reducing the danger of an explosion, do not completely remove that danger. From the experiments made, it is held that the solution of the problem does not in any way lie in the employment of a double bulb with an intermediate closed space filled with air or water. The heating of the water would be avoided by the use of a reservoir having double communication with the external envelope, an arrangement by which would be established a continuous current, and which would allow of the cooling of the water. But in order that the latter may be sufficient, the volume of water necessary would render the arrangement heavy and cumbersome, and the method is consequently not practical. A rational solution for the lighting of places where gas or explosive materials are present seems to be, according to the captain, simply in arranging the incandescent lamp in a glass cylinder closed at both ends by means of metallic cloth; the current of air would freshen the bulb, and the slight heating of the air passing out would not be detrimental. In case of the breakage of the bulb, the combustion of the filament would produce at most only a small internal explosion, as in miners' lamps, incapable of transmitting fire outside.—*Electrical Engineer* (London).

Prof. J. C. Bose, of Calcutta, has just succeeded, says the *Indian Engineer*, in reproducing signals in the form of light, sound and other phenomena without any connection between the transmitting and receiving stations; even solid walls have not interposed any obstacle to the ransmission of these signals.

Personal.

Mr. R. L. Weithas, who has so long and efficiently arranged the advertising pages of the *Electrical World*, has severed his connection with that journal. Mr. W. has acquired an interest in Burrelle's Press Clipping Bureau, Western Union Building, of which he will become secretary and manager. What is the *Electrical World's* loss will be Burrelle's gain, and we congratulate the latter upon the acquisition of the services of a gentleman at once so capable and so well known to the newspaper fraternity.

The "Street Railway Gazette" Sold to Mr. W. J. Johnston.

The following announcement, which is official, will come in the nature of a surprise to many of our readers:

The *Street Railway Gazette*, with all its assets, has been purchased by Mr. W. J. Johnston and will hereafter be issued each week from Mr. Johnston's office, 253 Broadway, New York. Mr. Clarence E. Stump, general manager of the paper, and Mr. J. W. Dickerson, the editor, will still be connected with it. The *Gazette* is the only weekly street railway journal in the world. It was established in 1886 and for the first six years was published monthly, but since 1892 has been issued every week. As a result of the change in ownership it is announced that some modifications will be made in the *Gazette*. The size of the page will be slightly reduced and the number of pages considerably increased. The reading articles will be by practical men for practical men and while technically accurate will be written in plain and simple language. More illustrations will be used than formerly, and the effort will be to make the paper in every way a worthy representative of the activity and enterprise and progressiveness characteristic of the street railway business.

SOCIETY NEWS.

American Institute of Electrical Engineers.

The regular monthly meeting of Council was held at 26 Cortlandt street, New York, April 17.

The following associate members were elected:

James C. T. Baldwin, Chicago, Ill.; Francis Elliott Cabot, East Milton, Mass.; S. B. Fortenbaugh, Madison, Wis.; W. C. Harris, Jr., Birmingham, Ala.; G. H. Jones, Iquique, Chili; Charles LeBlanc, Paris, France; Wm. E. Lindsay, East St. Louis, Ill.; Paul N. Nunn, Telluride, Col.; George Herbert Winslow, Pittsburg, Pa.

The following associate members were transferred to full membership:

Albert Schmid, Pittsburg, Pa.; Omenzo G. Dodge, Washington, D. C.; Charles Ashley Carus-Wilson, Montreal, Can.; James A. Lighthipe, San Francisco, Cal.; Arthur Edward Childs, Philadelphia, Pa.; John Waring, Ovid, N. Y.; W. L. Puffer, Boston, Mass.; H. J. Ryan, Ithaca, N. Y.

Mr. George A. Hamilton was elected treasurer for the unexpired term of the late treasurer, Mr. George M. Phelps.

At the meeting of the Institute in the evening President Houston officially announced the death of Treasurer Phelps with fitting remarks regarding his services in behalf of the Institute.

Mr. W. J. Hammer, chairman of the special committee appointed by the Council, made the following report which was accepted with a rising vote:

The Council of the American Institute of Electrical Engineers, desiring to express its sense of the loss to the Institute in the death of George May Phelps, at its meeting held Wednesday afternoon, April 17, 1895, at the Institute headquarters, appointed a special committee of three to draft suitable resolutions, which the undersigned as committee respectfully present herewith:

Resolved, That in the death of George May Phelps the Council has suffered the loss of an energetic, faithful and capable member and the Institute a most efficient officer: one who was constantly striving to uphold the standard of its work, one who was ever watchful of its welfare. In his disinterested efforts to serve the Institute he brought to bear upon its deliberations his keen perceptions, intellectual ability and eminent force of character.

Resolved, That a copy of this resolution be suitably engrossed and framed and presented to Mrs. George W. Graham, his daughter and the sole surviving member of his family.

WILLIAM J. HAMMER.
JAMES HAMBLET.
RALPH W. POPE.

A paper by Prof. E. J. Houston and Mr. A. E. Kennelly, upon "Resonance in Alternating Current Lines," was read by Mr. Kennelly and discussed by Mr. Bradley, Dr. M. I. Pupin and Prof. A. G. Webster.

A paper was also read by Prof. W. A. Anthony on "Underwriters' Rules," which was discussed by Messrs. Hammer, Leonard, Woodbury, Jenks, Holmes, Mailloux, Ayers and Hamblet. A communication from Mr. Fremont Wilson was also read.

On account of the lateness of the hour the final discussion of the paper was laid over until next meeting.

The Brooklyn Electrical Society Outing.

The first anniversary dinner and "Trolley Ho" party of the Brooklyn Electrical Society will be held on Thursday evening, April 25, at the Albemarle Hotel, Coney Island. The large "Trolley Ho" car of the Coney Island and Brooklyn Railroad has been chartered for the occasion and will leave the power house at Smith and Ninth streets, Brooklyn, at 7:45 P. M. The car will be handsomely decorated and the one hundred and odd members will show the residents along the road what lusty lungs the one-year old organization has developed in its brief existence.

Artificial Diamonds Manufactured by an Electrical Process.

An interesting lecture was delivered Tuesday evening, April 16, before the members of the Brooklyn Electrical Society, by Edward Durant, on "Electricity as Applied to the Manufacture of Artificial Diamonds and Rubies, Aluminum and Electric Gas."

Mr. Durant gave several practical illustrations and experiments, among which were the manufacturing of artificial diamonds, as follows: Common granulated sugar was put in a jar, on which sulphuric acid was poured. From this a pure carbon arose, and that, with the use of an electric current of great heat, gave a crystallized carbon. This carbon proved to be the diamonds.

The next experiment was that of making "Acetylene" gas.

Columbia College Lectures.

Prof. Lieber gave a very comprehensive review of the development of the electric railway in his lecture on that subject at Columbia College on Thursday evening last. In considering the efforts made in storage battery traction, he gave it as his opinion that this method is not at all practicable. The Love conduit is giving satisfactory service in Washington, D. C., and it was the belief of the lecturer that this form of traction would shortly be perfected. In the application of electric power to high speed passenger service on steam roads Prof. Lieber was positive that the electric motor will soon supplant the steam locomotive.

General News.

What is Going on in the Electrical World.

Montpelier, Ohio.—This town has voted to put in waterworks and an electric light plant.

Tiffin, O.—The sale of the Tiffin and Fostoria and Tiffin electric roads, advertised for the 15th inst., was postponed.

Louisville, Ky.—The Dinkey line, connecting Louisville with NewAlbany and Jeffersonville, is to be converted into an electric system.

Albany, N. Y.—F. R. Barnes has asked the common council for permission to construct an electric railway line in this city.

Madison, Wis.—D. C. Jackson and C. M. Conradson have recently brought out a line of electric motors and dynamos and are meeting with success.

Windom, Minn.—This place will soon have a special election for the purpose of voting on issuing bonds for a system of waterworks, sewerage and electric light.

Hackensack, N. J.—The Hackensack Gas Company has purchased the Edison electric lighting plant, and will now control both the gas and electric lighting.

South Bend, Ind.—The Interstate Power Company has asked the council for permission to erect poles and wires for electric lighting, heating and power.

Cottage City, Mass.—The Cottage City street railway has been sold to a syndicate of which Josiah Quincy, of Boston, is president, and will be equipped with electricity.

Arlington, Mass.—The electric lighting committee are obtaining estimates on a municipal plant. Many of the business men favor buying the plant of the Somerville Company.

South Haven, Mass.—This town is to have an electric lighting plant, and a committee has been appointed to advertise for bids; $10,000 has been appropriated. Mr. H. Zeedyk is a member of the committee.

Newcastle, Wyo.—The city council is making preparations to put in an electric light plant here. Plans are about completed and it is expected that work on the plant will be begun in a short time.

Saginaw, Mich.—If the Legislature gives the authority to our city council to expend $100,000 in erecting an electric lighting plant, this city will soon enjoy the municipal system of public lighting.

Connersville, Ind.—The city council has decided to put in a municipal electric light plant to cost from $12,000 to $20,000. The council refused to submit the matter to a vote of the people.

Baraboo, Wis.—Eastern capitalists have presented a petition to the council asking for a franchise to construct an electric railway from Devil's Lake to Kilbourn City, a distance of seventeen miles.

Auburn, N. Y.—The city attorney has been directed to prepare an act to be sent to the Legislature authorizing this city to build and control an electric lighting plant, if a majority of the electors so vote.

Enterprise, Miss.—S. H. Gelheman, of Springfield, Ill., and L. B. Bradley have applied to the mayor and board of aldermen for a franchise to erect an electric light plant and for an electric street railroad franchise.

Mound City, Mo.—The proposition granting the Mound City Electric Light and Power Company a franchise for twenty years for an electric light plant in Mound City has been voted upon and carried almost unanimously.

Versailles, Ky.—There is now prospect of Versailles being lighted by electricity again soon. The city council have approved specifications for their proposed plant and have notified several electric manufacturers to submit bids.

Brazil, Ind.—The representative of a Chicago house has been in the city recently conferring with the management of several of our coal companies with a view to putting in electric power for operating the machines in the mines.

Wilmington, Del.—Nathan Snellenburg & Co., of Philadelphia, are having plans made for a handsome store in Wilmington. It will be equipped for electric lighting and with all approved appliances, elevator, freight lift, etc.

Savannah, Ga.—Judge Speer of the United States Court has placed the City and Suburban Railway of Savannah in the hands of Col. John Screvin as receiver. The road includes seventeen miles of electric railway in and outside the city.

Des Moines, Iowa.—Financial and real estate men here are planning for an electric railway line to Indianola. It is said that articles of incorporation of a company to build the road will soon be filed. The line would be eighteen miles long.

Bellefontaine, O.—The new city council has decided to issue fifteen $1,000 bonds for the purpose of lighting the city with electricity, the bonds having been voted at the late election. The work of putting in the plant will be speedily pushed.

St. Louis, Mo.—The Kirkwood Electric Railway Company has asked the court for permission to increase its capital stock to $300,000, and will issue bonds for that amount, the proceeds of which will be used for the construction of the proposed railway.

Lockport, N. Y.—The common council ha voted at last to accept the proposition made by Charles A. Johnson, of New York, to finish the construction of the electric street railway here. Concessions were made that did away with all features objectionable to either side.

Milwaukee, Wis.—The contract for the heating and electric light plant for the new city hall building has been awarded to the Western Electric Company of Chicago, whose bid was $25,408. The Cassidy & Son Manufacturing Company, of New York, will furnish the gas and electric light fixtures.

West Chester, Pa.—The contractor has started work on the eleven miles of trolley road between Cobb's Creek and Castle Rock. The road is being built by the West Chester and Philadelphia Turnpike Company. The line when completed will give West Chester a direct trolley line to Philadelphia.

Indianapolis, Ind.—Arrangements are in progress here for the organization of a new electric light company whose field will be the suburbs outside of the city lines requiring wires to be placed underground. Leon O. Bailey is the attorney for the company, which includes several local capitalists.

Omaha, Neb.—The proposed electric railroad between Fremont and this city will require an investment of $300,000, and at Col. J. H. Pratt's suggestion, a thorough canvass will be made in Omaha and Fremont and along the route to ascertain what amount can be raised from the friends of the scheme.

Richmond, Va.—The sub-committee on streets have received propositions from Capt. Pizzini and from Martin & Pendleton, of Richmond, and E. A. Catlin, representing New York parties, for building an electric railway on Broad street. Mr. Catlin estimates that the work he proposes will cost $400,000.

Marietta, Ga.—The entire plant and franchise of the Marietta Electric Light Company are to be sold under foreclosure proceedings on May 7, prox. The plant consists of a 35 light Brush arc machine, a 600 light incandescent machine, a 70 H. P. high speed Ball engine, a 30 H. P. high speed Ball engine and three 35 H. P. boilers.

Baltimore, Md.—The Baltimore and Ohio Railroad Company have decided to put the Belt Line Railroad to use as soon as the overhead electric work is completed in the tunnel. It will probably be two months before the electric locomotives to be eventually used in the tunnel to push the trains will be ready for service.

Hornellsville, N. Y.—There is a plan on foot here which may result in giving Hornellsville cheap electric power for manufacturing purposes. The scheme is to construct a dam across Canacadea Creek, between this city and Almond, by which 1,000 horse power could be easily produced to be transformed into electrical power.

Auburn, Me.—The new line of electric road to be built from East Auburn to Turner will be seven miles long and will start in Auburn from a point near the terminus of the Lewiston and Auburn Horse Railroad Company. The capital stock of the company is $50,000. F. W. Dana, H. W. True and N. Q. Pope are the prime movers.

Buffalo, N. Y.—The growth of street railroad traffic in this city in five years has been remarkable. In 1889 the company carried some 14,000,000 people. In the year ending December 31, 1894, 42,506,603 passengers rode on the cars of the Buffalo railways, an increase of 300 per cent. Electricity is now the motive power for the entire system.

Exeter, N. H.—At a meeting of the incorporators of the Exeter street railway last week an option on the charter was unanimously voted to G. Ward Cook, of Haverhill, until July 1 next. If by that time a beginning has been made or satisfactory assurance of immediate construction given, the incorporators will give Mr. Cook control of the franchise.

McKeesport, Pa.—Application has been made for a charter for the Monongahela Traction Company to operate an electric railway from Pittsburg to Greensburg via McKeesport. The company will be capitalized at $1,000,000, although the charter only applies for $5,000 capital. Allen D. Wood, John F. Davitt, L. G. Woods, Richard Fickling and J. Harper Adams are the applicants for the charter.

Ottawa, Ont.—The International Radial Railway Company will make application at the next session of the Dominion Parliament for incorporation. The company proposes to build electric railway lines in various parts of Western Ontario; to operate barges and steamships between terminal points of the railway on lakes Erie and Ontario and ports of the United States; to acquire or enter into other arrangements with electric railways now in operation and with the Canadian Pacific Railway and the Canada Southern Railway or New York Central Railway, and to build works to generate electrical energy for heat, light, power and other purposes, and to distribute the same.

Athens, Ga.—The Athens Railway Company have made arrangements to remove the plant used in operating their electric railway to Mitchell's Bridge on the Oconee River where they have purchased a water power which can be developed to give 800 H. P. This will be employed in operating a generating plant capable of furnishing motive power for their road and supplying all the electricity needed in the city for lighting and manufacturing purposes.

Brooklyn, N. Y.—The new trolley regulations for Brooklyn make it necessary to have an indicator in every car in full view of the passengers so that the speed at which the car is running at any moment may be known; they fix the rate of speed at six miles within a mile and a half of the city hall, and require safety fenders to be attached to the front platform of every car. Fourteen inspectors will be appointed to see that the law is enforced.

Knoxville, Tenn.—The city council has agreed upon a bill to be presented to the Legislature giving Knoxville the right to establish and maintain an electric light plant. Investigations have lately been made of the water powers attainable, and if the bill is passed it is probable that the plant will be erected at some distance from the city at the point selected as the best for the purpose of producing electricity by water power and transmitting it to the city.

Ukia City, Cal.—The *Democrat* says: "While at Cloverdale last week we learned that a company of capitalists have appropriated the water power along Sulphur Creek, near that town, and intend putting in a dam with the view of obtaining sufficient power to generate electricity for the entire county of Sonoma. The company has already leased a site for the dam and will commence operations at an early date."

Columbia, Pa.—A new electric railway is projected to extend from Columbia to Mt. Joy by way of Ironville. The section between Columbia and Ironville is to be finished by the middle of July. The officers of the company, all Philadelphians, are as follows: President, James L. Hetherington; treasurer, Walter N. Boyer; directors, William A. Brazell, Casper Becker, Benjamin I. Wagner, Robert Armstrong, Col. F. P. Boyer and Col. George W. Bratton.

New Orleans, La.—The city council has passed the ordinance granting to E. M. Hudson and others the right to construct, operate and maintain a system of electric street car lines in this city, embraced in five franchises and reaching out to all points in the city.—The ordinance to authorize the Orleans Street Railroad Company to build an electric power-house in the square bounded by Decatur, North Peters, Marigny and Elysian Fields streets has been favorably reported to the council.

Niles, Mich.—The Interstate Power Company of Michigan and Indiana has been formally organized. Fred E. Lee, of Dowagiac, is president; R. D. Dix, Berrian Springs, vice-president; J. O. Becraft, Dowagiac, secretary and treasurer. An immense dam will be built directly on the State line to transmit power for an electric line from South Bend to Niles, and probably through Berrian Springs to St. Joseph. The company will also manufacture electrical supplies and supply power to others for manufacturing purposes.

Tampa, Fla.—The Consumers' Electric Light and Street Railway Company have purchased a water site on the Hillsborough River known as the Herndon Shoals and intend to build a rock dam there. They will erect a power-house at the shoals and place their new machinery in it. They expect to develop sufficient water power at that point to operate their dynamos at all seasons, and will furnish electricity for the operation of their road and for power and lighting in the city.

Seattle, Wash.—The election of officers of the Union Illumination Company, as the Union Electric Company and the Seattle Gas and Electric Company are known since the consolidation of the concerns a few days ago, has taken place, with the following result: President, C. P. Stone; vice-president, Maurice McMicken; secretary, L. A. Turner; treasurer, E. C. Kilbourne. Mr. Kilbourne is general manager of the concern; John Mather, late manager of the Seattle Gas and Electric Light Company, is superintendent of the gas department, and A. L. Hawley, of the Union Electric Company, is now superintendent of the electrical department.

Elkhart, Ind.—Arrangements are now being made to begin work on the new Indiana Electric Railway. The road is to start from Elkhart and run as far as Plymouth, a small town south of South Bend, where it will join on the new Chicago electric line, which is now being built. The road from Plymouth to Elkhart will probably be finished in a short time. The power will be obtained from the St. Joseph River dam, on the Michigan and Indiana line, which is now in course of construction. An electric line from South Bend to Niles is to be built this year and another road from South Bend to Mishawaka is now nearly finished. The power will all be obtained from the St. Joseph River dam; besides this the dam is to supply several other cities and towns in Michigan and Indiana.

Niagara Falls, N. Y.—The second of the great Westinghouse dynamos is being put together at the power house of the Cataract Company.—The contract for the construction of seven miles of double track electric road from Niagara Falls to Lewiston, through the Niagara gorge, has been let to Craig & Tench of Buffalo by the Niagara Falls and Lewiston Electric Railway Company. The tracks will be ready for operation by July 1. Open cars 34 feet long and seating sixty people will be used in summer.—The final test in connection with the monster 5,000 H. P. dynamo already set up in the power house of the Cataract Construction Company was made on the 16th instant, when the huge machine was run for the first time to its fullest capacity, which means 250 revolutions to the minute. The test was an unqualified success, for the great machine worked with clock-like precision and regularity, and not a hitch occurred.

Telephone and Telegraph.

The King-Price Telephone Company have just completed a line which connects Wesson, Beauregard, Hazlehurst and Martinsville with Crystal Springs, Miss.

J. H. Theobald, the general manager for Wisconsin of the Strowger automatic telephone, states that his company expects in a short time to be able to supply telephone facilities to 10,000 subscribers in Wisconsin at $20 to $25 a year.

The Milwaukee *Journal* states that I. B. Reid, editor of the Appleton *Post*, has purchased an interest in the new Standard Telephone Company, and may become manager of the branch company in Wisconsin.

Capt. J. Hardwick Jackson has secured a franchise from the city council of Augusta, Ga., to establish and conduct a telephone exchange in that city. Mr. Jackson's company will be known as the Interstate Telephone and Electric Supply Company.

Omaha, Neb., is yearning for a new telephone company to come in and cut the rates of the company now giving service there at $5 a month. The business district of Omaha wants a $3 a month rate and $2.50 for each additional 'phone, says a business man in one of the papers.

The Chicago Telephone Company has reduced its rates to about 50 per cent. of its former charges. It has 11,000 subscribers in Chicago and the nearby suburbs, 3,000 of them residential. The company has arranged twenty-five circuits on the North Side to put in practical operation a service for placing two or more telephones on the same wire.

A representative of the Harrison Telephone Company who has been at Owensboro, Ky., taking subscriptions makes a very encouraging report.

The Mutual Telephone Exchange at Lincoln, Neb., has now 154 instruments in use and expects to increase the number to 200.

The citizens of Auburn, Neb., have organized a telephone company with an authorized capital of $5,000. The directors are J. W. Kerns, Thomas W. Eustice, George W. Cornel, Church Howe, J. S. Stull. The company proposes to advertise for bids for constructing a first class system of telephones for the use of the citizens.

The Cranford Mutual Telephone Company has filed articles of incorporation at Elizabeth, N. J.

G. E. Paine has been appointed general manager at Chicago of the Postal Telegraph Cable Company, vice F. G. McCurdy.

An application for a charter for the Citizens' Telephone Company of Chattanooga, Tenn., has been filed by F. I. Stone, W. D. Carswell, T. R. Preston, H. C. Abercrombie and Wm. K. Stone. The objects of the company as stated are "the purpose of manufacturing electricity for telephoning purposes, and of building, equipping and conducting a telephone exchange, and other business incident to the purposes mentioned."

J. P. A. Anderson has asked the council of Madrid, Iowa, for a franchise for telephone, electric light and waterworks plants.

Dr. D. P. Fahrney, of Frederick, proposes to build a telephone system in Hagerstown, Md., if proper encouragement is given by the citizens.

The Board of Commerce of Youngstown, O., at a meeting on the 15th inst., resolved that unless the Bell Telephone Company reduced its rate to $24 per year for residences and $30 for offices the board would request council to grant a franchise to a new company at these rates, to be secured by a five-year contract.

W. E. West will erect a telephone exchange at Milledgeville, Ga. He has already about seventy-five subscribers.

The Anthracite Telephone and Supply Company has ordinances for right of way before the town councils of Centralia, Ashland, Shenandoah, Girardville and Mahoning City, Pa.

The New York and Philadelphia Telegraph and Telephone Company has filed articles of incorporation with the county clerk at Jersey City. The company has a capital stock of $15,000. Its incorporators are Edward P. Meany, of Newark; Melville Egleston, of Elizabeth, and Alfred E. Holcombe, of New York. The object is to erect a telegraph and telephone line from New York to Philadelphia. It will pass through Hudson, Essex, Union, Somerset, Middlesex, Monmouth and Mercer counties in New Jersey. Its principal office will be in Jersey City. Work of construction will be commenced at once.

The Clinton Telephone Company, of Clinton, Tenn., has been fully organized, with Dr. R. K. Medaris as president and general manager. The company has twenty instruments in operation.

The president of the Oregon Telephone Company, at Portland, Ore., promises a substantial reduction in charges on the 1st of May.

There is a plan on foot to connect a dozen small cities and towns with Americus, Ga., by telephone. The towns include Smithville, Sumter, Bronwood, Dawson, Weston, Shellman, Richland, Parrott's, Preston and Plains, thus making a complete circuit.

The commercial exchange at Goshen, Ind., has transferred its telephone franchise to George M. Beers, of Fort Wayne, who will adopt the Anthony, a comparatively new telephone, placed upon the market since the expiration of the Bell patents.

S. P. Walmsley and others have applied to the New Orleans city council for a franchise. In their application they say they "have no interest, direct or indirect, with any person or concern residing outside of the city of New Orleans; that they propose to inaugurate a home enterprise, to be in the hands and under the control of our own people; that they have not opened negotiations with any one whatsoever regarding the purchase of telephones or the use of any particular device, or the sale or transfer of the franchise which is asked to be granted; that the best instruments which can be obtained are to be used, and that the service will be superior to any heretofore given to the people of New Orleans."

An ordinance has been prepared by the board of works of Indianapolis and submitted to the council requiring all telephone, telegraph and electric light wires to be placed underground within the limits of a square mile bounded by North, East, South and West streets. Sewers may be used for conduits.—The board has notified all the companies which propose to carry on a telephone exchange business to send samples of their instruments to the office of the board for examination by an expert. The companies notified are the Phœnix, Gamewell, Central Union and Cushman.

The Phœnix Mutual Telephone Company has been granted permission to erect poles and string wires in Bayonne, N. J.

A lawyer in New Jersey, wishing to attend a sale of real estate went to Bridgeton, only to find that the sale was just beginning at Vineland, twelve miles away. Nothing daunted, he went to the telephone, put in his bid by its means and captured the property. Then he took the next train and signed the necessary papers.

In Albany, N. Y., there is a movement on foot looking to the establishment of a local company to compete with the Hudson River Telephone Company. A franchise permitting the new company to place its wires underground will soon be asked of the common council.

The Southern New England Telephone Company has reduced its rates in all its third class and second class exchanges. The basis of reduction is the value of the service in a city compared with its population and the cost of maintenance of wires and exchanges in the different places.

The Wizard Telephone Company will erect a machine shop at Council Bluffs for the manufacture of instruments. Machinery has been ordered.

A call has been issued for a meeting of telephone representatives from all parts of the State of Ohio at Columbus on the 29th inst. for the purpose of discussing the establishment of a complete long-distance exchange covering the whole State.

Proposals for Electrical Supplies for the Government.

WASHINGTON, D. C., April 18, 1895.

The Commissioners of the District of Columbia are asking for bids for the following electrical supplies for use in the various branches of the government of the city for the fiscal year ending June 30, 1896. Sealed proposals will be received at the office of the Commissioners until 2 o'clock P. M. on May 9, 1895.

The following is a list of the articles and amounts of same for which bids are asked:

Sulphate of copper (bluestone)	15,000	pounds.
Sal ammonia, best	400	"
Sheet copper (No. 30 Brown & Sharp's gauge), cut in strips to order	300	"
Molded zincs (amalgamated), for Le Clanche battery	10	
Molded zincs, pure, crowfoot, per sample in office	15,000	"
Glass jars, No. 1, 6 x 8 inches	500	
Le Clanche battery, complete	10	
The Burnley dry battery	500	
Imperial dry battery	500	
Law battery, complete	500	
Holtzer-Cabot Monarch battery, with long zinc	500	
Cold drawn copper wire, No. 12	10,000	pounds.
Galvanized iron wire, No. 12 extra best, best quality	1,000	"
Copper wire, Okonite insulation, No. 16	2,000	feet.
Copper wire, Okonite insulation, No. 12	500	"
Copper wire, Okonite insulation, No. 14	1,000	"
Office wire (copper), No. 16, wound and braided, paraffined and polished	200	pounds.
Office wire (copper), No. 18, wound and braided, paraffined and polished	20	"
Copper wire, two conductors, annunciator, No. 16	1,000	feet.
Copper wire, twin Okonite cable, No. 14	400	"
Register paper, cut and wound on spools to order	1,500	pounds.
Register paper, cut and wound loose on spools, chemical	100	"
Double telephone cords, tips complete (3 feet long)	500	
Double telephone cords, short (2 feet long).	500	
Glass screws (insulators), Western Union	2,000	
Brackets, screw, oak painted	1,000	
Double-pointed (telegraph) tacks	10	pounds.
Cross-arms, standard size, best yellow pine, painted, with steel pins, locust screw tips, complete	5,000	feet.
Screw bolts, with washer, ½ inch x 7 inches.	1,000	
Climbers, extra spring steel, with straps (Stubbs)	6	pairs.
Insulator pins, steel, locust screw tip, per sample	1,000	

WASHINGTON, D. C., April 18, 1895.

Sealed proposals will be received at the office of the Superintendent until 2 o'clock P. M. on May 9, 1895, for furnishing the Treasury Department and its annexes with electrical supplies for use during the fiscal year ending June 30, 1896.

The following is a list of the different articles upon which bids may be given:

Adjusters for lamp cord, hard rubber; sample required, each. Batteries, dry, sample required. Batteries, Le Clanche (any form) sample required. Binding posts, brass, machine screw, assorted. Binding posts, brass, wood screw, assorted. Bushings, hard rubber. Buttons, push, bronze, sample required. Buttons, push, nickel, sample required. Buttons, push, pear or similar shape, complete; sample required. Bells, vibrating, 3-inch gong, iron box, sample required. Bells, vibrating, 3-inch gong, sample required. Bells, vibrating, 3-inch gong, skeleton frame; sample required. Cups, porous, for Le Clanche batteries. Cut-outs, fixture, double-pole, porcelain. Cut-outs, porcelain, for ceilings. Cut-out plugs, one to thirty lights. Cut-outs (branch), D. P., porcelain, one to thirty lights. Cut-outs, branch, one to thirty lights, D. P. Cut-out wire, assorted, per pound. Chatterton splicing compound, per pound. Dove-tailed rosettes, K. W., No. 104 Western Electric Catalogue, or equal thereto. Dove-tail rosettes, K. W., No. 106 Western Electric Catalogue, or equal thereto. Handles, wood, for electric lamps. Joints, hard rubber. Key receptacles, polished brass, Edison pattern. Keyless fusible wall receptacles, Electric Engineering Supply Company's Catalogue, or equal thereto. Keyless receptacles, polished brass, Edison pattern. Key, fusible, wall sockets, Electric Engineering Supply Company's Catalogue, or equal thereto. Key sockets, polished brass, Edison pattern. Keyless sockets, polished brass, Edison pattern. Lamp cord, 2-twisted conductor, No. 12, silk covered, per yard. Lamp cord, 2-twisted conductor, No. 14, silk covered, per yard. Lamp cord, 2-twisted conductor, No. 16, silk covered, per yard. Lamp cord, 2-twisted conductor, No. 18, silk covered, per yard. Plugs, attaching, Edison pattern. Push-button plates, complete, nickel, 2 buttons. Porcelain insulator knobs, No. 1,929 Western Electric Catalogue, or equal thereto, sample required, per 100. Safety wire holders, porcelain, No. 1, No. 2,566 Western Electric Catalogue, or equal thereto, sample required, per 100. Safety plugs, Edison, No. 6,341, per dozen. Shades, tin, flat, green exterior, white interior, 8 inch, 3-4 inch holder, each. Shades, tin, flat, green exterior, white interior, 10-inch, 3-4 inch holder. Shades, porcelain, flat, 8 and 10 inch, for 3¼ inch holder, each. Shades, green reflector, ground glass bottom, 9 and 12 inch, each. Shades, silvered reflector, ground glass bottom, 9 and 12 inch, each. Shades, tin, cone, green exterior, white interior, 8 and 10 inch, 2 1-4 and 3 1-4 holders, each. Shades, porcelain, cone, green, 8 and 9 inch, for 2 1-4 inch holder, each. Shade holders, 2 1-4, 3 1-4, 3 3-4 and 4 inch per dozen. Staples, safety, insulated, Nos. 10, 15, 20, 25, 30, per 100. Tape, Okonite, white or black, per pound. Tape, Grimshaw, white or black, per pound. Wire, equal to Kerite, Nos. 8, 10, 12, 14, 16, 18, per foot. Wire, gutta-percha, insulated, Nos. 14, 16, 18 and 20, per pound. Wire, office, No. 14, per pound. Wire, two conductors of No. 14, No. 33 copper wire, insulated with silk, for pear-shaped buttons, per yard. Zincs, for La Clanche batteries (any form), sample required, per dozen.

All bids on the above material must be each, except where otherwise specified.

All further information can be obtained from Chief Clerk, Superintendent's Office, Treasury Department, Washington, D. C.

Independent Electric Company.

The Independent Electric Company, 39th street and Stewart avenue, Chicago, say that their recent reduction in the price of Fuse Wire and Links is having a marked effect on the business in this line. Their brand of Fuse Wire is well and favorably known for its uniformity and also the convenient and attractive manner in which it is packed.

The above familiar illustration has recently been registered by the Independent Electric Company as a trade-mark.

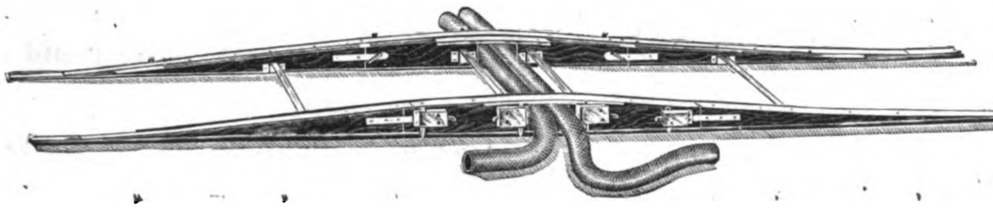
Packard Lamps.

Among the old stand-bys in the incandescent lamp line none have been better regarded by the public than the Packard Lamp, made by the New York and Ohio Company, Warren, O. Since the Bate case decision the company have returned to the old style of lamp, and are now ready to supply customers quickly with a standard lamp in the success of which there is no uncertainty.

A Portable Hose Bridge.

The Metropolitan Electric Company of Chicago are placing on the market a Portable Hose Bridge, for which the following features of merit are claimed:

Made of the best steel and second-growth oak; it is easily placed in position, ready for work, inside of three minutes; strongly and securely braced and clamped to the rail, making it impossible to get out of position; will carry the heaviest motor cars fully loaded; being but 8 inches high at its center and 16 feet in length, the rise of the car in passing over is almost imperceptible; weight of a bridge is 400 pounds; is in three sections to each side and easily carried on a car or "hurry up" wagon; two lines of 4-inch hose can pass under each bridge; every bridge guaranteed for ten years; the first time used will more than pay for its cost; overcomes the inconvenience of transfer checks and blockades; cars run on schedule time during a fire with the use of this bridge.



PORTABLE HOSE BRIDGE.

The illustration of the bridge, shown herewith, makes its application plain. It is a desirable acquisition to any railroad company's outfit.

INCORPORATIONS.

The American Electric Works Company, Denver, Col.—to buy, sell, rent, manufacture and repair all kinds of electrical steam and mechanical machinery. Capital stock, $10,000. Promoters: Wm. Thorne, Thomp. C. Walton, Chas. E. Hawkins, all of Denver.

The Roth Multi-Cylinder Motor Company, Cincinnati, Ohio—to manufacture and sell gas and gasoline and electro-motor engines and locomotives. Capital stock, $100,000. Promoters: Gilson W. Roth, H. L. Roth, J. M. Blair, Jos. Blair, R. C. Bliss.

The E. S. Kawly Electrical Construction Company, Chicago, Ill.—to engage in electrical construction business; instal electrical apparatus in buildings and elsewhere, etc. Capital stock, $12,000. Promoters: E. S. Kawly, V. Merriman, J. H. Weber.

The Metropolitan Electric Street Railway Company, Chicago—to operate a street railway in the counties of Cook, Du Page, Kane, Lake and Will, Ill. Capital stock, $5,000,000. Incorporators: Robert P. Parker, Richard E. Breed, James F. Dagley.

The Standard Telephone and Electric Company, Minneapolis, Minn.—to manufacture telephones and other electrical instruments. Capital stock, $50,000. Promoters: S. S. Kilvington, E. W. Batchelder, H. C. Dodge, Geo. L. Scott, Minneapolis.

The Osburn Electric Supply Company, Chicago, Ill.—to manufacture and deal in electrical goods, machinery, supplies and electrical appliances of all kinds, and carry on a general electrical business. Capital stock, $12,000. Promoters: Harry C. Osburn, M. Roy Osburn, Asa W. Waters.

The Milwaukee Incandescent Lamp Company, Milwaukee, Wis.—to manufacture and deal in incandescent lamps. Capital stock, $25,000. Promoters: John J. Reilly, M. J. Reilly, Barney Davis, Milwaukee.

The Felts Primary Battery Company, Sacramento, Cal.—to purchase, lease, operate or dispose of all kinds of electrical rights, patents, licenses, batteries, machinery, apparatus and other property pertaining to electric lighting. Capital stock, $1,000,000. Promoters: W. W. Felts, R. Watkins; Thos. E. Fogalsang, G. W. Merrell, Sacramento.

The Atlantic Coast Electric Railroad Company, Asbury Park, N. J.—to construct and operate a street railway or traction company. Capital stock, $1,000,000. Promoters: Wm. H. Hurst, John J. Walsh, J. Henry Haggerty, all of New York, N. Y.

The Manhattan Incandescent Light Company, Gloucester City, N. J.—to manufacture, prepare, buy, sell and otherwise dispose of the Welsbach and other incandescent lights and burning devices. Capital stock, $500,000. Promoters: Waldron Shapleigh, Camden, N. J.; Thos. Dolan, Randal Morgan, C. R. Collins, of Philadelphia.

The Cranford Mutual Telephone Company, Cranford, N. J.—to build and operate a telephone line. Capital stock, $10,000. Incorporators: William J. Lansley, Henry C. Thornton, Joseph Watterman, Wilfred C. Allen, George W. Littel, James Rodgers and John Rodgers.

The Wizard Telephone and General Electrical Manufacturing Company, Council Bluffs, Iowa. Capital stock, $100,000. Incorporators: Eli Brown, C. J. Willow and J. E. De Lee.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED APRIL 16, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

537,626. Electric-Railway Conduit System. Harry A. Belden, Washington, D. C. Filed Jan. 26, 1895.
537,630. Electric-Railway Conduit System. Albert N. Connett, Washington, D. C. Filed Jan. 26, 1895.
537,672. Electric Railway. Jean Claret and Olivier Wuilleumier, Lyons, France. Filed Sept. 19, 1894.
537,706. Sectional Conductor for Electric Railways. James F. McLaughlin, Philadelphia, Pa. Filed Feb. 7, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

537,493. Machine for Securing Filament-Holders Into Globes of Incandescent Lamps. Arnold J. Spiller and John R. Massey, Cleveland, Ohio, assignors to the Buckeye Electric Company, same place. Filed May 17, 1894.
537,498. Incandescent Electric Lamp. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. Filed May 23, 1892.
537,555. Filament and Carbon for Electric Lamps. Peter Stiens, London, England. Filed Feb. 14, 1895.
537,617. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed July 2, 1894.
537,633. Electric-Arc Lamp. Edward H. Crosby, Boston, Mass., assignor of one-half to Otis M. Shaw, same place. Filed Aug. 13, 1894.
537,693. Process of Evacuating Incandescent Lamps. Arturo Malignani, Udine, Italy. Filed Aug. 15, 1894.

DYNAMO ELECTRIC MACHINERY.

537,480. Commutator. Gwynne E. Painter, Baltimore, Md. Filed Feb. 28, 1895.
537,541. Regulator for Dynamo-Electric Machines. Walter S. Moody, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Aug. 30, 1893.
537,549. System of Electric Distribution. Edwin W. Rice, Jr., Swampscott, assignor to the General Electric Company, Boston, Mass. Filed Feb. 21, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

537,464. Printing-Telegraph. Oscar L. Kleber, Pittsburg, Pa. Filed June 5, 1894.
537,603. Automatic Telephone-Exchange System. Ward Decker, Owego, N. Y. Filed May 14, 1894.
537,644. Telegraphy. Robert H. Morris, Roselle, N. J., assignor to the Western Union Telegraph Company, New York, N. Y. Filed Aug. 10, 1894.

BATTERIES.

537,474. Secondary Battery. William M. McDougall, East Orange, N. J. Filed Jan. 7, 1893. Renewed June 15, 1894.
537,475. Secondary Battery. William M. McDougall, East Orange, N. J. Filed Aug. 2, 1894.

MEASURING INSTRUMENTS.

537,499. Electric Measuring-Instrument. Elihu Thomson, Swampscott, assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 26, 1894.
537,500. Electric Measuring-Instrument. Elihu Thomson, Swampscott, assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed October 26, 1894.
537,501. Electric Measuring-Instrument. Elihu Thomson, Swampscott, assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 26, 1894.
537,769. Electric Meter. Haydn T. Harrison, London, England. Filed June 14, 1892.

MISCELLANEOUS.

537,515. Electric Switch. James J. Wood, Fort Wayne, Ind. Filed Nov. 12, 1894.
537,533. Electric Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Dec. 22, 1894.
537,538. Electric Switch. Amandus Metzger, Schenectady, N. Y. Filed Oct. 5, 1892.
537,539. Electric Switch. Amandus Metzger, Schenectady, N. Y. Filed April 15, 1893.
537,595. Electrical Interrupter. Gustaf J. Andersson, Brooklyn, assignor to the Ozone Company, same place and New York, N. Y. Filed Feb. 18, 1895.
537,665. Electric Switch. Henry P. Ball, Bridgeport, Conn., assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Oct. 19, 1894.
537,673. Electrically-Actuated Vehicle. John B. Clark, St. Paul, Minn. Filed March 3, 1894.
537,679. Oil-Guard for Electric Fans. Philip Diehl, Elizabeth, N. J. Filed May 24, 1893. Renewed March 20, 1895.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

APRIL, 1895.

Day of Mo.	*Light.* H.M.	*Day of Mo.*	*Extinguish.* H.M.	*No. of Hours.* H.M.
1	P. M. 11.20			5.20
2		2	A. M. 4.40	
3	A. M. 1.20	3	“ 4.40	3.20
4	“ 2.00	4	“ 4.40	2.40
5	“ 2.40	5	“ 4.40	2.00
6	“ 3.00	6	“ 4.40	1.40
7	No light.	7	No light.	
8	No light.	8	No light.	
9	No light.	9	No light.	
10	P. M. 7.00	10	P. M. 9.20	2.20
11	“ 7.00	11	“ 10.30	3.30
12	“ 7.00	12	“ 11.40	4.40
13	“ 7.00	14	A. M. 1.00	6.00
14	“ 7.10	15	“ 1.40	6.30
15	“ 7.10	16	“ 2.30	7.20
16	“ 7.10	17	“ 3.00	7.50
17	“ 7.10	18	“ 3.30	8.20
18	“ 7.10	19	“ 4.00	8.50
19	“ 7.10	20	“ 4.20	10.10
20	“ 7.10	21	“ 4.20	10.10
21	“ 7.10	22	“ 4.10	10.00
22	“ 7.20	23	“ 4.10	9.50
23	“ 7.20	24	“ 4.10	9.50
24	“ 7.20	25	“ 4.10	9.50
25	“ 7.20	26	“ 4.10	9.50
26	“ 8.00	27	“ 4.00	8.00
27	“ 9.10	28	“ 4.00	6.50
28	“ 10.20	29	“ 4.00	5.40
29	“ 11.00	30	“ 4.00	5.00
30	“ 11.20	May 1.	“ 4.00	4.40
	Total			170.10

ELECTRICITY.

VOL. VIII. NEW YORK, MAY 1, 1895. No. 16

ELECTRICITY

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As ELECTRICITY reaches all classes interested in electrical work, its value as an advertising medium can be readily appreciated. Rates will be sent on application.

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EDITORIAL NOTES.

Collapse of the Sperry Company. In another column will be found mention of a recent visit of a few G. E. dignitaries, including Messrs. Coffin, J. P. Ord and S. Dana Greene, to the city of Cleveland, and of their intermediate stop at Buffalo. The interpretation placed upon this visit is beyond doubt just what these old campaigners desired to go out to the public. The editors of the daily press have swallowed the gudgeon, and we shall await with some curiosity the use which the editors of our esteemed contemporaries of the technical press will make of this remarkable news item.

Mr. Coffin is wont to boast of the ease with which the public can be fooled, and the length of time during which the process can be kept up. It is not surprising, perhaps, that one who has succeeded for so long in fooling so many people, including his associate directors and the stockholders whom he has robbed, should be able to lead off on a false scent those reporters who treat his utterances as those of a frank and honest man.

The subject of which we treat here is one in which, however, Mr. Coffin, assisted by Mr. W. H. Lawrence, succeeded in fooling his brother directors for a season, much to their loss, but not long enough for him to reap the financial reward which he started out to gather in.

In passing, it may be remarked that Mr. W.H. Lawrence, who was discharged from his position as foreman in the Brush Works by Mr. Stockley for incompetency, has learned much in a few years, and would not now be discharged from any position requiring financial shrewdness and an elastic conscience, for the same reason.

While the trip to Cleveland mentioned above was noted with eagerness by the daily papers, and started ambitious hopes in the Chambers of Commerce in two cities, it did not presage any good either to Buffalo or Cleveland. It did not bespeak the birth of any new enterprise for either city. It was rather a delicate and roundabout method (such as might be expected from Mr. Coffin) of announcing the funeral of the Brush Electric Company of Cleveland, of the Sperry Electric Company, and of the death of the plans which Mr. Coffin and associates had so skillfully laid for extracting from the G. E. treasury in legal form $1,000,000, $500,000 of which could have been divided among friends in the old-fashioned way.

ELECTRICITY has watched the career of the Sperry Electric Company with considerable interest, and we have never lacked full knowledge of what was going on. We might have told the stockholders of the G. E. Company over a year ago that they were in a fair way to be robbed of a million dollars or more through this enterprise, but we preferred to wait. We had strong hopes that one or two of our particular friends would, if let alone, put their feet into so deep a hole in this transaction that their standing in the business world would be settled forever. But the president of the G. E. Company is no longer beyond suspicion among his associates, and their suspicions have apparently killed the Sperry deal before its completion.

Mr. W. H. Lawrence, formerly foreman at the Brush Works, and now the head of the National Carbon Company, is entitled to the credit for the discovery of the Sperry railway motor. He found it at Pullman, where Mr. Sperry had succeeded in getting one built; to Mr. Lawrence primarily Cleveland is indebted for the expenditure of $250,000 belonging to G. E. stockholders (not to Mr. Lawrence) in "promoting" the manufacture of it for two years in that city.

Mr. Charles A. Coffin, although coming in second, could of course never remain long in that position, and to him the G. E. stockholders are indebted for throwing away a quarter of a million dollars in his effort to produce a round million from the same source for an utterly worthless business.

When Mr. Lawrence first discovered the Sperry motor, and laid it before Mr. Coffin for consideration, the Short railway speculation was successfully closed. No less than $440,000 had been taken from the treasury of the Brush Company to boom the Short enterprise, and more money of G.E. stockholders finally was used to buy up the outstanding stock and close up the affairs of that company, leaving the few purchasers of their apparatus without a source of supplies for further repairs, and compelling the purchase of entirely new apparatus.

The Short Electric Railway Company still owes the Brush (G. E.) Company the $440,000 as above.

Mr. Coffin was successful in the Short deal—why not try it again? He did.

The Sperry Company had a capitalization of $250,000 in $100 shares. Of these, 247 were (and are) owned by Mr. Sperry and one each by Messrs. James Parmelee, Myron T. Herrick and W. H. Lawrence. Sperry had no money. The other three gentlemen are supposed to have paid cash for their stock, making a paid-up capital of $300 for the Sperry Electric Railway Company of America.

But if the company had no money it had money's equivalent. A trade was made with Mr. Coffin by which the Brush (G. E.) Company stood sponsor for the Sperry Company, made the apparatus and paid all the bills. It was hoped to continue this until the entire outfit could be unloaded upon the G. E. Company for $1,000,000.

But in some manner the attention of Mr. C. H. Coster was attracted to the huge indebtedness of the Sperry Company to the Brush (G. E.) Company, and the trip of the dignitaries to Cleveland last week was the result.

The Sperry Company is as dead as a salted codfish hung upon a nail, and there is no further inducement for Messrs. Coffin, Herrick and Parmelee to interpose any objection to closing the Brush Works. It was the opposition of these gentlemen which prevented their being closed while the private scheme still had a spark of life.

Sperry apparatus has been sold in five towns, the People's Traction Company of Philadelphia having 125 cars, the Chicago General Railway Company 20, and Carbondale, Waterbury and Youngstown smaller outfits. These purchasers can now make their own repairs or scrap their apparatus. They will probably do the latter.

If the stockholders of the General Electric Company, at the meeting on May 14, desire to take up for discussion the manner in which their money has been wasted, these deals of Mr. Coffin with the Short and Sperry companies are worthy of consideration. There was no legitimate reason for the T.-H. or G. E. Company making a trade of any nature with either. Neither motor could be recognized as a competitor of the then standards. They were not competitors, and would have died a natural and early death if let alone.

The only reason for Mr. Coffin meddling with either of them was the desire to rob the companies of which he was the trusted representative of a large personal rake-off in each case; and in one instance the desire was gratified.

The books of the Brush (G. E.) Company show to-day $440,000 charged to the Short Company and $250,000 charged to the Sperry Company—neither claim worth one dollar. The assets of the Sperry Company are *nil.*

According to the charter of the Sperry Company the stockholders are liable for the debts of the company up to twice the amount of their stock. This leaves Messrs. Herrick, Lawrence and Parmelee liable for $200 each, and Mr. Elmer Sperry liable for $249,400.

The fiat has again gone forth, and the works of the Brush Electric Company will now be closed for good.

Mr. Sam. Hamill has played for three years a successful engagement in the part of "The Great and Elastic Straddler." He will now come down on either one side or the other—probably the other.

* * *

Connecticut Railroad Matters. When it was announced a few days ago that the Connecticut Legislature, which has been hearing arguments for several weeks on the question of granting charters to electric roads paralleling to some extent existing steam lines, had decided not to make any general regulation, but to decide each case upon its merits as it came up, it was assumed in some quarters to be a victory for the trolley people. Such is not the case. Every application coming before the Legislature since the hearing, where the parallel idea was involved at all, has been decided adversely to the trolley interests and against the best interests of the people of the State.

There can be but one interpretation placed upon the action of these Connecticut lawmakers. The merits of the trolley system for interurban traffic are so thoroughly demonstrated, and have been so overwhelmingly recognized by the public at large, that these hayseed legislators can not crawl behind the pretext that they thought they were working for the public good. They were working chiefly in the interests of the Consolidated steam road company, which for years has controlled the body.

If there be one man among them who honestly holds that the State is under any obligations to the railroad company, he is sadly misguided. Paternalistic ideas have slight foothold in America, but the arguments offered by the railroad lawyers would outdo in this direction anything that we know of even in Germany, the stronghold of paternalism. These lawyers held that the State had really guaranteed that the investment in New York, New Haven and Hartford securities should forever be a profitable one. This is not exactly nonsense. It is socialism of too dangerous a tendency to be tolerated in New England.

The advance of the trolley has been checked; the people who need the new lines can now wait another season or two, but they will get it sooner or later.

It would not be a bad notion to make an issue of trolley extension in the next legislative election in Connecticut. The trolleyites would certainly win.

* * *

The Telephone Situation. An interesting review of the present condition of the Bell Telephone Company and of the telephone situation generally is offered to the readers of ELECTRICITY this week. Nothing, perhaps, of editorial comment is needed to show that the imperious Bell monopoly is broken, and that the great corporation which has so long treated the public with contemptuous arrogance is even now bending the knee, and will soon be begging for public favor.

There is no way of estimating exactly the amount of actual and legitimate competition already in the field against the Bell Company. There is enough of it to make itself felt and to reduce the Bell Company's income by several millions per annum.

Whatever this competition may be, however much it may grow, it can change the situation and produce results in time only. The Bell Company's inherent weakness is such that it must give way from this cause alone sooner or later. A few more strong companies in the field for actual business, a few more local Bell companies asserting their rights, and American Bell stock will be offered at 50 on the Boston Exchange.

Though the telephone business is wide open, we advise investors everywhere to go slow and look carefully into the affairs of the companies proposing to sell rights. Telephone rights are not worth a pinch of snuff. The company that has only *stock* to sell should have no consideration.

There are independent companies, with factories established, ready to sell instruments and to install exchanges. They are the only ones worthy of talking to, and there are not many of them in the United States. Examination would show that most of the new companies advertising in the *Electrical World* are nothing but stock-jobbing concerns, without money, without credit, without a telephone system—without anything in fact save plausible stories and stock or rights to sell.

This condition was inevitable, and it will soon clear itself, leaving the new companies with money, with men who understand the telephone business, and with fully equipped factories, in practical control of the field.

Under the Searchlight.

Views and Opinions on Timely Topics.

MR. D. O. MILLS is likely to retire from the G. E. Board this month.

* * *

AN Edison licensee advises us that the licensees who are paying 18 cents for Edison 16 C. P. lamps are paying too much, as his last purchase was made at 12.5 cents net f. o. b. New York.

* * *

IN line with arguments advanced by ELECTRICITY some weeks ago in favor of keeping up the price of the standard incandescent lamps to a fair price, we are able to state that the Westinghouse Electric Company, immediately upon the announcement that they were prepared to deliver the Sawyer-Man lamp at 25 cents in barrel lots was actually deluged with orders. There is a large proportion of lamp buyers who realize that the best lamps on the market are none too good, and that an inferior lamp like the Edison is not worth buying at any price.

* * *

WE understand that Mr. Webster, he who worked-'em-all, has been uneasy of late over the casual remarks in this column concerning the procurement of the G. E. charter and the way the bribery fund was manipulated. Mr. Webster is getting nervous too soon; we have not yet told half the story which is available. When we have told it all, he might be nervous enough to go abroad. He and Mr. Clapp might go together.

* * *

NOTWITHSTANDING the payment of unearned dividends on Consolidated Electric Storage Company's stock, the price has declined to $1.50 and $2 per share—par value $25.

* * *

WE were in error last week in stating as a fact that G. E. preferred stock cannot be scaled down. There are two opinions upon this subject, both advanced by able counsel. The attempt will probably be made to reduce it one-half, and the matter will be settled in the courts.

* * *

The Electropoise and Religious Journals.

A Public Disgrace.

(From the Troy Press.)

It has become an axiom among promoters of questionable projects that the religious press of all class publications is the most easily satisfied to accept the advertisements of their wares. Humbugs and frauds which even the daily press reject as unfit for its columns are often greedily sought after by the editors of religious papers of easy conscious, simply because of the financial returns which they bring.—ELECTRICITY.

That this is true of many religious papers is proven by their own columns; but not of all. Now and then a denominational journal is careful to keep its advertising as well as reading columns pure and wholesome; but our observation leads us to say that it is really exceptional. At any rate most of the religious papers that we see print plenty of advertising of a class that is almost daily rejected by the *Troy Press*. Many advertising frauds send cash with their orders so as to lessen the likelihood of rejection, and it is no exaggeration to say that we return hundreds of dollars annually because the matter offered is objectionable. To see vile medical advertisements, catchpenny announcements for agents at fabulous salaries and other devices to defraud the public in a journal which purports to be religious is disgusting. A good family paper will keep its advertising no less than its reading columns free from that which is fraudulent, immoral and vicious.

* * *

May 1—"About this time look out for fish stories."

The following is taken from the Cleveland *Plaindealer*, but has appeared in slightly different form in many other papers:

BUSINESS IS BOOMING.

The G. E. Company Will Build New Factories.

President C. A. Coffin, Vice-President S. Dana Greene and Treasurer J. P. Ord and other directors of the General Electric Company, which does a large share of the electrical business of the country, have been in Cleveland for the past few days. They held a conference Monday at the works of the Brush Electric Company.

The matter under consideration is the consolidation of several of the company's plants in one mammoth concern. The gentlemen were in Cleveland to canvass the prospects for securing a site here.

"We have been in Buffalo," said one of them to a reporter yesterday, "and in that city a Buffalo syndicate offered to erect our buildings and present us with land for the plant. Their offer was equivalent to $1,000,000. A New Jersey concern has made us an equally desirable offer. The matter is as yet undecided and if Cleveland wishes to make an offer she has a fair field. We do not regard Buffalo as in any way superior to Cleveland, but of course Buffalo has made a fine offer."

It is probable that the matter will be submitted to the Chamber of Commerce. The plant will employ between 4,000 and 6,000 men. In the event of the plant being located in some other city than Cleveland it is not improbable that the Brush works may be a part of the consolidated concern and be moved with it.

A rumor about town yesterday was to the effect that Tom L. Johnson would endeavor to secure the works for Lorain.

AMERICAN BELL'S WEAKNESS.

Its Patent Foundation Gone, the Structure Totters.

NO LONGER A MONOPOLY AND RUINOUSLY CAPITALIZED.

Facts and Figures Concerning the Present Status of the Telephone Business.

New England investors have been mercilessly scourged during the past ten years, and unless all signs are at fault further desperate punishment is in store for them. They lost $125,000,000 in Union Pacific and collateral securities; $140,000,000 in Atchison; $80,000,000 in Northern Pacific and allied enterprises; $65,000,000 in Burlington and $20,000,000 in General Electric—a grand total of $430,000,000.

Each of the five properties was in its turn raised high upon the pedestal of New England favor and worshipped with blind idolatry. All New England was wrapped up in them. Three went into total collapse and two have shrunk and shriveled under the shadow of the coming of the auctioneer's red flag. They are in the list of "badly disfigured."

American Bell Telephone now ranks as the leading "gilt-edged" security into which the fetish loving New Englanders are investing their money, and the dews of death are glittering on the brow of that sacred monopoly. Its corpse is in preparation for New England's already overworked financial morgue. Founded in fraud, fostered by bribery and corruption, attempting to prolong its life by what has been judicially declared to be "grand larceny," and fattened into vast size on the fruits of oppression and rapacity, the hideous monster—ranking in public estimation as one of America's greatest monopolies—is an empty shell. More properly speaking, it is rotten to the core. It has reached the "confidence game" stage, and longer silence by the press as to its real condition would amount to participation in the robbery of thousands of widows and orphans and an army of innocent and deluded investors who have put their aggregated savings and trust funds into the property under the belief that it was as safe as Government bonds. It is the one security that New England brokers urge first upon anxious customers who come to them with a few hundred or a few thousand dollars to invest.

WHAT THE COMPANY IS.

What is American Bell Telephone? It is a corporation capitalized at $50,000,000, the basis of which is ownership in patents that have expired, and in the earning power of its stock in subordinate companies which are confronted with a newly arisen and overwhelming opposition that has already cut into their business and forced a reduction in telephone charges all over the country of from 25 to 50 per cent. These subordinate companies are face to face with an angered public, threatened on every hand with hostile State and municipal legislation, and pinned to the ground with the inexorable necessity of spending vast sums to renew plants so as to be in a position to meet the vigorous competition that is springing up in every community.

These subordinate or operating companies are capitalized to the extreme limit of earnings under most favorable conditions, and they are in nearly every instance bonded to the amount represented by the actual cost of their plants. These minor companies have a capital stock of very nearly $80,000,000 and their bonded indebtedness approximates $35,000,000.

During 1894, the best year in the history of the telephone business, and the last (final) year of the existence of the monopoly, the sub-companies earned $3,800,000 net to shareholders, of which $1,937,000 went to the parent company (the American Bell). The dividends of the sub-companies averaged a shade less than 5 per cent. Since that money was earned and paid out the telephone charges throughout the country have been cut 25 to 50 per cent., as above noted, and 100,000 instruments have been put in by opposition companies. With equipment allowed to run down in order to pay dividends on distended capitalization, the necessity confronts the Bell sub-companies of reducing revenues one-third and of raising more money with which to rehabilitate plants—a situation which may be described as gloomy viewed from an investment standpoint.

TROUBLE IN ITS OWN CAMP.

That portion of the income of the American Bell Telephone Company derived from the dividend on its $38,268,000 holdings in the stock of sub-companies is threatened with practically total extinction.

The total revenues of the American Bell last year were $4,848,294.94, according to the annual statement of its president, of which $1,937,657.77 was from its stockholdings, as noted. The largest source of income, however, was from royalties on patents which are now extinct. These royalties average $4 on each telephone, or 50 per cent. of the cost of the instrument. There are 604,000 telephones in the Bell service, and the royalties paid by the sub-companies into the treasury of the parent company footed up $2,502,922.17 in 1894.

This enormous tribute, amounting to 55 per cent. of the total revenue of the American Bell, is robbery pure and simple. It is blood money extorted by the parent company for certain so-called rights which have ceased to exist by reason of the expiration of the patents. By virtue of majority holdings in the stock of the sub-companies the hoggish parent company forced upon the lesser corporations contracts requiring the payment of such royalties in practical perpetuity. This palpably and remorselessly jug-handled arrangement for the extortion of $2,500,000 a year from subordinate companies has already aroused the furious indignation of many of the more far-sighted of the minority holders, and a suit at law has been commenced by one of the directors in the Central Union Telephone Company, an organization covering the greater part of Ohio, Illinois and Indiana, to restrain the monopoly from further exactions in that direction, the plea being that when the patents expired upon which royalties had been paid the right to demand such royalties should in justice cease also, and that contracts binding his company to continue such payments were extortion and thereby invalid. The director referred to is Mr. Milo G. Kellogg, a wealthy man of Chicago, and his attorney is ex-Solicitor General Aldrich. The minority stockholders in other companies throughout the country are watching eagerly the development of this suit, and from the mutterings which are heard in every quarter it is not unlikely that similar suits will be instituted in other courts. Another ground upon which the validity of these contracts is to be attacked is that they are null because the management of the company receiving the benefits controlled the majority holdings in the subordinate companies represented by the other end of the contract. The courts have held repeatedly that directors or officers or those in control cannot make legal and binding bargains with themselves as individual officers for the control of other corporations. The point has never been raised before as between the American Bell Telephone Company and its numerous subordinate companies, but the fight has now been opened and will be pushed to a conclusion.

The only hope the minor companies have of obtaining money without borrowing it, with which to keep up their plants, is in relief from the royalty robbery. Revolt against further submission to this robbery is so general that relief is certain to follow. With the illegality of these contracts established, the principal source of American Bell income is gone.

THE INSIDERS USED FORESIGHT.

Reading the handwriting on the wall and realizing the inevitable, "insiders" several years ago organized the American Long Distance Telephone and Telegraph Company under the laws of New York to serve, it is broadly intimated, as a raft upon which to float out all that is valuable of the American Bell when the collapse should come. The American Long Distance is capitalized at $12,000,000 and is heralded as the future rival of the Western Union and Postal in the telegraph field. It is a parasite that has grown upon and into the American Bell, and it is sapping the vitality of the parent company. Wherever and whenever it is possible, business is being diverted from all other Bell companies into the Long Distance. This is beautiful for the Long Distance Company but it is difficult to see wherein the American Bell shareholders are going to be benefited at the "show down." Nobody but the "insiders" know precisely what the relations are between the American Bell and the American Long Distance Company. Official reports are silent on that point, and the thousands of small investors are kept in the dark as to the true inwardness of the deal. Explanations are urgently demanded and are overdue.

Of the $50,000,000 authorized capital stock of the American Bell, $20,500,000 has been issued. At current quotations on the Boston Stock Exchange (180) it has a market value of $37,000,000. "Knowing" holders have been kindly letting widows, trustees, savings banks, preachers, school teachers, servant girls and the great army of small investors have the stock around top figures for a year or more, and the suffering when it comes will descend upon thousands instead of upon the few. The wolves will get away and the lambs will be left to endure the punishment. The unloading process is far from complete, however, and fearless publication of the iniquity of the thing may yet save other thousands who would, if left in ignorance, drift upon the shoals of disaster or stumble blindly into the trap set for them.

THE MONOPOLY IS BROKEN FOREVER.

A few of the weak points in the armor of the telephone monopoly are presented in the foregoing enlarged discussion and analysis of these points, and incidental reference to other matters will tend to further enlighten on the general situation—conditions necessary to a full and complete understanding of the facts in the case. It is in regard to the permanency of the earning power of the American Bell that stockholders and the investing public are chiefly concerned, for it is upon "earning power" that there has been reared the stupendous telephone capitalization represented by—

American Bell	$50,000,000
Sub-companies	80,000,000
Bonded debt	35,000,000
Total	$165,000,000

Monopoly is the arch upon which this sky-scraping structure of securities rests. Cut the ground from under monopoly and the huge pile tumbles.

How thoroughly and effectively the monopoly is already broken is shown by the ferocious competition that is meeting the old companies at every turn and in every quarter, and to add to the embarrassment of the Bell people, the Legislatures of half the States in the Union are considering bills to reduce the telephone charges to about one-half former rates. Such bills are pending in the Legislatures of Wisconsin, Illinois, Ohio, Pennsylvania, New York, Minnesota, Iowa, Missouri, Texas, Kentucky and nearly all the Southern and Northwestern States. Bills have also been introduced and are being pushed for the compulsory interchanging of business with other telephone companies already established or to be established. The Bell would have the people believe that opposition is all in the air. This is very far from being the case. Local companies are springing up all over the country, and no less than ten having control of available patents are already in the field. The Standard Telephone Company, which has been recently exploited in the newspapers as being about to grapple with the old monopoly on even terms so far as capital goes, is as yet entirely in the air. It has no exchanges in operation, and its achievements are all in perspective. In some quarters it has been hinted that the Standard is merely a Bell decoy, put up for the purpose of frightening off genuine competition. These suspicions may or may not be groundless. Time alone will determine that.

The Harrison Telephone Company has already many exchanges in operation, with a total number of about 40,000 instruments in use, and is making considerable headway in several Western and Middle States, and the smaller companies are succeeding in proportion.

A few instances may be mentioned illustrative of the irrepressible tendency towards a reduction in telephone rates. In Norwalk, Ohio, the Bell Telephone Company has offered to do business at $12 a year as against an old charge of $4 a month. In Crawfordsville, Ind., the Bell people are offering to supply service at $12 a year instead of $48 as formerly. At Lafayette, Ind., the price was formerly $48 a year; it is now $12. Indianapolis, Ind., charges have been reduced from $60 to $30. Decatur, Ill., now has a $12 service in the place of one costing $48 a year. A large reduction at New Orleans, La., is noted. Throughout Illinois, Wisconsin and Iowa charges have been reduced 25 to 40 per cent. In New York City there has been a reduction (on paper) from $240 to $80 and upwards a year. Just what the reduction is in that city has not yet been fully developed. It may or may not amount to anything immediately, depending on contingencies not possible to forecast. In Topeka, Kansas, there has been a reduction in charges from $60 a year to $18 a year. In Salina, Kan., Selma, Ala., and Durham, N. C., the Bell people are offering to do business for a year or more for nothing, and equally cheap terms have been offered in several other Western communities. Masillon, Ohio, Fort Wayne, Ind., and Port Huron, Mich., are also in the class that is now paying $12 a year instead of $48, the price ruling last year. A perfect epidemic of reduction has struck the very citadel of Bell monopoly—New England itself.

Scores of mutual co-operative companies are springing up all over the country, their basis being an assessment on subscribers for the bare cost of the plant and the payment of monthly charges just sufficient to cover operating expenses.

Chicago and many of the larger cities of the country have been attacked by independent companies, and it is only a question of time when the inhabitants of the great communities as well as the small towns will enjoy the benefits of competition. In Chicago the Bell Company charges averaged $125 a year. To shut out competition it has reduced its rate to $60 a year, a loss of revenue on 11,000 instruments amounting to $715,000 per annum. The newly organized companies enter new fields on the basis of average charges of $24 a year, whereas the old companies have been charging from $48 to $100 a year. In Ohio a State Association of independent companies is forming to fight the Bell.

It will be seen from the above that the Bell monopoly is being savagely attacked at the very base and fountain-head of its income.

FINANCIAL CONDITION.

Of tangible assets the monopoly is very poorly equipped. As stated, its foundation and very life is its earning power. As has been shown, the two large items under this head are being subjected to a line of attack that cannot help but be fatal in the long run. The old companies are placed at the grave disadvantage of being over-capitalized. They have been stocked to the full extent of an earning power that could only be enjoyed while they held an undisputed monopoly of the entire field. New companies starting in on business have an enormous advantage from the outset. They are not under the necessity of earning dividends on a large amount of "wind" capital, and neither are they handicapped with contracts requiring the payment of extortionate royalties on dead patents.

The aggregate bond and stock capitalization of the subordinate telephone companies in the United States under the Bell control approximates $115,000,000. The plants of these several companies consist largely of 604,000 telephone instruments and a little less than 400,000 miles of wire of all kinds. These plants can be duplicated for less than $40,000,000 according to competent authority. The telephone instruments, switchboards, poles, wires, etc., can be furnished at a cost of about $60 a subscriber. This calculation provides a total of less than $35,000,000 and an additional allowance of $5,000,000 to cover every other possible contingency.

The telephone business of the old companies must earn enough to pay returns on $80,000,000 local stock capitalization and $36,000,000 (market value) in the parent company stock, or $116,000,000 in all, besides interest on $35,000,000 bonds, and this on a plant that can be duplicated for less than $40,000,000. The earnings from the business for the year 1894 may safely be called a maximum. It represents the climax of fifteen years' development in a field in which there was no competition. Now, with rivals at every crossroad and pressing for admittance into every community, is it reasonable to suppose that that maximum can be maintained? That is something that anxious stockholders are already asking themselves.

Expert accountants who have undertaken in all candor and get at the true inwardness of the annual financial statement of the American Bell say that it is entirely too subtle for even their trained understandings. There are items of which no clue to their real meaning is given. For instance, in the liabilities there appears the item of $10,228,571 under the head of

"Patent Account" (Profit and Loss). Now as the patents have become worthless by their expiration, it is difficult to see how they should figure at all in this statement. They very evidently counted originally as part of the capital of the company. On the same side of the ledger there appears to the account of "Profit and Loss" $5,849,444, to account of "Reserves" $4,222,756, and to account of "Surplus" $2,152,000. What these various accounts mean is something to which the anxious inquirer is afforded no clue by the officers of the company. The four items, "Patent Account," "Profit and Loss," "Reserve" and "Surplus" foot up $22,500,000. So far as anybody knows, that vast amount may mean something, anything or nothing. So far as official explanation goes the terms are meaningless. As a convenience in bookkeeping they stand as a partial offset to the assets, which, as before stated, foot up to something like $45,000,000.

The balance sheet also affords a field for the scrutiny of the curious. Under the head of "Expense" are to be found the following items: "Legal Expenses," $178,342.88; "Interest and Taxes," $356,417.51; "Commissions," $459,915.71; "Concessions," $231,713.64.

President Hudson naively remarks that the expenses for legal services in the coming year will be much smaller than they were last year, important litigation having been closed. This is good. The litigation which is over terminated in the destruction of all that was left that was of any value to the Bell people in the way of patents. The reduction in legal expenses by reason thereof is a good deal like the saving in a doctor's bill for catarrh after a man's head is cut off. Some curiosity is shown as to what is really meant by the outlay for "interest and taxes." It is shown by the report that the investment in telephones is $1,209,000 and in real estate $951,000, a total of a little over $2,000,000. Taxes on that could not be very heavy. The bonded indebtedness of the Company is $2,000,000, bearing the exorbitant rate of 7 per cent per annum. Stretching everything, legitimate expenses for taxes and interest could not exceed $150,000. Where did the rest of the $356,000 go to? To what purpose was it applied?

It would likewise be interesting to know what sort of "commissions" absorbed the enormous sum of $459,000. Was it commissions on "grease" of the kind best known in State capitols during the sessions of Legislatures? Details upon this point would be interesting. And then something might be furnished with regard to "Concessions" that would be information for which stockholders are clamoring. The accounts that are classed as "Legal Expenses," "Interest and Taxes," "Commissions and Concessions," cover a vast amount of mystery. Under these headings nearly $1,350,000 was expended during the year 1894. There is absolutely no explanation given as to where the money went, how it was spent, or what for.

Now here is another phase of this question to be further considered: In order to meet the newly arisen competition the old companies are obliged to rebuild their lines at an enormous outlay of money, which outlay must be provided either by further increase of capitalization or by the extension of their bonded indebtedness, or taken from their greatly reduced earnings. These are the plain facts which confront the owners of this heretofore immensely profitable business, and it is folly to be blind to conditions that are patent to the whole world. In view of the facts, investors of an inquiring turn of mind will be slow in accepting the brave statements of the friends and upholders of the American Bell Company that dividends will be continued at anywhere near old rates. The arrangements between the parent and subordinate companies give to the former every possible advantage, and so long as fat dividends were being earned no complaint was heard. But now that there is a very strong possibility of a reduction all along the line, the minority holders who put up all the cash that had been invested are getting into an ugly frame of mind. The iron is entering their souls, and they are beginning to see that they are due to suffer from the operation of the agreements now existing. To them the future looks exceedingly blue. They are compelled to skim off the first layer of earnings to meet the interest on an aggregate bonded indebtedness approximating $35,000,000 and then to submit to the payment of tribute to the parent company at the average rate of $4 per year on all instruments used before they can begin to see a dollar for themselves. That is a pretty severe tax on an earning power that is already subjected to serious impairment. Without burdening the reader with too many details, it is pertinent in this connection to give a list of the more important subordinate companies which control the business in the United States. Their names are as follows:

The New York and New England Telephone Company, covering Maine, New Hampshire, Vermont, Massachusetts. This company has an authorized capital of $12,000,000, of which $10,394,000 has been issued It has a bonded indebtedness of $2,541,836.

The Providence Telephone Company of Rhode Island.

The Southern New England Telephone Company, occupying that portion of New England not covered by the two last mentioned.

The New York and Pennsylvania Telephone Company, covering a portion of New York, Pennsylvania and Delaware.

The Metropolitan Telephone and Telegraph Company, covering the city of New York and the country thereabouts within a radius of thirty-three miles. Capitalized at $3,300,000 and bonded at $2,000,000.

The New York and New Jersey Telephone Company, covering Staten Island, Brooklyn and nine counties of Northeastern New Jersey. Capitalized at $3,000,000 and bonded at $2,827,800.

Chesapeake and Potomac Telephone Company, covering Maryland, Virginia and the District of Columbia.

Cumberland Telephone Company, covering Tennessee, Kentucky and a part of Indiana.

The Southern Bell Telephone Company, covering the southeastern States.

The Southwestern Telephone Company, covering Texas, Louisiana and Arkansas.

Missouri and Kansas Telephone Company, covering Missouri, Kansas, Indian Territory and Oklahoma.

The Rocky Mountain Telephone Company, covering Colorado, Wyoming, Utah, Nevada, Idaho and Montana.

The Sunset Telephone Company, covering the Pacific slope.

The Wisconsin Telephone Company, covering Wisconsin.

The Michigan Telephone Company, covering Michigan.

The Nebraska and Erie Telephone Companies, covering Nebraska and the Dakotas.

The Iowa Telephone Company, covering the State of Iowa.

The Central Union Telephone Company, with $10,000,000, covering Indiana, Illinois and Ohio.

The Chicago Telephone Company, with $5,000,000 stock capital, $2,000,000 bonded debt, covering Cook County, Ill.

Details infinite in variety might be lugged in to fill the skeleton outline of the story and support the statements presented above, but a multiplication of facts would only carry the recital to unconscionable length. Bell history in its brutal entirety would fill volumes.

Advanced Electrical Work at Columbia College.

To determine whether or not the sluggish effect which opposes the transmission of electrical impulses in submarine cables and other conductors of high static capacity can be overcome, a series of elaborate experiments are now in progress in the electrical department of Columbia College. Prof. Pupin has the experiments in charge, and most flattering results are confidently expected.

Prof. Pupin is devoting his personal attention to the perfection of a multiplex system of telegraphy which will operate without the necessity of the delicate adjustment and balancing now required in the quadruplex system.

OPPORTUNITIES IN ELECTRICAL ENGINEERING.—II.

BY A. A. ATKINSON.

The question now is, with conditions as they are, which offers the most to the young man? So far as it can be seen at present, considering the number of positions open, the practically educated young man has the advantage, though if the technical graduate be willing to begin low in order to learn the practical elements of the business and to convince his employer of his superior ability and skillfulness, he will find plenty of opportunites for promotion; he can then leave the lower position to another beginner. But unless he be willing to do this, the practical man who is in a sense previously prepared for work in any application has much the advantage. Besides, he knows the practicalities, the other has them yet to learn.

I believe the day is past when we should expect new and wide applications to develop suddenly to require the services of a number of men; the surprises in lighting and power and transportation are not in the future. When these things were new, men not educated had to fill the positions; horse-drivers became motormen, fire-stokers station men, and steam engineers "electricians." Now as these industries widen, and that rapidly, the great problems are a more efficient service, stricter economy in all directions and a gradual weeding out of the undesirable, thus making room for those prepared to render the best service. Necessarily this process has been slow for several reasons, but now that the various departments of the electrical business have become permanently established, this will be more rapid. The bad wiring, the wretched installation, the miserable economy of operation which have prevailed in the majority of cases in light and power plants for small towns, and also in very many not so small, will gradually disappear, because the services of trained men are beginning to be appreciated and sought. For the same reasons new installations will be manned by those who are prepared for the work.

I can probably best indicate the situation to the electrical student by outlining the kinds of positions that may be open to him. So, not by any means including all, but serving as a broad basis of division, let us lay down the following: (1) Original investigation and invention. (2) Consulting and constructing engineer. (3) Superintendents of light and power plants, including isolated and central station work, stationary power, railways, mining, etc. (5) Artisans in light and power. (6) Artisans in factories. Those belonging in the first class I shall call electricians. Those in the second, third and fourth classes may properly be denominated electrical engineers. To be sure this is not meant to consider those cases where some member or stockholder of the company is made "superintendent" whether there is an engineer besides him or not. If he has not the electrical knowledge, and does not actually superintend the electrical part of the work, his title is a misnomer. Properly, in small towns where this is done, he should be superintendent or business manager of the "company" and not of the plant or works. It will be quite evident, also, that the station man in a small plant, who also looks after the wiring and general repairs, is not entitled to the distinction of electrical engineer. He is merely an artisan, and the plant and town are without an engineer. I assume in this connection that only he who has practically passed through the preceding steps and has arrived at the point of being the real superintendent of all the construction and repair of electrical appliances, whose theory and practice and experience entitle him to this distinction, shall be called electrical engineer in the sense in which I am using the title. Under (5) and (6) I mean to include all, highest to lowest, engaged in actual work in manufacturing establishments, and in the actual operation of electrical appliances in lighting and power.

As to numbers, we observe that those belonging to class (1) are comparatively few. Their preparation will be of the highest kind, technical and theoretical. The work of research must be undertaken only by those who have an intense love of truth for its own sake, and are willing to devote many weary days to its search with the expectation of no other reward than the great satisfaction of having added something to the world's knowledge. Science may indeed pause to do them tardy honor. Men of this stamp we all can name, and none are more deserving of the world's gratitude for their noble sacrifices in behalf of truth. Such men have established the laws of chemistry, physics and electricity—indeed have built the foundations of knowledge in all lines. They have established the bases for the modern practical applications of science, and they have invented practical devices for applying their discovered principles. They have given us the photophone, the phonograph, telephotography, the telautograph, the possibilities of electrical welding, heating, cooking, transportation and hundreds of others. And yet their work is not done. There are the problems of light without wires, the real nature of electricity, light and power without the present wasteful methods—perhaps by maintaining very high frequency vibrations—electrical energy directly from the sun, methods of improving the magnetic circuit of dynamos, earth telephony, etc., etc.

Very little need be said about class (3), for the number of places is necessarily limited, being open generally only to those who have received a special training in the factory itself. New establishments select men of experience from factories elsewhere. But those who are fortunate enough to secure places as artisans are the material—some of them—out of which those more enviable men are made.

There are much greater opportunities in class (2) and these will be on the increase. As the tendencies are more and more to stricter economy, least first expense and more efficient service in general, the electrical engineer will be more and more in demand. The time is rapidly approaching when every central station, lighting and power, and every form of electrical business, will have their consulting and installing engineers. The preparation for this work must be founded in practice. Without going into detail, it is apparent that the technicalities of engineering alone will be of little avail. The reason for many failures in the successful installation and operation of electrical plants has been that the "theories" of those in charge were not backed up by a thorough practical knowledge and experience.

Classes (4) and (5) have the advantage of by far the greatest number of individual opportunities; and as the financial condition of the present improves this will be true in a still larger measure, since capital being less conservative will hasten to invest in the business which when rightly managed promises the largest per cent on the outlay. The gradual adoption of electricity by steam roads and by new competing roads joining important centers, the rapid extension for lighting into towns everywhere, the enlarging of existing plants to meet the exacting demands for greater and better service, the extension of electric power into mines and other forms of industry —all will have the effect of opening up new and wider opportunities. But in the same proportion there will be the greater demand for more thoroughly prepared men. This needs no particular illustration; but to take a single instance, lighting, as representative of the situation in general, it has been stated on good authority that if electricity should supplant gas for lighting purposes the cities of New York and Philadelphia alone would at once require all the dynamos and lamps now in use in all the United States. I believe this is what we are gradually but surely coming to. With the inevitably cheaper production and more satisfactory results gas must die hard after a severe struggle, the Welsbach with its other devices. It can readily be seen what the advantages of electricity are, and the people will demand and get it. It needs no argument that the preparation for these two classes must be a thoroughly practical one—practical in the sense in which I have been taking it.

Under the head of (6) comes a number of positions, though much smaller than under (4) or (5). On the whole these places are not so desirable, since the chances for advancement will be limited to very few in this line of work.

From the foregoing outline it will be apparent that the men educated along what I have called practical lines have far the better chance for promotion under the present conditions, and the places they are at once able to fill are much more numerous. The technical graduate is prepared for (1). True he may work in (2) and the rest if he first goes to work to prepare for them by practical study and experience, either in school or under private instruction, with an apprenticeship. This done his higher instruction will be of much advantage to him. But I cannot help deprecating the tendency of our so-called technical schools in their instruction to sail off into the generalities, refinements and abstractions to the neglect of those things which are more essential for the immediate use of the great majority of their graduates.

I wish to repeat that there are and will be opportunities abundant for those rightly educated. In numbers they compare at least very favorably with those in other professions. Students must of course be taught the difficulties of low salaries at first—not speaking of the many favorable exceptions to this,—hard work and perseverance. But is this any less true in most other kinds of business as a rule? One great reason for the apparent overcrowding of the electrical profession is that so many are educated for positions that do not exist instead of preparing to meet the conditions as they are.

Athens, O., April 17, 1895.

Last of Prof. Crocker's Lectures.

The concluding lecture in Prof. Crocker's popular course at Columbia College, on the practical applications of electricity, was given on Thursday evening last. "The Telegraph and Telephone" was the subject. As in previous lectures of the course, Prof. Crocker gave considerable attention to the history and development of the art, making plain at the same time the extreme simplicity of the principles upon which the several instruments are operated. The synchronous and quadruplex systems were explained in detail, and experiments made to show the method of operation. To show the sluggish effect which the high static capacity of an ocean cable has upon the transmission of electric impulses, the most novel and interesting experiment of the evening was made. This experiment and Prof. Crocker's explanation of it clearly demonstrated why it is not possible to use the Atlantic cable for telephonic communication with Europe.

In connection with his remarks on the telephone, Prof. Crocker said it was only fair to the telephone companies in large cities to state that the complexity of connecting 10,000 or more subscribers is infinitely great, in fact almost insuperable. Hence it stands to reason that telephone service in large cities must of necessity be an expensive luxury.

ARC CARBONS AND THE RATING OF ARC LAMPS.*

DISCUSSION.—(*Concluded.*)

Prof. Thomas, of Columbus—I am not a member of this Association, and now have the pleasure of attending one of your meetings for the first time; but, as some of you know, I have been more or less interested in the questions involved in lighting by incandescent and by arc lamps, and noting the title of this paper on the programme which was sent to me, I brought with me the results of some work which has been done recently at the State University at Columbus bearing on the point under discussion. I thought it might be interesting to the members to know what the results of that work were. The work was undertaken with particular reference to the bearing of facts upon the proposed watt rating of arc lamps which grew out of the discussions of the Electrical Congress during the World's Fair. The measurements consisted in the determination of the amount of light given by the amount of carbons, not when they were mounted in arc lamps, but mounted in rigid holders, the length of the arc adjusted to a definite amount by means of the chain of the arc formed by a lens upon a screen. The strength of the current passed through the carbons was ten amperes. The length of the arc and readings of voltage required and candle power were measured by means of the Weber portable photometer (?). The carbons upon which measurements were made consisted of ten or more pairs of carbons, obtained from nearly all the central stations in the State of Ohio. The carbons were obtained by students of the university from their homes, or by their friends at home from lots of carbons that were in regular use in street lighting service, for the purpose of getting at the facts as to the light actually given by the carbons. The point of the investigation was to determine how much variation there is in the candle power afforded by arcs which are maintained at an expenditure of a constant amount in watts.

The watts that we made use of in the investigation were a little higher than the rating adopted by this Association, namely, about 500 watts, as nearly as we could judge. Our machinery was adjusted so as to work steadiest at ten amperes, and with the arc length we find commonly maintained in lamps in Columbus we found that sometimes 51 or 52 volts was required to maintain the arc in that condition.

With this brief explanation as to what the work consisted in, I may briefly run over the results, without of course naming the makes of carbon upon which the measurements were made. Readings were taken at different angles in the lower hemisphere, but without stopping to read the results showing the variation at different angles. I will give the results at 45 degrees, which has been found is about the angle at which the light is produced.

I find in the case of the first make of carbons tabulated that at 45 degrees the candle power measured ranges between 1,855 and 1,422. These readings which I give you are the results of the averages of readings taken from six to ten pairs of carbons of the individual make, and readings taken in each case by different observers, so as to eliminate as far as possible personal error, and to get as nearly as possible a basis for judging of the uniformity of performance of a given make. The variation in the candle power of this make shows 23.3, with variation of 3 per cent. in watts. The candle power relation is widely different from the relation of watts. Second make, similar data, candle power 8.86 to 14.29; variation in candle power 38 per cent., 2 per cent. in watts. The next make, 55.6 candle power, 7 per cent. variation of watts; candle power 977 to 2,200. Here is a reading of 2,200. These readings are worked up by my students, and are abundantly substantiated by individual work of my own.

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* A paper read before the N. E. L. A. at Cleveland by L. B. Marks.

The next make of carbons gives a variation of 39.8; 2.2 watt variation. Next, candle power 20.48 to 1,370, 33 per cent. variation in candle power for 2.3 variation in watts. Next, 40.3 in candle power, one-half of 1 per cent. in watts. Next, 45 candle power, with ⅞ in watts. Next, 26 variation in candle power, with 2.8 variation in watts. Next, 44.7 variation in candle power, 3 in watts.

The foregoing will answer in part the question which was partly answered by Mr. Marks as to the influence of size, etc., whether the carbons are coated or uncoated. The difference between them is shown here at 45 degrees. The average candle power of all makes with uncoated carbons, 1,677; half coated carbons, 1,474, of the same size, $\frac{7}{16}$; uncoated, candle power 1,611; coated, 1,459. In both these cases the smaller carbon has the smaller candle power. Of course, this is not to be taken as conclusive, because the point of investigation was not to determine the influence of size; and I should say from a scientific point of view there are many points left out of this investigation.

Not being a member of your Association, it would of course be improper for me to argue upon the question of the propriety of the watt rating; but I have done so much work in the matter, and am so interested in the success of your work, that I may perhaps be pardoned for expressing myself on the question. I think the watt rating is simply taking a step in one direction which does not tend in any degree to remove the trouble which you all experience, and you are simply changing the ground, that is all. My idea as to what should be done I have privately urged for some time. It is substantially that set out in Messrs. Houston and Kennelly's paper, read at this meeting, that the proper basis for a contract between a municipality and a corporation, the object of which contract is the lighting of the streets of a city, is the illumination that is produced upon the street. I care not whether the light be done by electricity, arc or incandescent lamps, or by gas, or gasoline, what the citizens want is light upon the streets; and if your contract will specify the degree of illumination required to be satisfactory under the usual weather conditions obtaining in a given place, and you name that in your contract, and then determine at any time when the question arises whether you have that illumination or not, you will have an easy means of settling your controversy. There will be no question of arc lamps, candle powers, or anything of that sort. Find out what the fact is as to the illumination which your contract calls for.

I cannot refrain from expressing a word of criticism, which I shall do in print soon, upon the paper of Messrs. Houston and Kennelly in regard to the instrument which was presented. The idea underlying that instrument was discarded some two or three hundred years ago. The principle that underlies it was one of the earliest made use of in the attempt to measure the intensity of light, and it was found unreliable, and the reason for it was set forth by Prof. Thomson in his remarks. The human eye is the thing which makes it unreliable. There are too many and serious differences in the eyes of individuals, and differences in the same eyes at different times. The instrument is an interesting thing for a person to use to satisfy himself, but when it is presented as a means of settling disputes in which values are concerned it seems to me that we ought to have had something better, something more susceptible of more accurate and reliable results, than that proposed.

Mr. Ayer—I do not agree with the last speaker that in rating the arc lamp by wattage we have made no progress. We have gotten from an absolutely indeterminable thing, candle power, to something we can put our hands on. When we contract for watts we can furnish them. It may not be the best way, but it prevents impositions on the central station manager. It is known that it is a very crude method of determining; but as yet nothing has been proposed other than the instrument offered here, which seems to me an impracticable device. Prof. Thomas tells us he gets a variation of 45 per cent. in candle power with a change of ⅞ per cent. of wattage. That is a very extreme difference. It does not seem as though we find much of that in ordinary practice, and it is an extreme case. It is an unstable thing we get our light from—the carbons. There is nothing uniform about them, and there is no way of determining what character or size of carbons are best adapted to particular cases. I think we would all welcome something which will definitely determine the amount of illumination to be given people at a definite distance from the light, or any point on the street, under usual conditions. In having wattage we have something definite; if we give you that, there it is; if we do not, you can talk to us.

Mr. Armstrong—I thought better things of Mr. Peck than what he stated here about our definition of what a two thousand candle power light was meaning nothing at all. When we agreed, in giving a two thousand candle power light, to furnish 450 watts, we met the conditions as well as they can be met. The truth of the matter is that candle power is the measure of light and we cannot change it, and we must make ourselves conform to that in some way, and we did the best we could when we selected the standard of watts.

Prof. Marks—A few words with regard to Prof. Thomas's remarks. The data submitted by him are certainly interesting and directly in line with reports contained in the paper. We are all aware of the occurrence, but probably not of the magnitude of the variations he refers to. However, though it is only too true that the candle power for the same watts may differ fifty or one hundred per cent. or more with different carbons, yet, for reasons given in my previous discussion, I do not see how the Association could be benefited by adopting a standard of candle power. From a practical standpoint it seems to me that it would be just as unwise for the central station manager to sell his lamp as a three hundred or a five hundred candle power lamp as it would be to sell it as a twelve hundred or a two thousand. There is of course no doubt of the value of making some measurement of the illumination, and, as has been suggested, the proper place to measure the illumination is not at the lamp but at the place which is lighted. In one case we may find that distribution is the all-important feature, the intensity of the maximum rays being of secondary importance, and in another vice versa. Though the same amount of energy be supplied in the case of two lamps trimmed with special carbons, one of them whose candle power is much less than the other may be preferable because of the quality of the light.

Before closing I wish to call your attention to a test in which two carbons, tested for mean hemispherical candle power, showed 456 and 486 candle power respectively. On being tested for efficiency they showed 11.71 per cent and 10.01 respectively. The efficiency referred to here is the radiant efficiency or ratio of luminosity to total radiation. The current in each test was nine amperes, and the P. D. forty-five volts. One of the carbons was a squirted coke carbon, the other a molded.

It will be noted that the carbon showing the higher candle power had lesser efficiency. It seems quite probable that in this case the difference in the quality of light explains the discrepancy.

Death of William J. Richardson.

In the death of Mr. William J. Richardson, of Brooklyn, which occurred last Thursday morning, the street railway fraternity loses one of its most conspicuous and able members and the city of Brooklyn one of its most estimable and honored citizens. For seven weeks prior to his death Mr. Richardson had been a sufferer from complicated nervous diseases, which developed into acute spinal meningitis.

At the time of the recent strike in Brooklyn Mr. Richardson was called upon to perform a task which a less able man would have failed to successfully accomplish. As an official of the Atlantic Avenue Railway Company he was forced to do that which was for the best interests of his company. As president of the Atlantic Avenue Railway Employees' Mutual Aid Association he desired that the employees of his company be accorded the kindest and fairest treatment. As an evidence of the employees' faith in his honesty, integrity and fairness no more striking proof could have been offered than their unanimous request that he be permitted to arbitrate the questions which were made the issues of the strike.

WILLIAM J. RICHARDSON.

Mr. Richardson was born in Albany forty-six years ago. His street railway experience began in 1867, when he became his father's assistant in the management of the Brooklyn and Jamaica Railroad. When the Atlantic Avenue Company was organized he was made secretary, which position he held until the reorganization of the company, when it passed into the hands of the Brooklyn Traction Company. He was one of the organizers of the American Street Railway Association and served continuously since 1882 as its secretary and treasurer. He held the same office in the New York Street Railway Association. In this capacity Mr. Richardson became widely acquainted in street railway circles. The efficient manner in which his duties were discharged, coupled with his faithful, earnest work for the advancement of all that pertains to street railway practice and construction, and the cultivation of more cordial relations between street railway interests and the public, brought to him the well-merited distinction of being the foremost leader in this field.

LEGAL NOTES.

The Supreme Court of Michigan has affirmed the judgment of the lower court in the case of Louis George and others against the Wyandotte Lighting Company, thus confirming the contract made in 1892 by the city with the Western Electric Company for the construction of an electric light plant.

Judgment has been rendered against the South Bend and Mishawaka Railroad Company in the suit brought by the Central Trust Company of New York to foreclose a bond mortgage amounting to $250,000, and also against J. McM. Smith, the purchaser for the company of the equipment for the road. The latter suit was for $29,000, and was brought by Isaac B. Newcombe. The company operates an electric road from South Bend to Mishawaka, five miles in length.

Henry B. Oakman and Harry M. Shaw, doing business as the Oakman Electric Company, manufacturers of electric specialties at No. 136 Liberty street, New York, have made an assignment to William D. Murray, of Plainfield, N. J.

Justice Russell, in the Supreme Court, has vacated the assessments made by the Commissioners of Taxes of New York for the year 1894 upon the personal property of the General Electric Company, the Edison Electric Light Company and the Edison General Electric Company, on the ground that they are taxable only at their principal place of business, Schenectady. New York County loses about $200,000 by the decision.

Judge Taft has handed down his decision in the suit brought at Cleveland, O., by Francis Lowrey, executor of the estate of Grosvenor P. Lowrey, against the Cowles Electric Smelting and Aluminium Company and Alanson T. Osborn for infringement of patent sold and assigned to plaintiff by Charles Bradley for a process of separating metals, particularly aluminium, from their ores by the use of an electric current, etc., the Judge holding that the defendants had infringed. He granted the plaintiffs a perpetual injunction, restraining the defendants from using the patent rights and ordered the letters of patent held by the Cowles people canceled and declared void.

The Westinghouse Electric and Manufacturing Company has filed a bill in equity against the Suburban Electric Company at Philadelphia, alleging infringement on several patented improvements, the exclusive right to which the complainant company claims. The improvements are for electro-magnetic motors, invented by Nikola Tesla, of New York, who assigned one-half interest in his patents to Charles F. Peck, and Tesla and Peck subsequently assigned them to the plaintiff company. The Westinghouse Company has also filed a bill against John Mustard, charging infringement by the defendant on the plaintiff company's patented improvements in method of electrical distribution.

Personal.

Dr. Arthur Brown, who has been representing the T.-H. International Company in Brazil for some time, has returned to this country to stay, and is now at his home near Boston.

Mr. Chas. Bragg, manager of the Westinghouse Company's Philadelphia office, was in New York last week.

Mr. Charles E. Bibber has opened offices at 620 Atlantic avenue, Boston, as New England agent for the Columbia Lamp Company and the Wagner Electrical Manufacturing Company, of St. Louis.

Portable Electric Light Plants.

To the Editor of ELECTRICITY.

DEAR SIR: In your issue of the 17th, under the heading "A Large Portable Plant," you say a successful test was made. I presume you mean a successful test was made with that particular plant, as the idea is not new. Portable electric light plants consisting of a vertical quick steaming boiler, high-speed engine, coupled direct to dynamo, were sold by Woodhouse & Rawson, Queen Victoria street, London, Eng., in 1889. Yours truly,

TRAVELER.

To Form a State Association.

A call has been issued signed, by the more prominent gas and electric light men in Texas, for a meeting at Houston on May 22 for the purpose of forming a State Association.

New York Electrical Society.

The April meeting of the New York Electrical Society was fixed for the 25th, when Mr. T. L. Wilson was to have delivered a lecture on Acetylene. At the last moment Mr. Wilson had to leave for the West and Mr. Edward Durant kindly filled the gap by repeating before the Society on the 24th ult. his lecture given on the 16th before the Brooklyn Institute on the Manufacture in the Electric Furnace of Diamonds, Rubies, Aluminum and Acetylene Gas.

Boston Notes.

Attention is being called through the Boston papers to the condition of the overhead wires of the West End Railroad Company throughout this city.

The Nantasket Beach branch of the New York, New Haven and Hartford Railroad is being equipped with electricity.

The lamp business in Boston is remarkably quiet at present. It was expected that several new companies would start up after the verdict in the Bates Refrigerator case, instead of which things rather look the other way. The low prices have apparently scared people against going into business.

The West End Railroad feeder wires throughout the busier parts of Boston are to go into underground conduits.

R. H. White & Co., the mammoth dry-goods firm, having just completed an extensive addition to their establishment, have placed the contract for lighting the store with four hundred arc lights.

Electric launches are to be run on the ornamental ponds in the various pleasure parks and pleasure grounds in and around Boston this summer.

Electricity is being utilized for advertising purposes in this city on a scale that is not approached in any other city in the country. To stroll through the streets of Boston after dark, strangers would be more than surprised and impressed by the magnificent displays that are made at the theatres and other places of amusement as well as by the principal restaurants and dry-goods stores.

General News.

What is Going on in the Electrical World.

Montrose, Pa.—A committee has been appointed to examine and report on the subject of electric lighting for this town.

Toronto, Can.—The question of civic electric lighting for this city will be submitted to a vote of the people on the 25th of May.

Salem, Mo.—A stock company is to be formed to build and operate an electric road from Salem to Licking, Houston and Cabool.

Batavia, N. Y.—The survey of the route proposed for the Batavia and Northern Railroad, from Oak Orchard to Batavia, has been completed.

Harrisburg, Pa.—A bill has passed the House of Representatives permitting electric street railways operated within the State boundaries to carry freight.

Columbus, Ga.—Grigsby E. Thomas, Jr., a prominent attorney of this city, has outlined a plan for an electric road connecting Columbus and Atlanta.

Brattleboro, Vt.—The Gaslight Company will put in a plant to furnish electric power for small manufacturers and users if they are assured of a sufficient demand.

Flushing, L. I.—An application has been made to the highway commissioners for a franchise to operate an electric road from the Whitestone line to Willett's Point.

Muncie, Ind.—A choice of routes for a new electric street railway in this city is being considered. George F. McCulloch is mentioned as being interested in the project.

Fulton, Mo.—The light committee of the council has been instructed to ascertain the probable cost of an electric lighting plant for this place and to receive bids for the same.

Little Rock, Ark.—It is reported that a company has been organized here to utilize a sixty-foot fall on a mountain stream not many miles from Little Rock to generate electricity for transmission to this city.

Rushville, Ind.—M. L. Howe, of Indianapolis, has presented a proposition to the city council offering to construct waterworks and an electric light plant for $70,000, four-fifths of the capital stock to be taken by the city.

Monroe, Mich.—Mr. Fenton, of Findlay, O., has applied to the city council for a franchise for the Citizens' Electric Railway Company giving them the right to operate an electric line in certain streets of this city.

Stockton, Cal.—Harry Bunn and J. W. Hartzell are busy securing the rights-of-way for the electric railway they propose to construct between here and Lodi. These have been secured for about two-thirds of the distance.

Hackettstown, N. J.—The lamp committee of council has been instructed to advertise for bids for lighting the streets of the town by electricity for the coming year with 85 or more electric lights of 20-candle power each.

Pittsfield, Mass.—The stockholders of the Stanley Electric Manufacturing Company have voted to increase the capital stock of the company from $200,000 to $300,000. The officers report a rapidly increasing business.

Flint, Mich.—John E. Nolan, of Saginaw, who is interested in the Owosso and Corunna street railway, has been here lately looking over the field with the view of putting an electric street railway line in operation in this city.

Allegan, Mich.—W. B. Brittin has been granted a patent on an electrical transformer, and is now arranging for the manufacture of it. A stock company will be formed and a factory started at either Benton Harbor or Coldwater or at Chicago.

Port Huron, Mich.—Sealed proposals will be received and information given by W. F. Wagenseil, city clerk, until the 20th of May for furnishing the city of Port Huron with electric light. From 150 to 200 arc lamps of 1,200 C. P. will be required.

Parkersburg, W. Va.—The Parkersburg Electric Light and Power Company and the Parkersburg Gas Company have consolidated. Neither company sold out to the other; they simply combined and will hereafter be operated under one management.

Moorhead, Minn.—The city council has accepted plans for a new pumping station and electric light plant to be built here this summer. Bids will be advertised for at once. Citizens are unanimously in favor of the plan of the city doing its own lighting and pumping.

Bucyrus, O.—The commissioners have granted a franchise for the Inland Electric road between Bucyrus and Sulphur Springs, a distance of seven miles. M. J. Monnett, the president of the company, states that work on the road will begin at the earliest possible moment.

Waukon, Iowa—An electrician with $3,000 or $4,000, to take interest in and full management of a lighting plant and business in a growing town, where receipts of $300 to $400 per month are guaranteed, may hear of something to his advantage by addressing G. L. Hubbell at this place.

Grand Rapids, Mich.—The Sweet Electric and Manufacturing Company of this city has filed with the city clerk a mortgage to E. H. Donnally as trustee. The mortgage covers all the company's stock, patents, accounts, etc., and is given to secure over $12,000 indebtedness due on labor and other claims.

Muncy, Pa.—A charter has been granted to Senator John J. Coyle, Charles N. Brumm, Patrick Campion and C. O. Smith, giving them the right to build an electric railroad from Muncy to Picture Rocks, a distance of eight miles. The incorporators have obtained the right of way and will begin work in a short time.

Deckertown, N. J.—B. W. Decker has resigned as president and general manager of the Sussex Electric Light, Water and Power Company. R. A. Sinn has been elected president and J. W. C. Casher general manager.

Atlantic City, N. J.—The lighting committee of city council recommend that the contract for lighting the city be awarded to Metzger & Co. for 20 cents a lamp per night, on the condition that they file a bond for $50,000 and have their plant ready for operation by May 30, when the contract with the old company expires.

Santa Barbara, Cal.—The supervisors have granted the franchise for the proposed electric railroad running from the city limits through the Montecito and Carpinteria valleys. The council has practically granted a franchise for the road to run through the city, the form of advertising for bids for the franchise being the only delay.

Chicago.—The Metropolitan West Side Elevated Railroad is approaching completion and trains made up of motor cars and trailers are now running on the portion of the structure that is finished. The road is operated by electricity on an elaborated plan of the intramural road at the World's Fair, the third rail supplying current.

Galion, O.—Proposals will be received at the city clerk's office until noon, May 6, for an incandescent light dynamo of 120 K. W. capacity, including exciter and all necessary station equipment, to be delivered at the city's electric light station. All proposals must be accompanied by a check, duly certified, for $100, as a guarantee.

Peterboro, Can.—Two hundred employees of the Canadian General Electric Works here have been discharged for refusing to sign a new rule of the company making the workman liable for the full value of any machine or part thereof which he had the misfortune to damage, or for defects found in an article that has passed through his hands.

Medina, N. Y.—A portion of the track of the Beecher Railway between Waterport and the lake has been finished and is in working order. The work is being pushed as fast as possible. An experimental car is being built to test the possibilities of the system for high speed work. It is expected to obtain a speed of 150 miles an hour.

Sandusky, O.—The Sandusky Electric Light Company at a recent meeting elected the following directors: Watson Hubbard, H. C. Huntington, C. E. Cooke, George E. Reiter, T. F. Spencer, J. O. Moss, Charles H. Moss, A. C. Moss, C. W. Sadler, Jacob Knebeler, James Woolworth, C. G. Nielsen, George R. Butler and George Feick.

Oneida, N. Y.—A scheme is on foot to establish a new electric light plant here to compete with the Warner Electric Light Company. Chas. E. Remick, chairman of the street lighting committee of the board of village trustees, is the leader in the movement. Five thousand dollars' worth of stock has already been subscribed and much more has been promised.

Lockport, N. Y.—Samples of a new insulating material formed of sponge crepon, supplied by the Sponge Cloth Company of this city and indurated by a process discovered by a Lockport man, have been sent for examination to leading electricians by the United Indurated Fibre Company who will manufacture it if the material proves to be of value.

South Haven, Mich.—At an election held here recently it was decided to bond the town for $10,000 to be used for the construction of an electric light plant. Mr. H. Zeedyk is a member of the committee appointed to advertise for bids. [In last week's news summary an item containing this information was by mistake headed "South Haven, Mass."]

Quebec, Can.—A project is on foot to furnish electric lighting to Levis from the Chaudiere Falls, which are 95 feet high and will give 500,000 horse-power. The distance is eight miles from Notre-Dame de Levis. These falls, though less in height, are greater in volume than those of Montmorency, which, with a height of 140 feet, afford only 300,000 horse-power.

Rochester, N. Y.—The Proctor Raymond Electric Company, organized March 8, 1893, with a capital of $20,000, has gone into the hands of a receiver, E. A. Marsh. In the papers presented to the court it is stated that the assets of the corporation, if well cared for and sold for what they are worth, will bring $42,863.74, and that the liabilities do not exceed the sum of $29,883.17.

Omaha, Neb.—A project much talked of here at present is the building of a canal from the Platte River at Fremont to an available point for the erection of a power-house on Papillion Creek, where the water power developed could be used for generating electricity to be transmitted to Omaha. It is estimated that 18,000 horse power is attainable through a suggested engineering plan.

Madison, Wis.—The lighting of the capitol by gas has become intolerable to many of the legislators and a proposition to provide for an electric lighting plant for the building, to cost $13,000, has been adopted.—Gov. Upham has signed the "street car vestibule bill," making it the duty of street car companies to provide a sheltered compartment on their cars for the motormen.

Buffalo, N. Y.—At the annual election of the Buffalo General Electric Company the following directors were chosen: Daniel O'Day, New York; Thomas Hodgson, H. W. Burt, J. M. Brinker, W. H. Orcutt, W. W. Sloan, J. L. Williams, P. P. Miller, Franklin D. Locke, S. S. Spaulding and C. R. Huntley, Buffalo; S. D. Greene, Schenectady, and George Urban, Jr., Cheektowaga.

Oakland, Cal.—The first electric railroad constructed in Oakland was finished less than five years ago, and at the present time the city is literally gridironed with electric street railroads which reach out in all directions. There are at least fifty miles of well-equipped electric railroads, furnishing rapid means of transit to and from the neighboring villages as well as to different parts of the town.

Rome, N. Y.—The application of the City Street Railway Company for permission to change its motive power from horses to electricity or any other power besides steam has been approved by the railroad committee of the common council. The recently elected directors of the company are J. S. Wardwell, W. P. Rayland, A. C. Kessinger, J. D. Higgins, W. R. Huntington, W. L. Kingsley and James H. Searles.

Columbus, Ind.—An electric device has just been invented by Dora Ogden, manager of the Western Union office at this place, by which steam whistles are to be blown by electricity, the current passing through an electric clock. By this device every factory whistle in the city, or in the United States for that matter, can be sounded simultaneously. The whistle may be set to blow at any hour desired.

Chattanooga, Tenn.—Under the auspices of the Chamber of Commerce a survey is to be made at once for an electric railway from this city to the Chickamauga National Military Park, which includes the battlefield. The promoters of the enterprise have elected the following officers: President, D. M. Steward; vice president, James R. McFarland; secretary, John M. McFarland. Directors: A. L. Ross, J. M. Rife, Geo. O. Fisher, Jos. Aull, G. P. Wilbanks.

Baltimore.—Mayor Latrobe has approved the Washington and Baltimore Boulevard Electric Line ordinances. The contractors have received orders to push the work with all possible haste, as the company is anxious to have the line in operation within the time prescribed by the charter granted by the last Congress, which was eighteen months. The road will be as near an air line between Baltimore and the national capital as possible, about thirty-two miles, and will cost about $2,000,000.

Pass Christian, Miss.—A company has been organized under the franchises granted to C. Phelps, L. B. Moseley and others to build an electric street railway from this village to Biloxi. The company is to be known as the Pass Christian, Mississippi City, Handsboro and Biloxi Electric Railway, with the following officers: L. B. Moseley, president; W. L. Dinkins, vice-president; C. Phelps, treasurer. The company will get out a charter at once and build the road as soon as possible.

Fresno, Cal.—The people of this city are jubilant over the formation of a company to utilize the immense water power of the San Joaquin River and transmit it by electricity to all points in the valley. The capital of the new organization is $800,000, all of which has been subscribed. Besides furnishing power for their own establishments the projectors have in mind the acquisition of the street car lines of the city, which will be changed to electric lines and the system extended.

Philadelphia.—An electric locomotive of a new type has been completed at the Baldwin Locomotive Works for the North American Company, which operates the property of the Oregon and Texas Continental Company and extensive street railway and electric lighting interests in Milwaukee. This locomotive was designed by Sprague, Duncan & Hutchinson of New York, and it is intended for special experimental work in handling heavy freight and for switching purposes.

Seattle, Wash.—The formation of the Union Illuminating Company and their lease of the properties of the Union Electric Company and the Seattle Gas and Electric Light Company may be considered another victory for electricity over gas, as the Union Electric Company is the controlling party in the new combination. Dr. E. C. Kilbourne, general manager of the Union Electric Company, as we stated last week, becomes the general manager of the Union Illuminating Company.

Anderson, Ind.—The Clodfelter Gas Belt Electric Railway Company, which proposes to connect all of the Indiana gas belt cities with Indianapolis, was reorganized on the 26th ult. with $500,000 capital. Among the eleven stockholders are J. D. Lindsay and A. B. Wilson, Jr., of New York. N. J. Clodfelter is vice-president and general manager. It is stated that the contract for the construction and equipment of the line from Marcen to Anderson has been let to the New York Standard Construction Company.

Asbury Park, N. J.—Work on the new electric railway between Asbury Park and Pleasure Bay was begun last week. It is the intention of the promotors to push the work as rapidly as possible. The proposed trolley road from Atlantic Highlands to Long Branch is also likely to be constructed at an early date. Articles of incorporation have been filed with the Secretary of State, and the $25,000 guarantee has been deposited with the State Treasurer. This road will be known as the Atlantic Highlands, Red Bank and Long Branch Electric Railway.

Indianapolis, Ind.—The Indianapolis and Broad Ripple Rapid Transit Company has filed a mortgage in favor of R. T. McDonald and the State Street Deposit and Trust Company of Massachusetts. The mortgage is to secure $400,000 worth of bonds which the company will issue. With the mortgage was filed a warranty deed to 130 acres of land at Broad Ripple to the Indianapolis and Broad Ripple Rapid Transit Company. The deed was executed by R. T. McDonald and Lillie McDonald. The Broad Ripple Company will issue the bonds for the purpose of paying off its indebtedness and to make improvements this summer. The officers of the company say that $100,000 is to be expended in improving the street car track and in making it a double line. The company will also build a power-house.

Albany, N. Y.—The Railroad Commissioners have been applied to for permission to change the motive power on the White Line branch of the Troy City Railway between Cohoes, Green Island and Troy, from horses to electricity. The necessary consent of property owners along the line has been obtained.—A bill has been introduced in the Senate providing that the contract time for which the city of Albany shall be bound to pay for light shall be extended to five years. It also gives the contractors the right to supply electricity in every part of the city for light and power, thus giving them the free use of the streets for the extension of electric wires.—The State Railroad Commission has granted the Herkimer, Mohawk, Ilion and Frankfort Street Railway Company permission to increase its capital stock from $55,000 to $150,000, the increase being for the purpose of electrical equipment.

New York.—It is reported that the Widener-Elkins Traction Syndicate of Philadelphia had offered $4,500,000 for the "Huckleberry" system of trolley roads, north of the Harlem, and that the offer was rejected, the officials of the company valuing their roads and franchises at $5,000,000. A suit is now pending in the Supreme Court to test the constitutionality of the franchises under which this "Huckleberry" or Union Railway is now operating.—The Madison Square Light Company has mortgaged all its rights, privileges and franchises to the State Trust Company for $500,000, and the company has authorized its president and secretary to issue bonds to an amount not exceeding $500,000 to pay off the indebtedness incurred by the acquisition of the East River Electric Light Company.—In the construction of the "underground trolley road" on 109th street the management have substituted for the underground trolley wire a solid iron rail through which the current will be sent. The new device has been given a trial, and it worked so successfully that the directors of the road abandoned the old idea and adopted the new one.

Telephone and Telegraph.

A telephone line is in course of construction between Sioux Falls, S. D., and Dell Rapids.

The Lewis County Telephone Company of Canton, Mo., has been chartered. Its capital is $1,800.

The People's Telephone Company of Catlettsburg, Ky., has been incorporated. Its capital stock is $200.

Enough stock has been subscribed for at Emporia, Kan., to warrant the formation of a new telephone company.

An ordinance has passed the Salem, Ore., city council granting a franchise to the Anthony Telegraph Company of Oregon.

Cherokee, Minn., is to have a telephone, managed by a private company. The rentals are set at $2 per month for all instruments.

A home telephone company has been organized at Princeton, Ill., with over 100 subscribers. Nearly all the subscribers of the company are patrons of the Central Telephone Company and it is the intention to reduce rates from $48 per year to $15.

The Upper Peninsula Telephone Company, organized to operate in Marquette, Mich., under the franchise granted to B. S. Kaufman, have forwarded incorporation papers to Lansing.

The new Occoquan Woodbridge Telephone Company, who propose to establish an exchange in Alexandria, Va., in opposition to the Bell Telephone Company, are now busy soliciting subscribers and will shortly begin the erection of its line.

E. G. Edwards, representing the English Haley company of Kirksville, Mo., proposes to put in a telephone exchange at Whitewater, Wis., on the new automatic system and at low rates. A thorough canvass of the place will be made, and if sufficient encouragement is given a franchise will be asked of the common council.

J. M. Drill and Oliver Watson announce that they are forming a telephone company at Buffalo, N. Y., with a capital stock of $250,000. The organizers will guarantee to place telephones in business houses for $35 a year and in private houses for $30, with an unlimited service. They intend to introduce the inventions of the Mutual Automatic Telephone Company of New York.

Arguments of counsel in the Bell Telephone case, in which the validity of the Berliner patent on the telephone transmitter is involved, were closed several days ago in the United States Circuit Court of Appeals at Boston. It is likely to be some weeks before the decision of the court is made public.

It is stated that there is such a lack of harmony among the projectors of the Mutual Automatic Telephone Company of Philadelphia that a reorganization of the company has become a necessity. This is the company that was involved in the council scandal which went through the farce of an investigation a few weeks ago.

The Stillwater, Minn., Telephone Company has voluntarily reduced the price of telephones to $3.50 a month in business places instead of $4 and to $2 instead of $3 in residences.

At Des Moines, Iowa, long distance telephones are being placed in the daily newspaper offices, trunk line railroad offices and city offices, including the fire department and the police headquarters.

The Massachusetts House has rejected the bill to compel the Bell Telephone Company to pay a tax on shares of stock held in sub-companies. The House accepted the adverse report of the committee on mercantile affairs on the petition of J. J. Casey that telephone companies should be placed under the supervision of the Gas and Electric Light Commissioners.

A telephone exchange has been organized at Northfield, Minn., by Tennant Brothers. Sixty-five subscribers have been already obtained.

The defeat of the bill for cheaper telephone rates in the Legislature was a setback that can be only temporary. Competition will accomplish what legislation has denied.

The Citizens' Co-operative Telephone Company of Shreveport, La., is now fully organized, with John W. Taber as manager. The new company is meeting with such encouragement as to induce the belief that in time it will be a strong competitor of the Southern Telephone Company.

The Interstate Telephone Company has been organized at Wilkes-Barre, Pa., to build a telephone line connecting Wilkes-Barre, Pittston, Scranton, Carbondale and small towns between those places. The officers are: Hon. John Graham, Wilkes-Barre, general manager of the Wyoming Valley Traction Company, president; Timothy Burke, of Scranton, vice-president; Horace E. Hand, of Scranton, secretary and treasurer.

The city council of Chattanooga, Tenn., has granted a franchise to the Citizens' Telephone Company to establish a telephone system in that city. It purposes putting in telephones at a rate of $30 a year for business houses and $24 a year for residences.

The Harrison Telephone Company has applied to the city council of Detroit for a franchise. Attorney Charles Flowers, of the company, stated at a meeting of the Committee on Streets that the new company had already over 3,500 subscribers on its books, among them O. W. Shipman, who has subscribed for seven telephones.

Alpena, Mich., has a new telephone company composed altogether of its own citizens. The subscribers for telephones are also subscribers for stock.

Business men of Fort Wayne, Ind., have decided to form an independent telephone company. "The promoters," says the *Gazette*, "are men of means, and can secure abundance of capital to carry out their project, and they insist that the city will be given cheaper and better telephone service than it possesses at present, and and that, too, within a very brief period."

George S. Holmes has secured a telephone franchise at Pierre, S. D., and begun putting in a system there which he expects to extend to surrounding towns.

The Bell Telephone Company intend erecting a long-distance line between Huntsville, Ala., and Shelbyville, Tenn. The latter place is connected with Nashville, Nashville with Evansville and Evansville with Chicago. Then Huntsville will be connected with Atlanta, thus connecting Atlanta with Chicago, via Huntsville, a distance of over 900 miles.

The Ashland, Ky., *News* says: "The Keystone Telephone Company of Pittsburg, Pa., has written several parties locally about the prospects of the establishment of a new exchange here, but so far as can be learned they have not to date been accorded any very great amount of encouragement. The Keystone Company claim to have a system that is equal to any on the market and are willing to place the exchange at very low rates."

The Susquehanna Telephone Line, a company recently organized in Susquehanna, Pa., proposes to sell its 'phones to subscribers for $12, and will establish an exchange in that town when enough subscribers are obtained. The president of the company is L. G. Larrabee.

The Drawbaugh Telephone and Electric Company have made a propcsition to the citizens of Myerstown, Pa., offering to locate there if a specified amount of money be raised by the residents. At a meeting held for the purpose a large amount was subscribed.

More than $1,200 have been subscribed for a telephone line from Tallahassee, Fla., to Thomasville, Ga., via Bradfordville, Centerville, Duncansville and Surette. The line will be about thirty-six miles long.

The Gerst telephone bill, notwithstanding the fight that was made in its favor by the commercial organizations of the State of New York, has been killed for this session of the Legislature by the discharge of the committee on electricity. The probability of such an outcome was announced in this paper several weeks ago.

The stockholders of the Orange County Telephone Company at a meeting in Middletown, N. Y., on Tuesday of last week elected the following directors: L. S. Stivers, J. E. Iseman, J. L. Wiggins, A. B. Wilbur, F. M. Stratton, L. V. Sinsabaugh, R. C. Tuthill, G. A. Swalm, Jr., T. D. Mills, J. J. Silk, E. Fancher, Frank Harding, T. A. Weller.

A representative of the Harrison International Telephone Company is in Watertown, N. Y., securing subscribers. The company has been granted a franchise and part of the stock will be held by prominent business men of the city. The charge for the new telephone is $2 per month for business places and $1.50 for residences, just one-half the rates of the Bell Company.

The city council of Paris, Ky., has given the new Paris Telephone Company a ten-year franchise, and the company will begin at once to erect its poles and make connections with the outside world. H. A. Power is president and Dr. H. Roberts secretary and treasurer.

A representative of the Stromberg-Carlson Telephone Manufacturing Company has proposed to business men of Morris, Ill., to introduce a system in that city on the basis of a local stock company to which he will furnish the instruments, and it is thought that in this way business houses can be accommodated at an expense of $18 or $20 a year, while residence 'phones will cost but $12 or $15. Marseilles, Ill., has gone into the scheme and has many subscribers.

The council of Winterset, Iowa, has passed an ordinance granting H. J. B. Cummings, Fred Strong, Dr. Hinshaw, C. C. Schwaner and T. Mardis and their assigns the exclusive right to use the streets and alleys of Winterset for telephone purposes for the next ten years. This ordinance, as locally construed, prevents the old company from soliciting further business in Winterset, and restricts it to the instruments already in.

The Merritt Lamp.

A patent has recently been issued to Mr. Charles Andrew Merritt for an incandescent multi-filament lamp which will be readily understood by the following description:

The lamp is made with three or more filaments; they may all be of the same candle power or have different degrees of illumination; each one is to be used separately, or two or more of them can be used at the same time in multiple arc. One terminal of the carbons is attached to a contact post in the base of the lamp, the other leading-in wires are attached to the outer shell for a return contact. The contact posts for each filament are insulated from each other and are touched by a switch shown at L, Figs. 1, 2 and 4, which also forms a contact with the key in the socket. There is no change necessary in the socket from present construction. By placing the pointer end or switch on any contact post the carbon connected with it will be lit up, or by

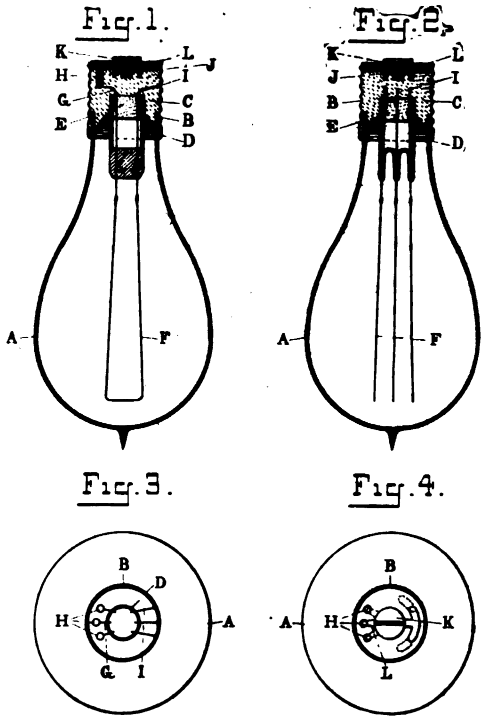

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

The Merritt Lamp.

turning the broad end around one or all may be lit up.

It would seem that this lamp could be made at a slight additional cost and would be a great saving to the consumer.

Probably the true way to use this lamp would be to burn each carbon for about 300 hours; four filaments would thus give 1.200 hours' continuous use at a comparatively small loss of brilliancy. While each filament might drop 10 to 15 per cent. in burning, every time a fresh one is started it would bring up the lamp to full candle power; that is to say, in using the lamp before the globe becomes smoked enough to obscure the light the initial brilliancy will be restored as many times as there are extra carbons to use.

THE FORT WAYNE ELECTRIC CORPORATION'S NEW MULTIPOLAR DYNAMO.

Figure 1 of the accompanying illustrations represents a new 60 K. W. medium speed dynamo designed for incandescent lighting or power. It is the first of a series of multipolar dynamos designed by Mr. James J. Wood, the Corporation's electrician and mechanical engineer, which vary in size from 25 to 800 kilowatts. As will be seen from the figure, the design of this dynamo, like all of Mr. Wood's apparatus, presents a very beautiful and substantial appearance, while the mechanical perfection of detail, workmanship and finish stamps it at once as a modern high-grade machine. In the several sizes up to and including 120 kilowatts, the lower portions of the field, pedestals and base are made in a single casting, while in the larger sizes, which have an outboard bearing, the parts are cast separately and bolted to the base, making the dynamo easier to install, as should the same design be maintained throughout, the castings would become very heavy and difficult to handle. A notable feature in this Generator is the absence of all loose cables, wires and connections, so common on most machines, the connections in this dynamo being made by removing the perforated door, where they connect with the main binding-posts, which are mounted on slate bases at each side, effectively protecting them from dirt or injury. The two small binding-posts shown in front are for the field rheostat connections. The dynamo is compound wound and can be run in either direction by simply reversing the brush-holders on the studs and without changing any of the other connections, the brush-holders being so proportioned with relation to the commutator that the act of reversing them on the stud changes the point of contact 90 degrees, leaving them in the correct position for commutation when the dynamo is run in the opposite direction. The curved pedestal on the commutator end is also a decided advantage, as it not only reduces the floor space and weight of metal required in the base, but enables the dynamo to be turned end for end on the sub-base should it be required to belt from either end. The bearings are self-oiling and aligning and are of ample proportion to withstand the strains to which they are subjected, while the field coils are wound on steel spools with brass heads, making them very easy to replace in case of an accident.

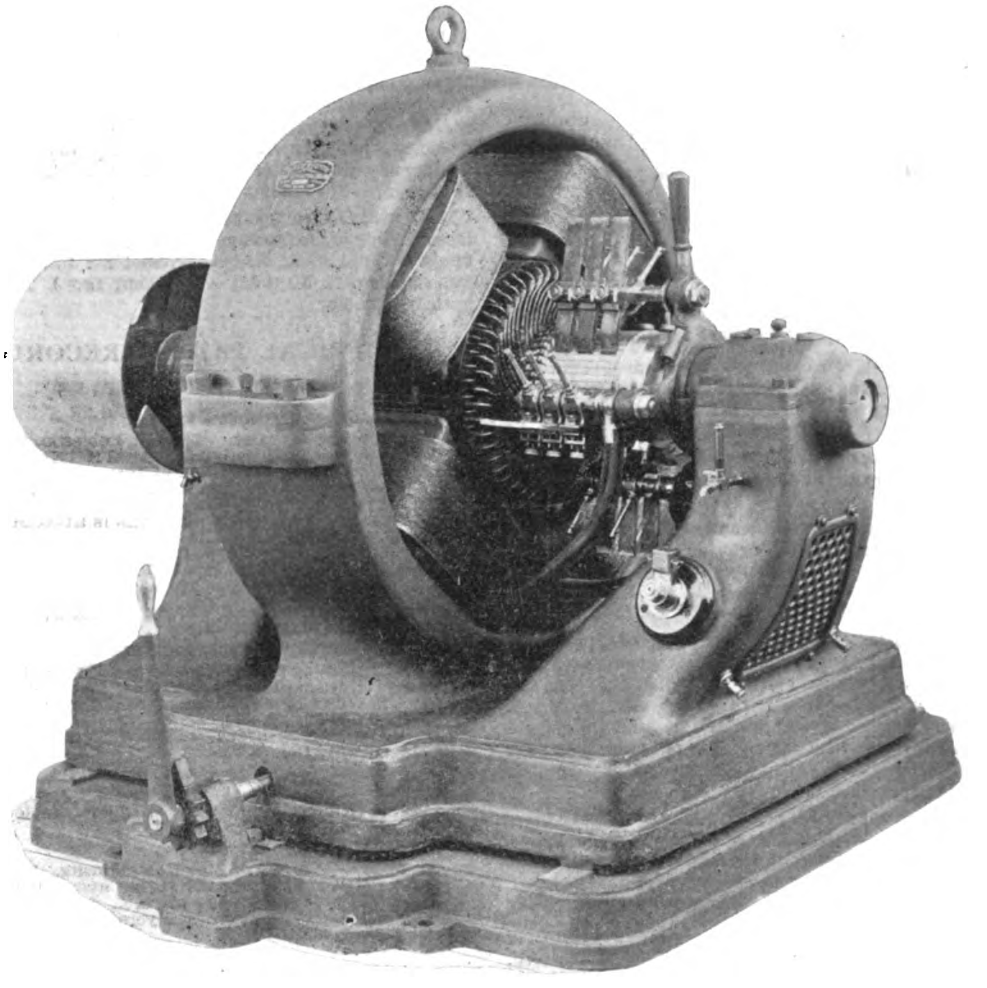

FIG. 1.—"WOOD" 60 K. W. DYNAMO.

The armature construction of this dynamo (Figs. 2 and 3) possesses many novel features, showing in a marked degree the ingenuity and originality of the designer. Fig. 2 shows the commutator and core complete with one of the coils in place, while Fig. 3 shows one of the armature punchings, the method of building up the core, and one of the coils before being insulated. As will be seen from Fig. 3, the armature core is constructed from segmental punchings, having hooks projecting from the inner edge which partly encloses the clamping bolts. These punchings alternate with one another in order to break joints, the hooks making contact with the bolts on opposite sides but without completing the magnetic circuit around them. It will be seen from this construction that the several segments are self-supporting, there being no strain on the spider or bolts other than that produced by the torque. As a consequence the spider can be of exceedingly small cross section and in marked contrast to the heavy cast-iron or steel structure so common in other multipolar machines, while the labor of fitting is reduced to a minimum, there being no dovetails or other difficult fits to make. The hooks, which engage with the clamping bolts, not only break joints, but alternate in position, leaving spaces between each equal to the thickness of the iron punchings. These hundreds of spaces enormously increase the radiating surface of the core, which of course reduces the temperature.

A careful set of tests show that with this construction there is absolutely no current generated in the clamping bolts or spiders. Its advantages may be summed up in the following terms:

1. Minimum weight of armature,
2. Enormously increased radiating surface,
3. Self-supporting core construction,
4. Simplicity of spider construction,
5. Economical use of sheet iron,
6. Small cost for punching dies and their maintenance,

—this method adapting itself perfectly to armatures of large diameter, and any capacity required. Those wishing a more detailed description of this construction are referred to Mr. Wood's patent, No. 529,437, of November 20, 1894.

The windings or coils which compose the armature circuit are also of novel construction, and present features of extreme simplicity over the bar method of winding heretofore employed. As will be seen from Fig. 3, the coil is composed of four bare wires wound on a former with a heavy copper connector soldered at one end, which makes connections by screws to the commutator segments. The advantages of this construction are: First, the soldered joints so common in bar winding at each corner, with their tendency to get loose, are entirely dispensed with, there being but one soldered joint to each coil, in place of five in the old method. Second, as a consequence, the resistance of a turn, and the $C^2 R$ losses in the armature are materially reduced. Third, the four naked wires of which the coil is formed present a greater radiating surface in proportion to their area, and consequently carry the currents generated in them at a much lower temperature.

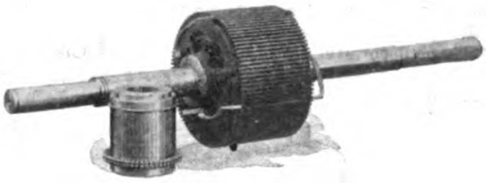

FIG. 2.—ARMATURE CORE AND COMMUTATOR.

After being formed in shape as shown in Fig. 3, they are then carefully insulated and placed in position on the core as shown in Fig. 2, the return ends being soldered into holes in the commutator connector before referred to. The commutator is then slipped on the shaft, each connection being screwed to its proper segment by two screws. As there is no strain anywhere on the insulation, and as the voltage between each turn is very low while the ventilation is perfect, it would seem as though such an armature ought to last forever.

The commutator of this machine, shown separate in Fig. 2, is constructed from hard drawn copper with mica insulation, put together by hydraulic pressure, and both it and the brushes and brush-holders are of ample cross section for the currents which the dynamo is intended to generate, and as a consequence it does not heat. The armature circuits are so arranged and connected that either two or four sets of brushes can be used on the commutator; either set can be removed while the dynamo is running and the remaining set will carry the current without over-heating. On a recent test this dynamo was run on a load of 525 amperes at 120 volts for ten hours after which careful temperature readings were made. It was then found that the highest temperature in any part of the dynamo was but 35 degrees C. above that of the room.

The dynamo weighs complete 7,300 lbs., while the armature complete weighs but 950 lbs., and at a speed of 650 revolutions per minute delivers 500 amperes at 120 volts, which can be raised to 140 when required.

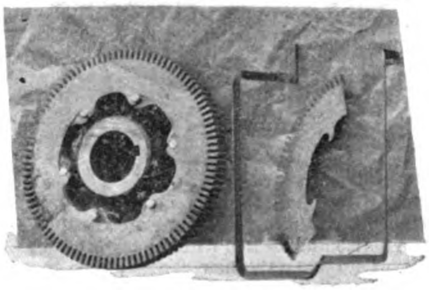

FIG. 3.—DETAILS OF ARMATURE CONSTRUCTION.

COMMERCIAL PARAGRAPHS.

The Metropolitan Electric Company have placed on exhibit in their store a sample board, showing a very complete assortment of pliers, splicing clamps, vises, etc.

The Central Electric Company of Chicago have issued Catalogue No. 15, giving full particulars as to the large line of Lundell Fan Motors which they carry in stock at all times.

The Siemens & Halske Electric Company are sending out an open letter to customers giving strong arguments for the superiority of the direct-current low-tension system of lighting over all others.

The Interior Conduit and Insulation Company's Catalogue of 1895 models of Lundell Fan Outfits is now ready. It contains among other desirable matter a price list on separate parts which may be needed.

The New York office of the American Electrical Manufacturing Company, formerly in the Havemeyer Building has been removed to 39 Cortlandt street.

The Metropolitan Electric Company have made a new departure by establishing a bargain counter on which can be found a complete line of useful devices at hard-time prices. It will be well for the trade to inspect these goods before placing their orders.

A. L. Hawley, formerly assistant manager of the Union Electric Company of Seattle, Wash., is now superintendent and purchasing agent of the new Union Illuminating Company of Seattle, and will be in the market for stock of supplies, both electric and gas, and gas stoves, during June and July. His address until June 1 will be Seattle, and after that date, catalogues, etc., can be addressed to him at 1,255 Wabash avenue, Chicago.

Special Decorative Incandescent Lamps.

The Columbia Incandescent Lamp Company are placing on the market some special incandescent lamps, very suitable for decorative purposes.

Figure No. 1 represents the full size 16 candle-power coiled-filament round-bulb incandescent lamp, which is made in high voltages and is very suitable for window and ceiling decorations. The lamps are capable of being used in a horizontal position without any drooping of the filament. They maintain their candle power to the high degree of the new type Columbia incandescent lamps in high economy, and give a very pretty effect either clear or in ground glass.

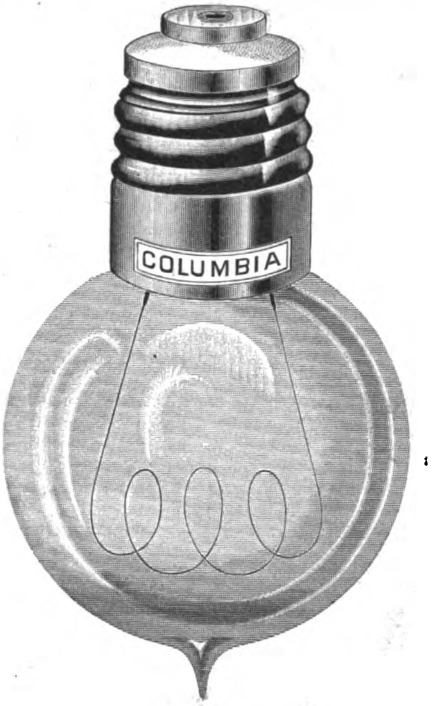

FIG. 1.

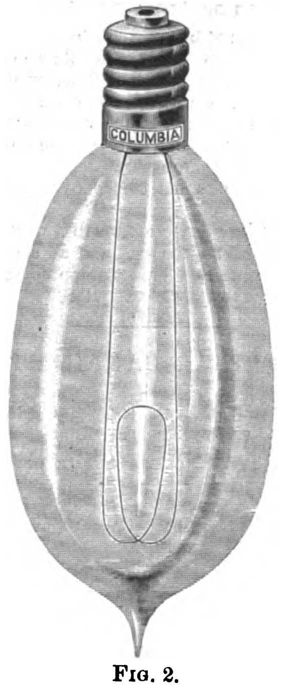

FIG. 2.

Figure No. 2 represents a special candelabra lamp, which is suitable for burning in series on 100 volt circuits and upwards. These lamps, used with the small yellow and red silk shades, make a very pretty and harmonious effect.

In More Commodious Quarters.

The Metropolitan Electric Equipment Company has moved from 10 and 12 Chambers street, New York, to more commodious quarters at 44-46 Duane street. This company, which has acquired the distinction of producing the most striking and artistic effects in Decorative Lighting, has on hand a large number of contracts in this field. Mr. C. Colombani, the skillful and artistic originator of the decorations, has in preparation some designs which promise to surpass, in point of beauty and effect, the many and remarkable creations he has already produced in this line.

INCORPORATIONS.

The Hobart and Western Electric Railway Company, Hobart, Ind. Capital stock, $50,000. Promoters: Alfred Morrison, Andrew J. Smith, Geo. Stoker, Seward Lightner.

The Great Western Electric Company, Des Moines, Iowa—to manufacture all kinds of electrical machinery, appliances, appurtenances and supplies. Capital stock, $500,000. Promoters: Warren A. Drake, Riverside, Ill.; L. F. Dyrenforth, Riverside; Ralph H. Smith, Evanston; T. C. Sullivan, H. K. Gilman, Chicago; C. E. Hunn, Des Moines, Iowa.

The Delaware County Electric Company, Chester, Pa—to supply light, heat and power by means of electricity. Capital stock, $1,000. Promoters: S. T. Wellman, Upland, Pa.; W. C. Gray, O. B. Dickinson, Chester.

The Baird Electric Conduit Company, Chicago, Ill.—to build, equip and operate street railroads operated by horse, steam, electric or other power; deal in street railroad and railroad appliances, material, supplies, etc. Capital stock, $5,000,000. Promoters: F. C. Baird, Geo. E. Baird, W. H. Craig.

The Electric Porcelain and Manufacturing Company, Trenton, N. J.—to manufacture every kind of porcelain insulating devices for electrical purposes. Capital stock, $50,000. Promoters: Carl F. Adam, Ferdinand F. Wachter and David Crossley, Trenton, N. J.

The Northern Waterworks and Power Company, Beresford, S. D.—to build, operate and maintain waterworks plants, electric plants and milling plants. Capital stock, $75,000. Promoters: J. L. Potter, Beresford, S. D.; C. O. Potter, Elmira, N. Y.; F. H. Potter, Mellette, S. D.

The Big Four Electric Company, Chicago—to manufacture electric apparatus. Capital stock, $200,000. Incorporators: William H. Brown, Louis K. Gilson and Henry G. Ames.

The capital stock of the Pasadena (Cal.) Electric Light and Power Company has been increased from $50,000 to $100,000.

The Asbury Park Electric Company, Asbury Park, N. J.—to furnish electricity for light, heat and power, etc. Capital stock, $200,000. Promoters: George A. Smock, Jas. M. Ralston, John W. Rockafeller, Harry J. Rockafeller, Asbury Park.

The Automatic Telephone Company of Wisconsin, Chicago, Ill.—to maintain and operate telephone exchanges, and to furnish telephone service as well as telephone and electric lighting and power, to furnish electric wiring, erect telephones and their accessories and do general telephone and electrical business. Capital stock, $500,000. Promoters: J. Harry Theobald, Wm. Thos. Whipple, Maurice Rosenfeld.

The Lafayette Machine, Electric Light and Power Company, Denver, Col.—to conduct a machine shop for manufacture and repair of electric fixtures and generate electricity for light, heat and power. Capital stock, $10,000. Promoters: John S. Spencer, Frank D. Taggart, Henry Jay Mayham, of Denver, Col.

The Wadsworth Electric Railway Company, Wadsworth, Ohio—to build railways to be operated by electricity or horse power, construct and operate telegraph and telephone lines, furnish electric light, heat and power. Capital stock, $10,000. Promoters: F. G. McCauley, W. A. Ault, O. V. Dibble, R. F. Weaver, Frank Mills, W. S. Holloway.

The Wayne and Conshohocken Street Railway Company, West Chester, Pa.—to construct and operate a street railway. Capital stock, $30,000. Promoters: Francis Fenimore, St. Davids; Richard H. Johnson, Julius A. Bailey, Wayne, Pa.

The Rockland Telephone and Telegraph Company—to construct and operate telephone and telegraph lines from Nyack to Montmoor, to Hillburn and Ramapo; Montmoor to New City, to Congers, to Rockland Lake and to Haverstraw, N. Y. Capital stock, $8,000. Directors: William R. Thompson, Frank L. Colgrove and William Dewey, of Nyack; John I. Traphagen, of Suffern; G. A. Blauvelt, of Monsey; A. A. Demarest, of West Nyack, and L. H. Hutton, of Nanuet.

The Vance Electric Company of New York City—to carry on a business of general contractors and electrical engineers for all classes of electrical construction work. Capital stock, $10,000. Directors: Arthur S. Vance, of Brooklyn; John H. Cheever, Elizabeth Cheever, Charles C. Guiteau, of New York City, and Charles A. Allen, of Dover, N. J.

The United Electric Telephone Company of New York City. Capital stock, $50,000. Directors: Norman C. Raff, Frank R. Gemmon, Henry C. Williamson, Albert L. Richardson, Charles P. Rowland, Henry A. Tobb and F. C. Toepleman, of New York City.

The Harvard Telephone Company, Harvard, Ill. Capital stock, $2,500. Incorporators: John C. Blake, John F. Reham, Herbert D. Crumb.

The Stromberg-Carlson Telephone Manufacturing Company, Chicago—to manufacture telephones. Capital stock, $50,000. Incorporators: Alfred Stromberg, Androy Carlson and Arthur B. Cotton.

The Nunda Electric Light Company, Nunda, Ill.—to operate an electric light plant. Capital stock, $5,000. Incorporators: E. G. McCollum, H. H. McCollum and E. E. McCollum.

The Mount Vernon Telephone and Messenger Company—to operate a line of electric telegraph or telephone to connect the towns, villages, cities or other places within the County of Westchester, N. Y. Capital stock, $40,000. Directors: Horace Granfield, C. H. Ostrander, F. T. Davis, G. H. Gray, John Dawson, John Berry and William Archer, of Mt. Vernon, N. Y.

The Westchester and William's Bridge Traction Company—to operate a street surface electric road between the villages of Westchester and William's Bridge, N. Y. Capital stock, $60,000. Directors: G. P. Morgan; A. G. MacDonnell, and Charles F. Tracy, of New York City.

The Toledo Electric Street Railway Company of Toledo, Ohio, has increased its capital stock from $1,400,000 to $1,750,000.

The Cambridge and Guernsey Consolidated, Chicago, Ill.—to prosecute mining, produce and market coal, salt, gas, oil and electricity for all purposes; buy and sell merchandise; build an electrical light plant for lighting, heating or power. Capital stock, $200,000. Promoters: U. S. Frye, C. N. Crandle, Walter J. Hammond.

The Kitsee Electric Company, Camden, N. J.—to manufacture dynamos, motors and electrical contrivances of all kinds. Capital stock, $75,000. Promoters: Jno. M. Carroll, Camden, N. J.; Robt. A. Balfour, Leo J. Tierney, Philadelphia, Pa.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED APRIL 16, 1895

ELECTRIC RAILROADS AND APPLIANCES.

537,857. Electric-Motor Car. William Robinson, Boston, Mass. Original application filed April 12, 1889. Divided and this application filed Jan. 16, 1890.

538,005. Electric-Railway. Conrad C. G. Wolpers, Brooklyn, N. Y. Filed Oct. 2, 1894.

538,104. Electric Motor for Railway Cars. Charles E. Emery, Brooklyn, N. Y. Filed April 19, 1894.

538,158. Electric Railway System. James M. Faulkner, Philadelphia, Pa. Filed Jan. 12, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

538,023. Electric-Arc Lamp. Frank M. Lewis, London, England. Filed Oct. 12, 1894.

DYNAMO ELECTRIC MACHINERY.

537,994. Controlling Mechanism for Electric Motors. Charles H. Richardson, Philadelphia, Pa., assignor to the S. S. White Dental Manufacturing Company, same place. Filed June 9, 1894.

538,097. Commutator-Brush. Louis Boudreaux, Paris, France. Filed Oct. 28, 1892.

TELEPHONE AND TELEGRAPH APPARATUS.

537,967. Telephone System. William Coonan, Jersey City, assignor to himself, and Wm. A. Childs, Englewood, N. J. Filed Aug. 4, 1892.

BATTERIES.

537,989. Storage-Battery. Morris Moskowitz, Newark, N. J., assignor, by direct and mesne assignments, to himself, Leon D. Adler, same place, A. S. Adler, Philadelphia, Pa., and Theodore W. Myers, New York, N. Y. Filed May 7, 1894.

MISCELLANEOUS.

537,829. Electric Alarm-Clock. Henry W. Knapp and Lawrence E. Gerrety, St. Paul, Minn. Filed Oct. 25, 1894.

537,855. Electric Appliance for Elevators. James H. Roberts, Grand Rapids, Mich. Filed Oct. 6, 1894.

537,856. Electrical Appliance for Elevators. James H. Roberts, Grand Rapids, Mich. Filed Feb. 23, 1895.

537,860. Electric Guest-Call. Frank O. Smith, La Crosse, Wis. Filed June 2, 1894.

537,876. Rheostat. George H. Whittingham, Baltimore, Md. Filed Dec. 11, 1893. Renewed Sept. 27, 1894.

537,907. Rosette or Ceiling Cut-Out. Eugene A. Snow, Syracuse, N. Y., assignor to John R. Owen, same place. Filed Sept. 21, 1894.

537,920. Coupling for Electrical Connections. James M. Faulkner, Philadelphia, Pa. Filed Aug. 9, 1894.

537,932. Method of and Apparatus for Protecting Electric Circuits. John M. Oram, Dallas, Tex. Filed Jan. 15, 1895.

538,020. Insulated Conductor. William M. Habirshaw, New York, N. Y. Filed Oct. 16, 1894.

538,024. Electric Brake. Edward D. Lewis, Savona, N. Y. Filed Dec. 7, 1894.

538,064. Fastening for Non-Conducting Coverings. Philip Carey, Cincinnati, Ohio. Filed July 21, 1893.

538,083. Separable Terminal for Conductors. David N. Osyor, Columbus, Ohio, assignor to Joseph A. Jeffrey, same place. Filed Nov. 28, 1893.

538,090. Electric Cut-Out. Herbert A. Wagner and Ferdinand Schwedtmann, St. Louis, Mo. Filed Jan. 5, 1895.

538,127. Electric Door-Opener. John Schneider, Long Island City, N. Y. Filed May 7, 1894.

538,132. Electrical Igniting Device for Gas-Engines. Alfred J. Signor, Elkhart, Ind. Filed March 26, 1894.

538,224. Automatic Cut-Out System. Lewis L. Borradaile, Philadelphia, Pa., assignor of one-half to Joseph C. Borradaile, same place. Filed Feb. 5, 1895.

ELECTRICITY.

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EDITORIAL NOTES.

The Right Will Win.

To many of our readers it may seem entirely superfluous to call attention to the peculiar conditions of the electrical trade as distinguished from other industries, and to point out that just such a course as has been pursued by this paper was, and is, not only justifiable, but essential to the very life of the industry. But while the progress of events has made it clear to a few of the more advanced thinkers among the thousands directly or indirectly interested in the business that, with all its disagreeable features, such a vigorous campaign against wrong, and against the individuals responsible for or typifying the wrong, is for the general good, there are many, especially of the distinctly professional class, who have looked upon our policy with disfavor, and who, while not denying the existence of the evils which we have laid bare, have held that a policy of silence and tolerance would have been better, and that the wrongs would have righted themselves without the disgrace and humiliation which have resulted from their complete exposure.

The fact that ELECTRICITY was the only one of the trade papers to take hold of the subject with vigor, to expose trade abuses and those responsible for them, has apparently strengthened this view of the situation.

Those who have been of this opinion, however, have failed, we think, to consider the subject in its full breadth and depth. The fact that our contemporaries have not printed one word to aid the right and to wipe out the wrong proves, not that they do not see the wrong, but that they are governed by a short-sighted policy and are afraid to attack the vampires in the art because those vampires have had money to spend in advertising. This is the case in a nutshell as regards the older journals. The heads of every one of them admit in private conversation that the trade is in danger, that the source of that danger lies chiefly in those great corporations which have no other idea of business than the ruin of competitors and the robbery of the investing public.

The narrow view of the case that the evils which exist are inevitable and must be endured is not tenable. They are not inevitable, and need not be endured forever. The trade *can* be cleared of the parasites; the handicap *can* be removed; the electrical industry *can* be placed on an even basis with the other great industries of the world. While in our social life petty deceits and misrepresentations are looked upon without serious criticism by most of us, and accepted as incurable, the policy of misrepresentation and deceit should not and can not be tolerated at all in large enterprises such as the one we are interested in. In the electrical business, as in railroads, etc., millions of money are invested, chiefly the money of the middle classes—small investors, ignorant of the business, and confiding in the representations made by those who know more. The lines upon which the large corporations have been conducted, the gross mismanagement, the continued robbery of the many to enrich the few, have killed all confidence in the solidity of the industry, and have worked great injury not only to the innocent investors but to the very industry itself.

We hold with greater confidence than ever before that ELECTRICITY has shown from the first abundant reasons for existence, for claiming the support of every honest man directly or indirectly interested in the business and looking to that business for his living or for profits upon investments. Yet many of those who are supposed to mold public opinion have looked askance at our work, questioned our good faith and doubted the good effect of such a crusade.

We shall yet demonstrate to all the skeptics and to the world at large that in our fight we have been at all times right, and that we are entitled to great credit for a work which should have been carried on at least in part by the other trade journals. We stand by our guns, and *shall stand there*, aiming at what we know to be wrong in whatever corporate or individual name it may appear, just as certain as we are of our own existence that sooner or later the sober judgment of the entire trade will give to us more credit for work done in the interests of the art than is extended to any or all of our contemporaries. And we shall not have long to wait.

We adopted, after careful consideration, a policy which we know to be sound, not only from the newspaper standpoint, but which is for the best interests of everyone represented in the trade in any honorable capacity.

It may be that before the fight is ended not only the G. E. Company but other companies will be driven into bankruptcy. So. Their legitimate businesses will not be ruined, the stockholders will not be injured but benefited, as will also be the entire industry and the large investing public. The businesses will go on, but the coteries of speculators who have become interested in this art only to its bedevilment will be forced out. This is our single aim, and when the result is achieved, the incubus removed, general prosperity will come immediately, capital will come in again, and the first step will be taken towards a solid foundation for a great and profitable industry. Such a foundation has never been built, and it will not be until the speculators and robbers have been driven out.

The electrical business, or that part of it developed to such a marvellous extent by the earnest technical workers in the last fifteen years, has, by its very magnitude and opportunities for profits, attracted to it men of various stripes of character. They may be divided into two general classes. Of course minor classifications or subdivisions might be mentioned, but for the purposes of this article the two general classes are sufficient.

The first class includes the *producers*--those who have contributed by their efforts to the general welfare of the race, who have originated and worked out ideas which have added to the world's wealth, assisted in the amelioration of the harsher conditions of life—have made in fact life better worth the living. These producers are not only those who have labored with their hands, but those who have used the brains with which they were endowed, and the class may justly be said to include the business men who worked along legitimate lines hand in hand with the inventor to perfect improvements and place them within reach of the people at large, rich and poor.

The second class embraces those who have not been producers in any sense of the word, but who have come into the business with the sole object of taking advantage of the work of others and turning that work to their own financial benefit, regardless of the rights of others. They are the men who contribute nothing to the world's wealth, but who succeed only in re placing the bank accounts, transferring the savings of the workers to their own pockets.

The number of persons who belong in class 1, those who have contributed to the development of the art by honest effort, is very large, though those who have become *prominent* for working out the various difficult problems is comparatively small. And every man who has assisted by his labor in the perfection of necessary devices is entitled to some measure of credit and to his share of the commercial rewards. Not one in ten of these men is getting to day any appreciable share of the reward to which he is entitled, and chiefly for the reason that the parasites of class 2 have appropriated the results to their own benefit.

Class 1 has utilized the hitherto unknown or unused forces of nature to the public good; class 2 has substituted for genuine ability a low order of cunning and knavery, stolen the work of the former, disgraced the industry and brought it to the verge of wreck.

Every new industry offers inducements and attractions to a class of people who have never made an honest living or by the exercise of their faculties contributed to the advancement of the human race, and also to a more dangerous class who have conducted orderly and respectable businesses with a fair measure of profit, establishing a good reputation, and who are thus prepared to successfully deceive the public when they enter, as many did in the electrical line, upon a career of stockjobbing and public plunder. The history of the world's business, however, furnishes no parallel to this trade in the number of such persons who were attracted, and who have succeeded by hook or by crook in freezing out the more conservative and in debasing the industry.

The *producing* class have never, with perhaps few exceptions, endeavored to force the sale of unfit apparatus upon the consumer by misrepresentations, and to the subsequent injury not only of the purchaser but also of the whole trade. Not so class 2, the members of which have had no scruples in this respect, but have foisted upon the central station men, the railroad companies and the public generally anything and everything in the shape of apparatus, regardless of whether it was of any actual value and utility or not. The methods adopted to do this are already well known, but have not been sufficiently impressed upon the public which has been so wronged. To find this out more clearly will be the important work of ELECTRICITY in the future.

The temporary success of this vicious policy was made possible by the dense ignorance which prevailed in the early days, and which has not yet disappeared altogether, of everything connected with the art. Even the so-called teachers of the period showed small understanding of the underlying principles.

It has been the desire of ELECTRICITY to clear up the entire situation, to show who were the enemies of the industry and who its friends. When one group has been disposed of, the others will follow quickly. They are not confined to one corporation. While they might disappear eventually in the regular order of things, the present condition of the trade shows that, left to themselves, they would outlast the present generation and bring the whole business to complete wreck. Our children might re-establish a solid business, but the legitimate rewards would not come to the army of thousands now here. To hasten this cleansing process nothing could be more effective than a newspaper campaign such as we have made. Our policy has been for the best interests of every honest worker.

There has been enough money made in the manufacture and sale of apparatus to have made a competency for every one engaged in it. No other trade or industry has contributed so largely to the general welfare of the world. The world has been willing to pay for the benefits conferred. It has paid for them. But the cormorants of class 2 have stepped in between the public and the producer and robbed both, so that instead of a successful business industry, what do we see? an unstable discredited trade, with the rank and file making a bare living, struggling along in hopes of better times, and scarcely realizing the forces which have brought them where they are.

ELECTRICITY'S mission is to help them to see and to remedy the evils.

Millions have been made as the fruit of honest labor, and those millions have been squandered in rascally schemes and gross mismanagement. Class No. 2 has not only stepped in to rob the legitimate worker of his reward, but has used that work for purposes of further robbery in swindling the investor.

Nothing can be more certain than that without ELECTRICITY'S early exposures the G. E. Company would have had at least temporary success in their campaign of extermination.

Their first point of attack was not their competitors (except in the incandescent lamp field) but the consumers. Their first policy towards central stations and other large customers was that of the highwayman. This policy was partially shown in the preparation of Contract Form D. The agents went to the central station man and laid bare to him the weakness of his condition, and this weakness did not need to be exaggerated. The agent said: You have a plant covering so much territory and having cost so much money, and you sell so much current. Now we are in position to dictate terms. We do not care to go into the lighting business in your town, but we must supply the apparatus and supplies. Give us a five or ten year contract at our terms and we will get along together without trouble. If you refuse to give this contract, we will come into the field ourselves; we can build a new station at half what yours cost, and do better work.

Nothing prevented the success of this plan so much as the growing knowledge of the weakness of the G. E. Company itself. It did not take long for the central station people to find out, through the columns of ELECTRICITY, that the great attempted monopoly was only a rotten shell, and that a degree of backbone on their own part was all that was needed.

As certain as the sun rose in 1892 ELECTRICITY prevented the G. E. organizers from issuing the remaining $20,000,000 of unissued stock—and if they had got that additional money there would not have been enough of the independent element to-day to make a respectable funeral procession for those who had died.

The stand and-deliver policy failed, and now we have a new one with the same object in view, to wit, the sale of apparatus and supplies for less than cost. It is now the intention to trust to financiering schemes to carry the G. E. Company along while they are losing money on every dollar's worth of product sold, until their competitors shall one by one be forced to the wall. That this policy is already meeting with some success is in evidence. That further success awaits it is certain, unless the independent manufacturing and selling companies realize their danger, combine for common defence, and sustain papers which have the disposition and the power to protect them.

Unless the STOCKHOLDERS of the G. E. Company can be reached and informed of the iniquitous, even criminal, abuse of position on the part of the management, that management will hang on long enough to create unlimited trouble and disaster from which not one independent concern in ten can recover.

ELECTRICITY proposes, therefore, at great expense, and with thoroughness, to conduct from now on an educational campaign. The first object lesson will be a complete history of the Northwest General Electric Company that will run through several numbers. And if those responsible for this company's condition are not landed in the penitentiary through our disclosures it will be because the swindled preferred stockholders and others refuse to make use of the documentary evidence which we shall present. We believe it to be of supreme importance to show to the stockholders of the G. E. Company that their interests are being managed by criminals and for purposes of criminal robbery.

What ELECTRICITY has done is on record, but the record is not completed. When it is, those who now criticise or withhold their support will be proud to do homage to the paper which knew the right and was not afraid to fight for it. We need the support of the trade, but the trade needs us far more. We claim that support as our right and will yet have it in fulness.

In future articles we shall give many specific instances, as we have in the past, in support of the position here taken. We shall take up the affairs of more than one company, and show conclusively to any intelligent man that exposure of all the rottenness, though unpleasant, is essential to the purification of the business, and that until this rottenness is uncovered, and cast out, there will be no improvement in conditions, no room for any honest man or company to make money.

No injustice has been or will be done by ELECTRICITY. We know that we are right, and we shall continue until the cause of the right in the electrical industry of America has fully triumphed over wrong.

This is the keynote of the entire conflict—THE RIGHT AGAINST THE WRONG.

* * *

Ewing's Magnetic Tester for Hysteresis.

To Prof. J. A. Ewing more than to any other man are we indebted for the present state of our knowledge of the magnetic properties of iron. Several of what have proved to be the most important properties are in fact his own discoveries. With the advent of the alternating current methods of distribution came the transformer, or rather might it more truly be said that with the advent of the transformer came the commercial alternating current.

This involved a study of the magnetic properties of iron under practically new conditions, viz., under conditions of rapid reversal. It had been noticed that there was a retardation of the magnetizing or demagnetizing effects as regards the causes which produced them—a *lagging behind* of the effect after its cause. Ewing first quantitatively studied these effects and gave to them the name hysteresis, from ’υστερεω, the Greek verb meaning "to lag behind." He found that in a complete cycle of magnetization, i. e., when magnetizing a piece of iron in one direction and then demagnetizing it, and then magnetizing it again in the opposite direction, and finally bringing it back again to its original condition, a definite amount of energy was expended which was dependent upon the quality of the iron and its previous history. The energy thus expended appeared as heat, and was not only a total loss as regards the final useful results, but where carried too far became destructive of the insulation of the surrounding coils. Prof. Ewing mapped out the hysteresis curves of an immense number of specimens of iron of different grades, and thus made the world familiar with the generic characteristics as regards hysteretic losses of the various types of iron. The manufacturers of alternating current apparatus were not slow to see the importance of selecting irons which would dissipate the least energy by hysteresis, but the difficulty was in distinguishing that which was good from that which was bad. While pure irons, low in carbon, were invariably better than those which were the reverse, analysis proved entirely inadequate as a guide for selection. The property was due quite as much to the physical character of the iron as to its chemical composition.

The only reliable test was found to be the physical one of measuring the hysteresis losses of a sample. The ballistic method, by which Ewing had made his classic investigations and determined the standard curves, now so well known, was slow and tedious. It could be employed only in properly equipped laboratories by skilled experimenters, and furthermore, as Ewing himself states, judging large lots of iron by single small samples, as was necessary by reason of the expense and tediousness of this method, was very unsatisfactory. Experience has shown that even in one batch of plates of the same rolling so much difference is apt to exist between one plate and another as to make the testing of a single sample furnish a poor guide to the average quality of the batch. Prof. Ewing mentions an instance under his observation in which as much as 15 per cent. variation in samples taken from the four corners of a single plate not quite two feet square was observed in an iron of excellent quality.

But this, up to the present, has been the only method of testing the suitability of iron for transformer and armature purposes, and manufacturers, while they have been giving more and more attention to the importance of procuring the best materials as they realized the necessity for it, have still been subject to variations in material quite as wide as those noted, notwithstanding the exercise of the utmost care in selection.

What was needed and wanted was not a laboratory method but a shop method by which the particular iron that was to go into each individual structure could be tested before it was used. Such a method must be rapid and of at least fair accuracy to be of value, and furthermore required to be one that others than highly trained experts could employ with satisfactory results.

The accomplishment of such a desideratum seemed almost too much to be hoped for, but Prof. Ewing announces in the paper to which we are referring that he has solved the problem in a most complete and satisfactory manner.

By Prof. Ewing's method it seems that any one who can turn a crank and read a clock-dial can make the tests, and the time occupied is so short that it is now possible to know with an accuracy sufficient for all practical purposes the quality of iron that goes into each transformer in the largest manufacturing establishments that are to be found.

The world did not appreciate the value of the results of Prof. Ewing's studies of hysteresis because it had not yet become aware of its baneful effects. It was at that time in blissful ignorance of what it afterwards, most largely through Prof. Ewing's instrumentality, became painfully aware. The world did not demand Prof. Ewing's investigations, but they were undertaken unbidden and the results at first coldly received. The world *has* demanded a more expeditious method of informing itself of the quality of the iron it was given to use, and this new discovery comes as a welcome guest. It will be received with open arms by the electrical fraternity everywhere, and while as a technical accomplishment this latest work of his cannot stand on the same plane as that of which it is the natural sequence, it will be regarded as scarcely less important by the commercial world.

Only second in interest of the literature received by us from England this week, is Mr. Crompton's admirable lecture on "The Utilization of Electrical Energy for Cooking and Heating Purposes," delivered before the Society of Arts, London, on April 24. Mr. Crompton is a pioneer in this line of work, and usually regarded as the highest authority in the world in all matters relating to heating by electrical means. In his address, which we will publish next week, we promise our readers a most instructive dissertation on the new arts of electrical cooking and heating.

* * *

The Load Line.

The most difficult problem confronting central station men to-day is to establish some plan of operations whereby the load line may be as nearly horizontal as possible, showing the continued use of approximately the full capacity of the plant. It is the peak of the load line, generally so conspicuous, which is the bugbear of the thoughtful manager. How to get rid of it is a subject now occupying the minds of practical students everywhere.

In the load diagram of the General Electric Company which we print this week, it will be noticed that this concern, since 1892, has succeeded, if not in obtaining an even line, at least in averting the peak. We do not know that the management has labored with this end in view—the intention may be concealed, but not so the result. The peak at 119⅞ has not been in any danger of being reached again since 1892. Popular opinion is that this company does not aim at an even line, and that the zigzag effect is the one striven for. If that be the case, the speculative directors will regard the product of our draughting room as a thing of beauty. The line shows the splendid chances of the past thirty-six months for making 10 to 30 point turns in the stock, which it is said have been taken advantage of by the insiders.

Appearances now indicate, however, that the wavy up-and-down motion has ceased for good, and that the load-line for the next year will be easily drawn and will be nearly perpendicular—leading down to zero,—after which we have no doubt the central station ideal will be at least partially realized; that is, the line will be horizontal near the zero level.

* * *

A New Fire Board Needed. In the controversy which has arisen in electrical circles over the recent promulgation of the New York Board of Fire Underwriters no criticism is directed against the Attix wire as an excellent and highly efficient product of skillful wire making, which qualities it admittedly possesses. But upon the Board itself must rest all the onus which rightfully, and with certain and poetic justice, belongs and comes to those who do absurd things.

This body has an almost sacred duty to perform. In its official capacity it is supposed to throw about the construction and electrical installations of new buildings such safeguards as shall reduce to a minimum, if not wholly eliminate, all danger and risk from the use of electric service. To accomplish such desirable results the Board must necessarily be in touch with and well informed upon all advances in the art of making electric service safe. But when, through ignorance or in utter defiance of advanced engineering methods, it takes steps which render nugatory all the well-directed and long continued efforts of wire manufacturers, architects, engineers and inventors to produce the highest degree of excellence in all applications of electric service, the Board as a body deserves not only the severest condemnation, but its action makes pertinent the observation that it needs to be succeeded by competent and representative men.

Personal.

Mr. William Taylor, formerly of the firm of Taylor, Dee & Mack, Chicago, has accepted a position in the business office of the *Electrical World* in New York.

James G. Biddle, who has been manager for some five years past of the electrical department of Queen & Co., has recently opened an office at 525 Drexel Building, Philadelphia, as dealer and manufacturers' agent for scientific and electrical apparatus.

Mr. J. S. Speer, secretary of the Partridge Carbon Company, Sandusky, was a welcome New York visitor this week.

Mr. L. E. Myers, of Chicago, was in the city for a few days last week.

Under the Searchlight.

Views and Opinions on Timely Topics.

Love, Hate and "Electricity."

(From a letter to the editor in the New York World.)

Will some kind reader inform me whether love or hate can be solved by ELECTRICITY?

We have no doubt of it. Give us a show.

* * *

G. E. securities sold during the year included:

Cleveland Electric Illuminating Co. (pref.)	$45,000
Edison Illuminating Co., Easton, Pa	27,250
Edison Illuminating Co., New York	500,000
Gesselschaft Co	113,000
Cumberland Electric Light Co., Nashville	40,000
Citizens' General Electric Co., Nashville	45.000
Manhattan Electric Light Co., New York	9,060
Weymouth Electric Light and Power Co	5,000

It will thus be seen that the gilt-edged securities have been sold—leaving what? Clearly non-negotiable stocks and bonds. If anything else COULD HAVE BEEN SOLD to raise necessary money, would New York Illuminating Company's stock have been sold? Certainly not. It is absolutely certain that those securities remaining in the treasury to-day are chiefly worthless and are carried on the books at twice or three times their actual value.

One example is sufficient to show the character of the stuff which has been added to swell the totals this year in these schedules. In the list of manufacturing companies, Schedule A, there appears $2,000,000 of the stock of the Short Electric Railway of Cleveland, a company which has gone out of business owing the G. E. Company $440,000 and stock in which is worth just what the paper would bring by the pound for junk, and nothing more.

Who can be misled by such barefaced humbug?

* * *

ELECTRICITY has no public criticism to make of Mr. Frank R. Colvin as an individual, no private grievance to ventilate. But we wish to warn all independent telephone companies against him as an unfit person to allow in any of their offices. As a supposed independent telephone man himself, he gained access to a great many details of other people's business. In his present position he is compelled to violate all confidences of this nature. He is a spy. He should be kicked out.

* * *

General Electric.

(From Mr. Coffin's Personal Organ.)

The General Electric Company is considering closing the Brush Works at Cleveland, but the question is not yet decided.

A director of the General Electric Company says: "The valuation of the company's assets given in the annual report is only a fair valuation and we ought to still shrink it a little further next year."

Indeed! We guess it will shrink itself before next year.

* * *

The Gilmanesque Idea is Not Dead.

(From a recent Incorporation Notice.)

The Great Western Electric Company has filed articles of incorporation. The offices of the company are at Duluth, Des Moines and Chicago. The capital stock is $500,000, of which $200,000 is preferred. The incorporators are: L. F. Dyrenforth, T. C. Sullivan, Warren A. Drake, H. K. Gilman and R. H. Smith.

* * *

Patents and Prophecies.

(From the Evening Advertiser.)

It will be noticed at once that the "patent" item is unchanged. It seems to us that we have some faint recollection of the able editor of ELECTRICITY telling us about the middle of January that "the $8,000,000 of patent assets would be wiped out this year or next, making a further impairment." In justice to Mr. Greene we will defer remarks on this point until the next annual report comes out, so as to be strictly fair.

Fairness is always the aim of this paper, and we are glad to know the same spirit actuates the esteemed financial editor of our contemporary.

Our prophecy was based upon knowledge, and the 1895 report, like that of 1894, was changed three times in its preparation and a different result reached each time.

An officer of the courts will soon present a report showing his estimate of G. E. assets. Until then we know of no one's opinion half as good as our own.

* * *

WHO MAKES THEM?

To the Editor of ELECTRICITY.

DEAR SIR: We have a customer who wishes to buy an electrical engraving machine. This machine is to be similar to dentists' tools, but will have to revolve instead of working as a hammer. If you know of a manufacturer of such apparatus, will you kindly let me know and greatly oblige. Very respectfully yours, E. M.

[We know of no such machine.—ED.]

* * *

Mr. W. J. Clarke, of the G. E. Railway Department, arrived in New York May 1, having recently left Kingston, Jamaica. Mr. Clarke made the trip from Havana to Montego Bay in company with a number of refugees who had been connected with the rebellion in Cuba.

American Institute of Electrical Engineers.

The annual meeting for the election of officers, reception of reports, and transaction of other business of the Institute will be held at 12 West 31st street, New York City, Tuesday evening, May 21, instead of May 14 as announced on the balloting circulars.

At the same meeting the discussion of Prof. Anthony's paper will be resumed, and it is expected that a paper will also be presented by Mr. A. D. Adams, of Boston, on "The Most Economical Form for Bipolar Field Magnets."

Saturday Half-Holidays in Boston.

The following electrical supply concerns of Boston will close their places of business during the months of May, June, July, August and September at 1 o'clock Saturdays and 5 o'clock other days: Pettingell, Andrews & Company, Holtzer-Cabot Electric Company, Anchor Electric Company, Gillis & Gleeson, Ziegler Electric Company, Thompson-Brown Electric Company, and the Electric Gas Lighting Company.

Electrical Instruction at the American Institute.

At the weekly meeting of the Electrical Section of the American Institute, on Friday evening last, W. H. Freedman, E. E., gave a very instructive talk on "Manufacture and Testing of Cables." The various steps in the progress of manufacture, from the copper ingot to the finished cable, were traced more or less in detail. The methods employed in testing conductivity, insulation resistance, capacity, as well as determining breaking-down point under high voltages, were explained and illustrated by blackboard diagrams.

The Patent Campaign Begins.

The G. E. Company, as already announced in ELECTRICITY, has prepared for a lively patent campaign this summer. One of the earlier suits to be heard is that on the Bursh double carbon lamp against the Western Electric Company, whichis being argued.

The Waddell-Entz Company's Affairs.

Upon application of the receiver, who states that there is no possible return for creditors in running the factory, and little to be divided at best, the court has ordered a sale of the assets to be made within sixty days.

A MAGNETIC TESTER FOR MEASURING HYSTERESIS IN SHEET IRON.*

BY PROF. EWING, F. R. S.

Makers of transformers are now generally alive to the paramount importance, from the point of view of all-day efficiency, of using iron in which the hysteresis losses are small. The need, however, is felt of some simple means by which this quality can be readily determined. Tests made by the ballistic and other methods have shown that different samples of iron may exhibit extraordinarily wide differences in regard to hysteresis. The author has found, for example, in the course of his own tests of iron supplied for transformers, a range of nearly three to one in the hysteresis of good and bad samples. It is unnecessary to point out how much the all-day efficiency of a transformer working under ordinary conditions will be affected if the sheet iron used in its construction has three times as much hysteresis as it need have. Again, experience shows that even in one batch of plates of the same rolling so much difference is apt to exist between one plate and another as to make the testing of a single sample furnish a poor guide to the average quality of the batch. Even in a single plate samples cut from different parts show marked differences in hysteresis. The author has noticed as much as 15 per cent. variation in samples taken from the four corners of a plate not quite two feet square, the material of which was of very excellent quality. It is well known that different analyses of the nearly pure iron of which such plates are rolled exhibit corresponding variations. The impurities appear to be unequally distributed; and, further, it is not unlikely that the irregularities which are found in the magnetic quality depend in part on slight differences in the treatment as regards annealing. Whatever their cause, there can be no doubt that they exist, and their existence makes the result of a single test often somewhat fallacious. What is wanted is a sufficiently large number of tests in any one batch of iron to allow a fair average to be estimated for the quality of the batch.

To make this possible a simple and expeditious method of testing is imperative. The ballistic method, although unimpeachable on the score of accuracy, is anything but expeditious, and can scarcely be called simple. The value of the hysteresis is arrived at by first observing the relation of the induction B to the magnetizing force H for a considerable number of points in each of a series of cyclic processes of magnetization, then drawing the B-H curve for each of these cycles and measuring the enclosed area. The operation requires some skill and experience, and a good deal of patience. The same criticism applies to other methods of finding the hysteresis by first finding the relation of magnetism to magnetizing force (as, for instance, by the permeameter or by the author's magnetic curve tracer). It must be borne in mind that in the testing of transformer iron the permeability is a quite secondary matter. What is of primary importance is the hysteresis, and high permeability is not necessarily or invariably found associated with small hysteresis. In the testing of sheet iron by the ballistic method the finding of the relation of B to H is a step in the process; it is not the object of the test.

These considerations have led the author to devise an apparatus which measures the hysteresis directly by a single operation, and in a manner sufficiently simple to allow the test to be applied to numerous specimens without much expenditure of time, trouble or iron. The basis of the instrument is the mechanical measurement of the work done in causing reversals of magnetism to take place in the iron under examination. Such measurements have been made before as a laboratory experiment and under special conditions. Thus, Mr. L. R. Wilberforce and the author, two or three years ago, endeavored to determine the hysteresis of a cylinder of iron when rotated in a strong magnetic field, by measuring the couple required to keep it slowly turning. And a method of the same general character has been employed with complete success by Mr. F. G. Baily to investigate the disappearance of hysteresis which takes place in such a cylinder when the field is made sufficiently strong—a matter of great interest in connection with the molecular theory of magnetism. In the machine now brought forward as a practical tester for workshop use the same mechanical principle is involved. The process of reversal, however, resembles that which occurs in a transformer rather than in a dynamo; the induction is caused to have practically the same value in all samples, and that a value appropriate from the transformer point of view; the sample is cut in a very simple form, and is arranged to be readily inserted and removed. The magnetism is reversed by turning a handle, and the result is given by the position of a pointer on a scale.

Fig. 1 is a drawing of the instrument now exhibited, the form of which has been reached after a good deal of experiment. The iron to be tested is cut or stamped in the form of strips, which are three inches long and five-eighths of an inch wide in this instance. The number of these pieces that is taken to compose the sample depends on the thickness of the sheet: six or seven pieces will in general be sufficient for the usual gauges of transformer iron, and a smaller number if the material tested is the thicker sheet used in dynamo armatures. The bundle of pieces forming the sample is placed in a carrier, *a*, and is covered with a vulcanite washer and secured by two clamps, *b b*. The carrier is made to rotate by means of the friction pulley, *c*, and driving wheel, *d*. This causes the sample to revolve between the poles of the permanent magnet, *e*, with the effect that its magnetism is periodically reversed. The work done in reversing the magnetism, in consequence of hysteresis, causes a mechanical movement to be exerted by the revolving sample upon the magnet, and the magnet being supported on a knife-edge at *f* in line with the axis of the carrier, tends to follow the sample and is deflected through an angle which serves to measure the work expended. Since a definite amount of work is done per reversal, whatever the frequency (so long as that is not so high as to make a sensible addition to the work by inducing currents), the deflection of the field-magnet is independent of the speed at which the carrier revolves, and no special care has to be taken to turn the handle at a uniform rate. If the rate is very slow the magnet will show each individual impulse which it receives as the ends of the sample pass its poles, but when the speed is sufficiently raised these impulses blend into a steady deflection; and the speed may be further augmented, to the extent of doubling it, or more, without making the deflection change. It is only at higher speeds still that the effects of induced currents become apparent. The deflection is observed by means of a pointer and scale above the magnet. The swinging of the magnet is checked by means of a dash-pot below, consisting of a vane, or spade, moving in a box filled with oil. The stability is adjusted to give any required degree of sensitiveness, by means of the weight, *g*, which travels as a nut upon a screw fixed to the magnet, and serves to raise or lower the center of gravity of the oscillating system. The magnet swings about a knife-edge working in an agate trough, and a lifting arrangement like that of a balance is provided, operated by the handle, *h*, to save the knife-edge from unnecessary wear or injury. The pointer is set to zero in the middle of the scale by means of a nut which runs on a screw projecting sideways from the middle of the magnet, and a more delicate adjustment of the zero may be affected by means of the levelling screw, *i*. In operating, the observer inserts the sample and secures it by the clamps, then begins to turn the handle and lets the magnet down on its knife-edge. After reading the deflection of the pointer to one side he reverses the direction of rotation, reads the deflection to the other side, and takes the sum of the two readings as the total deflection. The deflection is proportional, or very approximately proportional, to the hysteresis of the iron, even when samples widely different in quality are compared.

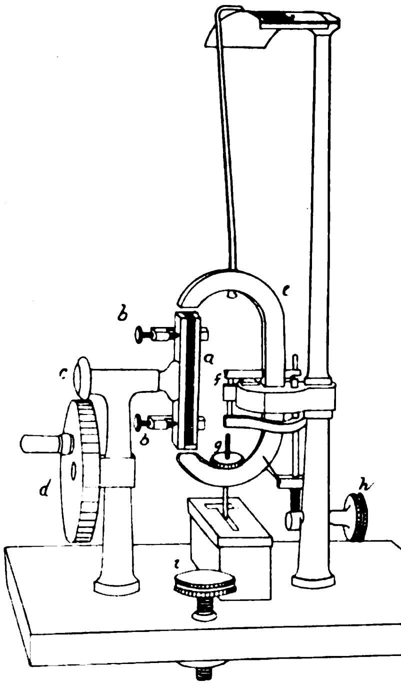

FIG. 1.

To secure that this shall be so, a considerable air space is left between the magnet poles and the ends of the sample, with the result that such variations of permeability as are liable to be met with in different samples are almost without influence upon the total induction through the iron. The author has examined the induction by means of a search coil wound around the sample, and has found it to be practically the same in the best and worst specimens of transformer iron. The dimensions and strength of the field-magnet are so proportioned with reference to the section of the sample and to the extent of the air gaps as to make the induction have a value fairly representative of transformer work. In the instrument shown the induction is about 4,000 C. G. S. units with the normal size of test sample. By increasing or reducing the area of section of the sample the intensity of the induction is reduced or increased. Within reasonable limits, however, any value of this intensity may be adopted in testing, for it is known from the results of ordinary ballistic tests that curves drawn to show the relation of the hysteresis loss to B preserve their relative positions through a wide range of values of B. In other words, the relative amounts of hysteresis in different samples do not change, or scarcely change, when the iron is more strongly or less strongly magnetized. This, of course, follows from the fact that a formula of the type originally suggested by Mr. Steinmetz,

$$\text{Hysteresis loss} = c\,B^n,$$

is practically applicable, c and n being constants within limits which are more than sufficiently wide to include the inductions used in transformers.

In cutting the pieces which are to make up the sample care has to be taken to make the length always the same, otherwise the air gaps, and consequently the induction, will vary irregularly. The carrier is formed so that it serves on a length gauge; and to facilitate the preparation of the samples a supplementary gauge is furnished in the form of a clamp of hardened steel, in which the strips are readily filed to the exact length after being cut a trifle too long. The width of the pieces requires no particular care.

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*Paper read at the Institution of Electrical Engineers, London, April 25, 1895.

The author was under the expectation that it would be necessary in making an accurate comparison of quality between different specimens to give the sample the same weight in each case, in order to make it have the same cross section. He finds, however, that no nice adjustment of the weight is required, provided advantage is taken of a property which will be most easily explained by citing an experiment made with the tester.

The experiment in question shows the effect of varying the section of the iron by varying the number of strips which make up the sample. Eleven strips of thin transformer iron were taken, each three inches long by five-eighths of an inch wide, cut from the same plate. These were all used to form the sample in the first instance; then one was removed and the remaining ten were tested, then nine, and so on, until finally the sample under test consisted of a single strip. The following are the scale readings for this, and also for another exactly similar experiment, which was made with a different specimen of transformer iron, of a poorer quality than the first. The two specimens are distinguished as A and B:

Number of Strips in Sample.	Scale Readings of Magnetic Tester.	
	(Specimen A.)	(Specimen B)
11	72	118
10	71	117½
9	70	117
8	69½	116½
7	69	116½
6	69	117
5	69	120
4	71	124
3	75	132
2	85	142
1	69	130

These results are also shown in the curves of Fig. 2. It will be seen that both curves have the same general character, and that the scale readings of the tester pass a very flat minimum when about seven pieces form the sample. Whether six, seven or eight pieces be used, there is no material difference in the readings. Precisely similar results are given by other specimens. Hence, if a weight is chosen equal to that of seven pieces of this material as a general standard, it will suffice, in preparing other samples for test, to select that number of strips which will give a weight approximating even roughly to the standard weight. The nearest whole number of strips will do, and it is not necessary to cut a narrow or wide strip to make up the exact weight.

When only two or three strips of this thin iron are taken, the work expended in reversing the magnetism of the bundle is increased. The total induction through the sample is somewhat diminished, but the intensity is increased, and this more than compensates for the smaller volume of iron that is being operated on. It is only when the sample is reduced to a single piece that the saturation of the iron prevents B from increasing sufficiently to continue this effect, and there is then a sharp fall in the curve.

These considerations have led to the use of samples the aggregate thickness of which is equal to that of six or seven thin transformer plates. In testing armature plates the same weight is approximated to by taking a smaller number of pieces. It is scarcely necessary to add that solid pieces, or bundles of wire, may be tested as well as sheet iron.

CALIBRATION.

An extensive series of experiments has been made in order to determine to what degree of accuracy the readings of this magnetic tester correspond to the hysteresis losses as found by ballistic tests for various samples of iron. For this purpose it was necessary to test each identical sample in as nearly as might be the same state, first ballistically and then in the new tester. In view of the variations which are observed between one part of a plate and another, the author did not feel that it would be satisfactory to use separate pieces for the ballistic observations and for the observations to be made with the tester. After some consideration he adopted the following two plans:

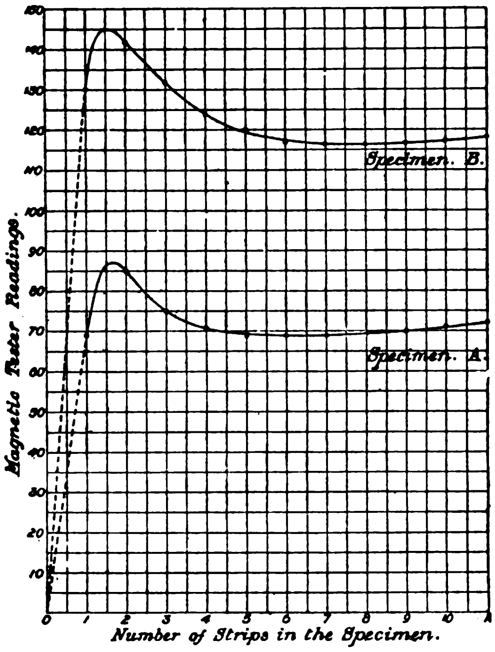


FIG. 2.

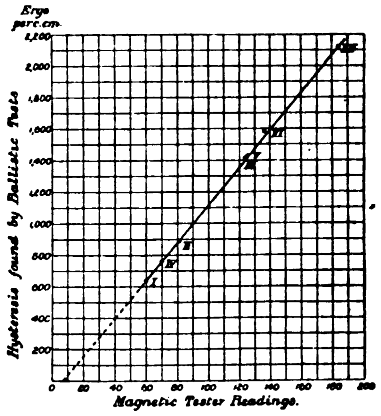
In the first place, the ballistic tests were made on rings, each consisting of a long strip cut to the width subsequently wanted in the magnetic tester, namely, five-eighths of an inch. This was bent into a ring, the ends just overlapping. After bending, the ring was annealed in a gas flame to get rid of the hardness produced by the bending. This is a most essential step, for in good iron the process of coiling into a ring, even of large diameter, hardens the metal very perceptibly and increases the hysteresis. Then the ring was tested ballistically, a sufficient number of cycles being taken to allow a curve to be drawn showing the relation of the hysteresis loss, or $\int H\,dI$, to B, from $B = 2,000$ to $B = 8,000$ or so. The same thing was done with each ring. Then the rings were uncoiled and cut up into three-inch lengths for the tester, and the pieces were straightened and annealed to get rid of the hardness due to this straining. The whole number of pieces into which each ring had been cut were then dealt out into packs of six (or five, or seven, according to the thickness of the material), and these packs were shuffled until repeated trials in the tester showed that every pack gave nearly the same scale reading. The mean scale reading for the several packs obtained from each ring was then taken as a mean applicable to that ring. Here it was assumed that the first and second annealings might be held to bring the material into the same physical state.

To guard against any uncertainty on this point, four additional trials were made, using a different procedure. Long strips were again cut, but each of them was tested ballistically in its original straight form in a solenoid with open ends, the induction coil being wound over the central region only. Each strip was 36 inches long and five-eighths of an inch wide, and a single strip was used in each test. The general effect of the free ends is to shear over the B-H diagram, but not to alter the enclosed area. Enough areas were measured to determine, as before, the curve of $\int H\,dI$ and B for each strip. The strips were then cut up into pieces for the tester which were treated as in the former case. In this procedure there was no annealing.

By these two means seven standard samples in all were produced, of quality ranging from exceptionally good to exceptionally bad. The magnetic tester readings for these were taken, using approximately equal weights to form the sample in each case. In the following table the tester readings are given alongside of the value of the hysteresis loss ($\int H\,dI$) as determined ballistically for an induction, B, of 4,000 units for each of the seven specimens. Numbers I, II and III were those tested ballistically in the ring form, the others were tested in the form of straight strips.

Comparison of Magnetic Tester Readings with the Hysteresis Loss determined by Ballistic Tests.

No. of Specimen.	Magnetic Tester Scale Readings.	Hysteresis Loss by Ballistic Tests. Ergs per c.cm.
I.	60	640
II.	81	890
III.	124½	1,420
IV.	70	750
V	125½	1,430
VI.	136	1,580
VII.	184	2,120



The same results are shown graphically in Fig. 3. It will be seen that they accord well with one another, and that the scale reading of the magnetic tester is nearly proportional to the hysteresis loss. A straight line drawn from the origin among the observed points lies sufficiently near all of them to allow the assumption to be made, so far as workshop testing is concerned, that the deflection in the tester, when multiplied by a factor depending on the sensitiveness of the instrument, is a practical measure of the hysteresis.

More exactly, however, the locus of the points is seen to be a straight line passing not quite through the origin. This may be partly due to the fact that the induction produced in the tester is not absolutely so high in the bad as in the good iron. In all probability, however, it is mainly due to this—that as the sample revolves some small amount of work is done in periodically changing the distribution of magnetism in the field-magnet itself, in addition to the work that is done in reversing the magnetism of the sample. Any work expended within the field magnet would contribute to the deflection, and would exist even if the sample (while retaining its permeability) were entirely destitute of hysteresis. Hence the line may be expected to pass a little to the right of the origin, as it is actually found to do.

It is intended to furnish with each instrument two standard samples of iron, along with a table stating their hysteresis as found by reference to ballistic experiments (in ergs per cubic centimeter, and also in watts per lb., at an assigned frequency). In proceeding to test other samples the operator will first note the deflection given by each of his standard pieces, and then, by simple proportion, or by aid of a diagram, he may go on to interpret in absolute measure the deflection observed with any specimen. This will make his results independent of any loss of strength on the part of the field-magnet, or of any changes he may find it convenient to make in the sensibility of the instrument.

The hysteresis of the standard samples is stated for B = 4,000. To find the hysteresis for any other induction it is only necessary to use the following table of factors, which has been deduced by the author as a general mean from ballistic tests of many samples:

Induction B.	Relative Amount of Hysteresis.
2,000	0·33
2.500	0·47
3,000	0·63
4,000	1·00
5,000	1·41
6,000	1·89
7,000	2·41
8,000	3·00

Other forms of the instrument can be constructed by making the field revolve while the sample is pivoted, so that the sample deflects; by placing the axis vertical instead of horizontal, with a control furnished by a spring or by bifilar suspension; by using a weighted arm or a torsion head to measure the deflecting couple, instead of observing the deflection by a pointer on a scale; and so forth. But the author believes that the form now exhibited will be found both accurate and handy in general use.

He hopes it may contribute indirectly to the betterment of the iron used for magnetic purposes, by making it easy for a purchaser of iron or a purchaser of transformers to specify a maximum of hysteresis, and to see that he gets what he specifies. A notable improvement in the quality of sheet iron in this respect has been going on during the last few years, and it is now practicable to get iron which a short time ago would have been pronounced impossibly good. But it would be easy to quote tests showing that some iron of relatively very poor quality still finds its way into armature and transformer cores. The author's aim has been to put into the hands of those who are practically concerned with magnetic hysteresis, whether as makers of plates, builders of transformers, or engineers of alternate-current supply stations, an apparatus in which testing is reduced to its simplest terms, where each test consumes no more than a few square inches of the sheet, where the preparation and testing of the sample take only a few minutes of time, and the operation consists in turning a handle and reading how good or bad the iron is from the position of a pointer on a scale.

Westinghouse News.

The daily papers report that the Westinghouse Electric Company is now working day and night forces at its new factory at Brinton, and has on full time 2,700 factory hands. The output in the railway department is twenty-five motors per day and will soon be increased to thirty.

The board of directors have expressed the opinion that it would be desirable to adjourn the stockholders' meeting until the latter part of June or early in July, in order that a more adequate showing of the importance and advantage of the new works may be then given to the stockholders.

UNDERWRITERS' RULES.*

BY WILLIAM A. ANTHONY.

(Discussion.)

Mr. C. O. Mailloux—This paper, with its unimposing title and modest dimensions, is, I think, one of the greatest importance to electrical engineers. I do not wish to disparage the preceding paper, and it ought not to be any disparagement to say that the paper we have just heard is at least of equal merit, great as is the value of the preceding paper, because although the question of electric wiring is one which seems a relatively simple matter in these days of sines and sinusoidal functions, yet it is one which, when we come to the practical and commercial side of our profession, we have at one time or another to deal with; and there are those of us who have extensively to do with it. I think that we should be very watchful of the construction which is placed upon the rules formulated by the different insurance companies. They may be working for the purpose of making the electrical business better, but that is with them only an incidental consideration; they have not the interest in so doing that we should have. Their interest is primarily to see to it that the installation is made safe from fire. We have a further interest. We have some interest in seeing that the installation is perfect, not only electrically but practically, and that it is a credit to the profession which it represents. I am very sorry to call the attention of this body (or at least some of the members of it who may not be familiar with it) to the fact, though many of you are familiar with it, that in the matter of insurance rules the electrical fraternity has been handled with a spirit of inconsistency and partiality, and with a want of that broad, liberal treatment that characterizes other lines of fire inspection. This case of the Attix wire is perhaps as good an instance as any, and it ought to be one sufficient in importance to call the attention of electrical engineers to the necessity of our acting, either singly or jointly, in such a manner and with such emphasis as to let our voice be heard and prevent the continuance of such inconsistencies.

As the paper very clearly puts it, it strikes one as almost absurd to characterize or define as a tube a piece of wire which has a solid wrapping of some material supposedly fire-proof applied to it. It is no more a tube than would be any other wire on which might be put a covering braid or some other material than the insulation. I do not see why a simple braid or a simple tape really is not as much a tube; yet we have found ourselves tied hand and foot in many cases by such rulings as that on the part of insurance inspection authorities. I might mention a dozen cases in my own practice which are equally incongruous, equally absurd, and which have caused needless delay, needless expense, trouble and annoyance. I think it is time that the Institute as a body should protest against a continuance of such rules and such measures on the part of insurance companies. I may state with pleasure that I have heard several representatives of distinguished and prominent insurance companies express themselves in no uncertain terms in regard to the manner in which this work has been done by those who were supposed to represent them and do their best for their business. I have stated to some of them that it has an evil influence on their business. I know of cases where the insured has preferred to do his own insuring rather than submit to the arbitrary dictation of the insurance inspectors. Some of the insurance companies themselves have expressed their dissatisfaction, and they feel, in some quarters at least, that there ought to be a change in policy, that insurance rules ought to be compatible with and favorable to progress in electrical installations and ought to be the means of promoting progress rather than obstructing it.

Mr. William J. Hammer—I am heartily in sympathy with the gentleman who presented this paper and the gentleman who has just spoken. I think that subjects of this character are of the utmost importance to the American Institute of Electrical Engineers. At the last annual meeting I had the honor as the chairman of the National Electric Light Association's Committee on Standard Rules for Electrical Construction and Operation to present their last report to the Institute, with the result that a committee be appointed to examine and endorse it on behalf of the Institute in order to secure fuller co-operation and a better enforcement of these rules. Two gentlemen appointed on the committee of the Institute, who are among the most honored members of this body, made the statement to me at the time, that they thought it was unadvisable for the Institute to take up a matter of this kind, because it was purely a commercial one and the Institute was a scientific body. In this connection, I wish to say that I heard some one make the remark recently that many members in the Institute thought it was hard to get papers before this body which were within five miles of the earth. I think we have had admirable papers of the character that have been read to-night by our worthy President and Mr. Kennelly, but there are also other papers, reaching a very large percentage of the members, that are of vital interest to the professional work that a good many of us are engaged in, and I am particularly interested in this class of work, having been identified for a number of years with the work of the Committee of the National Electric Light Association, which promulgated the rules now practically used all over this country by the insurance people generally, and I might add, without any credit to the organization that brought them out. I think severe criticism can be made justly upon the Underwriters for allowing their inspectors or their experts to bring out rules of this character and pass them and foist them upon electrical engineers and the public at large. I think many of these things have not been treated in as conservative a manner as they might have been. Last year a very earnest effort was made to secure the co-operation of all the electrical interests, including the insurance inspectors, etc., with a view to having one single set of rules go out, having them more rigidly enforced and having them kept up to date. Those efforts, although very earnest were not brought to a conclusion. Since that time the committee has continued its efforts, and before very long the Committee of the National Electric Light Association, who are recognized as the ones who have brought this subject to the front for years past, will extend a formal invitation to the representatives of the telephone interests, the street railway interests, the Fire Chiefs' Association, the American Institute of Electrical Engineers, and perhaps some other association or two which will be interested in seeing that proper rules, which are conservative in their character and which do not benefit any particular class of manufacturers or any particular industries to the exclusion of others, are adopted; and it is hoped that before this year is out some uniform action will be taken by these organizations which will look to just the step that Prof. Anthony and others have recommended and which is certainly highly advisable. I merely refer to this now, because very earnest efforts have been made during the past year, and they are being pushed very actively by a committee of the National Electric Light Association acting in conjunction with some of these other gentlemen, and the matter will be brought before the Institute as well as these other bodies within a short time and in a manner which I trust will appeal to them and be treated as being of such decided importance to the electrical interests for the Institute of Electrical Engineers as well as other bodies to co-operate with the National Electric Light Association in its important work.

Mr. H. Ward Leonard—This subject is one that has interested me for a good many years, and I am familiar with the difficulties that have always been met with by contractors in dealing with the rules set forth by the Underwriters and the requirements that they lay down. Having installed a good many hundred thousand lamps on different styles of wiring in the past ten or twelve years, I feel that the use of anything such as has been described in this paper as the Attix "tube and wire" is certainly a distinct reversion to the condition that applied to electric light wiring in about 1885 or 1886. I personally installed work at that time which was done with practically identical materials and which were as good, I think, as the Attix tube and wire can be to-day, and it seems to me that the conduit is an essential condition for thoroughly first-class work to-day and that a conduit to be of any service whatever must be a permanent, reliable, strong hole, which will be always there, enabling you to pull the wire out and in in case of any failure of the wire. I personally am very strongly a believer, and always have been—at least for a great many years—in placing the opposite poles of a circuit, whether it be a two-wire circuit or a three-wire circuit, all inside of a single iron pipe, and I have put in some thousands of lamps in this city in which both poles of the circuit are inside the single plain iron pipe with quite satisfactory results, and I wish to call attention to a point which may not have impressed itself on all the members, and that is that in case you do have both poles of the circuit inside of the iron pipe and the system of iron pipe be grounded, it is almost inconceivable that any condition of leakage or trouble in the electric circuit should occasion a fire. In other words, it is my belief that the rule of the Underwriters which they have so strenuously urged for the last few years, that when conduits are used only one wire be placed in each conduit, is merely aggravating the possibilities of fires which could be eliminated by using first-class insulated wires inside of a single metallic conduit. The Underwriters apparently have been convinced of this point comparatively recently, and have waived that requirement where the wires are placed in an armored conduit. As an indication of the difficulty of securing attention on the part of the Underwriters to those whose voices ought to be heard in practical matters relating to electric work, I will say that there exists in this city an association of nearly all of the representative concerns of electrical contractors; and feeling that the Underwriters had imposed very arduous and unreasonable rules, and in fact conditions which made it more expensive, more difficult and more dangerous to do electric wiring work, the contractors in question appointed a committee when they learned that the Underwriters were likely to issue a new set of rules in the then immediate future. They appointed this committee to wait upon the Underwriters for the purpose of aiding them in drawing the rules and in arriving at rules which would be mutually satisfactory, and I happened to be chairman of that committee and so can speak about it from my own knowledge. A letter was sent to the Underwriters by me, as chairman of this committee, expressing a desire to participate in their discussions in regard to this matter, or at least to be given an audience to express our views in regard to some of the points which we hoped would not be inserted in the new rules, and which we had considered arduous in the old rules, and the letter was acknowledged with the statement that in case they cared to have any conference with us or to hear any expression of opinion from us they would let us hear from them, which we never did. I am heartily in sympathy with the general tenor and purpose of this paper, and believe that this Institute is by all means a proper body to express its opinion in regard to matters having so practical a bearing on the work of electrical engineers.

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* A paper presented at the 96th Meeting of the American Institute of Electrical Engineers, New York and Chicago, April 17, 1895.

Mr. James Hamblet—It came to my notice a short time ago that certain buildings in the city of Brooklyn were wired for electric lights and inspected by the inspectors of the Board of Fire Underwriters and approved. The lights were used for a time, and then a certain time after that inspection they were again inspected and condemned, and the owners were compelled to re-wire their buildings or improve them according to the new rules adopted by the same Board of Fire Underwriters. I also know a similar instance in Brooklyn where a contractor made an estimate for the work and the inspectors were watching him; and the inspector told him that by the new rules a certain kind of tube was to be used and he must put in that kind of a tube. That destroyed his profits on that little job.

Mr. Mailloux—I do not think that this subject can be disposed of in the time that remains for this discussion, and for one I feel that I would like to have an opportunity to collect my ideas. I am under the weather this evening with a cold, and can scarcely formulate my ideas as I would like to. There are one or two facts in connection with the matter which I think it might be well to bring to the attention of the meeting, and which may serve to stimulate discussion. In the first place I would like to call attention to the fact that the insurance companies themselves are not entirely satisfied with the way the matter has been arranged, and at present out of some forty or fifty insurance companies represented in New York City there are nearly one-half who have formed a little insurance inspection association of their own. They are no longer satisfied with the inspection made by the official Underwriters but have an inspector of their own. I am very sorry that their inspector is not here this evening, as he is a member of the Institute and could give us some very interesting information. I trust that he may have an opportunity at another meeting to give us his experience, which is, I assure you, quite interesting.

Gentlemen, I feel quite strongly in this matter, because I have had a great deal of experience with the insurance inspectors not only in this but in various districts, and as Mr. Jenks has very well observed, I found a noticeable difference, of which I will give you one instance. The iron conduit tube was adopted by the New England Insurance Exchange in June last. I had occasion to communicate with them with reference to a large installation at Newport which was in their district. I had found that their rules would not allow me to use an iron conduit, although there were certain electrical and other objections to any other forms of conduit which might be allowed under the rules. I stated the case, urging the electrical objections, and the mechanical ones as well, and received a reply the next day stating that the objections were well taken, that they had been submitted shortly before by others, and that it had been decided to allow the iron conduit tube to be used with twin conductors for such cases. Some four or five months afterwards I had occasion, in connection with several installations contemplated in New York City, to go over the same matter. A question came up almost similarly. I went over in person to consult with the officials of the inspection department in New York and was informed by them that they had as yet taken no action in regard to the iron conduit tube, expressing at the same time grave doubts as to the propriety of their taking any action whatever. It seemed to them to be something that was of very doubtful, if any, utility, if not absolutely bad. However, in the same breath almost, I learned that the Attix tube, so-called, was then allowed. This was several months before any official promulgation of this "Attix" rule was made, as this conference took place some time in October or November. You can scarcely imagine the feeling with which I heard this announcement. I scarcely could believe that we were in a metropolis and in a progressive age when I heard that we were going to be relegated by official direction back to methods which I for one should not sanction. I will state that as a member of the examining board of this Institute I would not want to acknowledge or accept as a member a man who was capable of admitting Attix wire as the rule prescribes. I would consider that he was doing something derogatory to his profession. Although we are still far away from the ideal and the perfect, we who have had practical experience with the different ways of interior wiring consider the iron conduit tube such a great step in advance that we hailed it with a certain degree of delight; but we were literally told that we must not touch that. Now I submit when we reach such a point that the progress of our profession is retarded by arbitrary methods such as these it is time for us to act. I will give you another case which is quite interesting. I have now a case where the insurance inspectors inspected a large dry goods establishment in Brooklyn. I was called in by the proprietors of the establishment after they had made efforts during several months to adjust the matter with the insurance companies—I was called in by them to see what could be done in the matter. It took me three months to bring about a conference between the various insurance inspectors interested in it. There were some twenty odd companies who carried partial risks on the establishment, it being a very large one. I discovered very quickly that some of these inspectors wanted certain things done and other inspectors wanted that very thing not done, and so on, for a long list of requirements; yet they were all working from the same rules. Some of them told me that I must not allow any molding to be capped. Others said that that was very wrong, the rules required it to be capped; and so on through a long list of inconsistencies. I began in June. In October I succeeded in bringing about a conference between the different insurance companies at which I appeared as representative of my clients. I took delight in calling the attention of the seven or eight inspectors present to the fact that they were extremely inconsistent and arbitrary. I put it in those words and stated my reasons clearly, and this particular case furnished me ample reasons. I think it had a salutary effect—a certain agreement was drawn which stated what these inspectors would all agree to agree or disagree about. I had made so many efforts to satisfy them all that I had given up hope of doing so, and I thought all further effort useless until I had their signatures as evidence of what they would or would not allow. It was no longer a question of rules. It was a question of what their individual preferences or whims might dictate. Now, gentlemen, I think the electrical profession needs some attention when it is placed in such a position as that. I think that, not only looking at it from a scientific standpoint, but also from the standpoint of dollars and cents, it will pay us to go to the bottom of this thing. I believe that with the proper amount of suasion we ought to be able to place ourselves in a position where, instead of being dictated to, we may ourselves dictate to some extent what is proper. I do not think there is a more competent body in the United States to formulate rules and restrictions, to prescribe what is a proper thing to do in connection with electric wiring, or what is profitable and desirable from the engineering standpoint. I submit that men who are business men merely, though they may have experience, are not so well fitted as those who have had the training and experience of years to do this. I think that with all the scientific men and all the practical men that this Institute contains it is more competent than any other body to dispose of this question. I am in a position to assure this body that it has sympathy from the outside, that it has sympathy from the very ranks of the insurance companies—which is saying a great deal—because I have already called to your attention the fact that they have dissenters, men who are dissatisfied with the way their business is transacted, and they are only waiting for a word of sympathy or encouragement or some little energy on our part and on the part of all the other associations interested in the electrical industries in order to give us a helping hand and bring about the desired change.

(To be continued.)

New York Wins.

Next N. E. L. A Convention to be Held in This City.

At a meeting of the Executive Committee and officers of the National Electric Light Association held in Grand Central Palace, New York, Saturday evening last, it was officially decided to hold the next Annual Convention in New York. The motion naming New York as the place of meeting was offered by Mr. John A. Seeley and seconded by Mr. Chas. R. Huntley. It was passed by a unanimous vote. The question of the advisability of holding a Convention independent of an exhibit by the manufacturing and supply interests was raised by Mr. A. J. De Camp, of Philadelphia, and discussed at some length by that gentleman and others. On motion of First Vice-President Nichols, a committee, consisting of Mr. Seeley, Mr. Huntley, Mr. De Camp, and the president and vice-presidents and secretary, was appointed to meet at some future time to fully consider the question in all its relations.

Vice-President Nichols, appreciating the valuable services the electrical press has rendered in behalf of the Association and its work, moved that a vote of thanks be tendered to the workers in this branch. The motion was warmly seconded by Mr. Gardener.

Introductory, if not preparatory, to the business of the evening, a dinner with elaborate menu was served. The following gentlemen were present: C. H. Wilmerding, president, Chicago; Frederick Nichols, first vice president, Toronto, Can.; E. F. Peck, second vice-president, Brooklyn; George F. Porter, secretary; E. H. Davis, Williamsport, Pa.; W. R. Gardener, Pittsfield, Mass.; J. J. Burleigh, Camden, N. J.; A. J. De Camp, Philadelphia; C. R. Huntley, Buffalo; W. W. Carnes, John A. Seeley, A. Markle, R. B. Corey, M. Nathan, W. D. Weaver, S. L. Coles, T. C. Martin, W. F. Osborne and B. E. Greene.

The Metropolitan Trust Company of New York has applied to the Federal Court at Sioux Falls, S.D., for the appointment of a receiver for the South Dakota Transit and Railway Co. The trust company holds bonds of the road amounting to $75,000. It was considered certain that Judge Edgerton would appoint Dr. F. H. File receiver.

GENERAL ELECTRIC'S THIRD ANNUAL REPORT.

Results Claimed by the Company for the Past Year's Operations.

COMPARISONS WITH PREVIOUS YEARS.

Following is the full text of the General Electric Company's report for the year ended Jan. 31, 1895:

SCHENECTADY, N. Y., May 1, 1895.

To the Stockholders of the General Electric Company:

For the sake of greater clearness, the following report has been divided into two sections, showing:

1st. The result of liquidating the assets which appeared on the company's books prior to January 31, 1894.

2d. The result of the business of the fiscal year ending January 31, 1895.

As previously reported, the profit and loss statement showed on January 31, 1894, a debit balance of	$12,454,967.42
The result of liquidating and providing for loss on the old assets, as explained below, has increased this by	2,754,392.27
Making the total loss on old accounts (prior to 1894) as now ascertained or estimated.	$15,209,359.69
The business of the year 1894 has yielded a net profit (over interest on debentures) of	414,642.72
Leaving the present debit balance of profit and loss	$14,794,716.97

LIQUIDATION OF OLD BUSINESS.

In the last annual report your directors sought to exhibit the extent to which your company had suffered from the panic of 1893, and from other causes inherent in some of the enterprises in which it became interested at the time of its organization. Mention was made of the fact that the accounts receivable included $2,531,609.88 due by the Fort Wayne and Northwest companies and other allied interests. Contrary to the expectation of your directors, and the statements of persons directly interested in the Northwest Company, your claim as a creditor of that company now proves to be without value; and certain other interests inherited by your company through the Northwest Company are also valueless. The aggregate loss from these sources is about $945,000 (viz., $456,484.48 on the account owned, and about $489,000 on other items), and this sum is included in the charges to profit and loss in the Supplementary Statement for the year 1893 attached hereto.

During the past year the Fort Wayne Electric Company, a former ally of one of your constituent companies, has gone into the hands of receivers, and its affairs are now being liquidated by the court. Your company has filed with the receivers its claim for $1,137,555.48.

The balance sheet and the schedules accompanying it show the outstanding interests of your company as stockholder in manufacturing and other companies. Many of these securities will be sold as opportunity offers. Such a course will, in some instances, involve considerable shrinkage from former book values.

There exist also several unsettled contracts antedating the formation of your company, but which your company has to recognize, and which will cost, perhaps, $500,000 to settle.

To cover the estimated loss on all the matters above mentioned, your directors have arbitrarily charged $2,000,000 to profit and loss account, and the results, as shown at the head of this report, are after making this deduction.

BUSINESS OF THE FISCAL YEAR ENDING JAN. 31, 1895.

Notwithstanding the adverse conditions of the past year, the output of your various factories at cost value was only slightly below that of the previous year. The output in the amount of material produced was considerably in excess of the previous year.

Special attention has been given to the supervision of credits, economy of administration and the improvement of factory facilities, and your directors and officers have sought to adopt every device calculated to increase the efficiency of manufacture and to reduce the cost of the manufactured product. In this they have been in a marked degree successful, and great credit is due those officers and employees of your company directly in charge of manufacturing details.

In the last annual report mention was made of the shrinkage in inventory values of electrical machinery arising from new inventions and improvements, whereby types of machinery which have been the best of their kind are often rendered obsolete. It is impossible to guard wholly against loss from this source, inasmuch as it is essential for your company to keep on hand at all times a considerable stock of manufactured goods. Such stock has been greatly reduced in the past year, and it will be the policy of your board to keep it down to the lowest point consistent with prompt filling of orders. This, together with the work accomplished in developing standard types of apparatus and supplies, warrants belief that the loss from this source will be diminished in the future.

In the last report your directors expressed the opinion that they could, out of the then unliquidated assets, pay off the balance of your floating debt and also provide all necessary working capital. These expectations have been realized, and in addition thereto the company has purchased and cancelled $1,250,000 of its own debentures at an average cost of less than 89 per cent.

As will be seen by the statement of profit and loss herewith, the business of the year just closed amounted to		$13,263,611.58
The cost of goods sold, legal and general expenses and taxes were		11,451,863,98
Leaving a gross profit of		1,811.747.60
Against which is charged interest on debentures outstanding		464,583.83
Leaving (over interest on debentures)		$1,347,164.27
There are further charged off:		
Various old losses which are difficult of division between 1894 and earlier years, and are, therefore, all charged against the year ending Jan. 31, 1895	$443,023 96	
Cost of all patents and franchises acquired or settled for during the year	162,298.11	
Depreciation of inventories	288,401.14	
Sundry losses	38,798.34	
		932,521.55
Leaving a net profit of		$414,642.72

EXPIRATION OF THE INCANDESCENT LAMP PATENT.

As a result of the decision in the "Bate case," recently announced by the Supreme Court of the United States, it is now settled that the fundamental patent upon the Edison incandescent lamp expired in November, 1894. Your company still owns patents of more or less importance upon the incandescent lamp, but it will chiefly rely upon the high quality of the lamp manufactured by it and its facilities for manufacturing in large quantities at a low cost to maintain its commanding position in the lamp business irrespective of patent control. Lamp prices have necessarily been greatly reduced. While the volume of this important part of your business will without doubt be largely increased in the future, the percentage of profit thereon will necessarily be less than heretofore.

PATENT LITIGATION.

During the year the company has been successful in a number of suits in which it has been attacked by the owners of patents which it was charged with infringing. It has been defeated in no such suit. A valuable patent on the Edison form of socket has been sustained by a Court of Appeals. Several important suits on railway patents owned by the company are in progress, some of which will be argued this spring.

ENGINEERING DEPARTMENT.

The work done by the engineering department during the past year deserves special mention. Much has been accomplished in the development of large units, as well as in the perfection of the minor details of manufacture.

The only successful work yet accomplished in the operation of elevated roads by electricity has been done by your company, and it is now engaged in important installations of underground electric conduits for street railways.

In large power generators, in mining and power transmission work, in regulating and measuring devices, and in railway motors, the development and perfection of design have been especially noticeable.

SELLING DEPARTMENT.

The selling organization has been conducted on an efficient and economical basis, and the sales made during the past year have been almost wholly on a cash basis, the average terms of payment on all sales being forty days after shipment.

LICENSEE COMPANIES.

These companies contribute an important part of the business done by your company in central station lighting and distribution of power, and their growth and prosperity are closely identified with the welfare of your own company. The relations which have heretofore existed between these licensee companies and your company continue, and the policy of your company in the future, as in the past, will be to cultivate their business and co-operate in the development of such licensees.

REDUCTION OF CAPITAL STOCK.

At the last annual meeting the following vote was passed:

Resolved, That the matter of reducing the capital stock of the company in the manner prescribed by law be referred to the incoming Board of Directors, with request that they give it attention; and, if such a course commends itself to them, that they call a special meeting of the stockholders for consideration and proper action.

Your board, after careful consideration, has deemed it inexpedient to take any action with reference thereto.

FUTURE BUSINESS.

The indications are favorable for a volume of business in excess of that of last year; but prices are abnormally low, and satisfactory results will largely depend upon the ability of your company still further to reduce the cost of production and distribution of its manufactures.

PATENTS.

The $8,159,264.02 at which patents are carried is the amount at which their value was taken on pages 8 and 9 of the first annual report of your company.

The attention of stockholders is called to the accompanying Balance Sheet and Statements of Profit and Loss.

Attached hereto will be found also the report of the second vice-president, explaining in detail the items on the Balance Sheet and the relation of profit and loss to the business of the current and previous years, and the stockholders are referred to same for details as to these matters.

In closing this report, the president and directors desire to express their thanks for the good work done by the officers and employees of the company in their efficient administration of the various departments.

By order of the Board of Directors,

C. A. COFFIN, President.

SCHENECTADY, N. Y., May 1, 1895.

C. A. COFFIN, ESQ., *President.*

SIR: I submit herewith:

(1) Consolidated Balance Sheet.

It includes the assets and liabilities of the Edison General Electric, Edison Electric Light, and the Thomson-Houston Electric companies, which, for convenience of bookkeeping only, are consolidated with those of the General Electric Company. The assets and liabilities of the Thomson-Houston International Electric and the Pennsylvania General Electric companies were taken over by the General Electric Company during the past year and are also included in this Balance Sheet.

(2) Consolidated Statement of Profit and Loss.

It includes the profit and loss accounts of all the companies above mentioned.

Explanation of the items is as follows:

Assets.

PATENTS AND FRANCHISES.

This account remains at the amount shown in the last two annual reports. It represents, as stated in those reports, the cost to the General Electric Company of the Edison and Thomson-Houston patents and contract rights, and its interest in the patents of the various Thomson-Houston sub-companies. During the year $94,917.11 was expended in purchasing and taking out new patents, and $67,381 in acquiring the territorial licenses which the Thomson-Houston Company had granted to the Thomson-Houston International Electric and the Thomson-Houston Electric Light companies, the latter being the predecessor of the Pennsylvania General Electric Company. These amounts, as well as all expenses of patent litigation for the year, have been written off to profit and loss.

MANUFACTURING PLANTS.

This account represents the real estate, buildings, machinery, tools, etc., at Schenectady, Lynn and Harrison. Their book value at January 31, 1894, was $3,941,128.98. During the year $61,124.34 was expended for new buildings and $268,079.73 for new machinery. On the other hand, $370,333.05 has been written off to profit and loss as an allowance for depreciation, leaving the present book cost of these plants $3,900,000, or $41,128.98 less than at January 31, 1894.

REAL ESTATE.

This account has been increased during the year $100,098.19, chiefly by taking real estate mortgaged to secure old accounts in settlement of those accounts.

STOCKS AND BONDS.

Lists of these securities are annexed hereto in Schedules A and B.

Those having a market value have been taken at book values slightly under the price of recent sales. Where there is no established price it has been necessary to estimate their value from financial statements submitted by officers of the respective companies. Effort has been made to keep the book values of stocks and bonds of "local companies" down to present cash values.

There are stocks and bonds of various companies amounting to $8,500,000 at par, but of so speculative a character that they are carried at a total book value of only $82, being one dollar for each lot. Some of these latter are practically worthless, but others possess some merit and their aggregate value is likely to be considerable.

NOTES AND ACCOUNTS RECEIVABLE.

This account represents what is believed to be a conservative value of notes and open accounts of customers, after deducting and charging off to profit and loss old notes and accounts receivable of 466 debtors, not now dealt with except on a C. O. D. basis, amounting to $2,291,844.48, heretofore carried at $234,973.69, but no longer carried as assets, except for the aggregate sum of $466, being one dollar for each debtor. They will be liquidated as speedily as possible.

INVENTORIES.

This account represents raw materials, goods manufactured and in process of manufacture at the works and manufactured goods on consignment and at sales offices, all at factory cost. They have been inventoried item by item.

Reductions from the sum at which they were previously carried have been made and charged to profit and loss. The continued writing down of manufactured goods is with the intent that only standard salable apparatus shall be considered an asset.

WORK IN PROGRESS.

This account represents the amount expended on installations in progress, without any credit for the profit to be derived from such installations when completed and billed.

Liabilities.

CAPITAL STOCK.

To acquire five shares of common and four shares of preferred stock of the Thomson-Houston Electric Company, which had not been exchanged at the date of the last annual report, three shares of common and one share of preferred stock of this company have been issued during the year.

INDEBTEDNESS.

Pursuant to the policy announced in the last annual report, various stocks and bonds, which it was not desirable for the company to hold permanently, have been marketed. Their proceeds were placed in a special fund. The cost of all securities purchased has been charged to that fund as follows:

Securities were sold for	$1,307,298.07
Securities were acquired at a cost of	1,085 226.56
Leaving a balance	$222,071.51
To this was added from the liquidation of old notes and accounts receivable the sum of	885,996.82
Making a total of	$1,108,068.33

which was used to buy $1.250,000 of the company's debentures in the open market at an average price of about 88⅝.

By liquidating as above, and by adhering to the policy of selling for cash or on short time, the company has not only collected enough cash to retire all its floating and reduce its funded debt, but has had sufficient working capital to pay cash for all its purchases during the year.

The following comparison shows the debt of the company, other than outstanding debentures and real estate liens, on the 31st days of January, 1894 and 1895:

	1894.	1895.
Notes payable	$744,341.31	None.
Accounts payable, accrued interest, etc	446.307.92	494,258.01
Total	$1,190,649.23	$494,258.01
Less cash on hand	591,143.88	404,236.48
Net amount of unfunded debt	599.505.35	90,021.53
Paper indorsed and discounted.	1,422,949 48	None.
Total	$2,022,454.83	$90,021,53

Reduction of unfunded debt	$509,483.82
Reduction of real estate liens	26,200.00
Debentures cancelled	1,250,000.00
Reduction of debt during the year	$1.785,683.82
Reduction of indorsements	1,422,949.48
Total reduction of obligations	$3,208,633 30

PROFIT AND LOSS.

It is difficult to separate losses ascertained during the current year into those properly chargeable to this year, and those due to the errors or misfortunes of previous years. The division of the Profit and Loss Statement has been made with a view to exhibit, as far as it could be distinguished, the profit of the year just ended. The losses incurred on notes and accounts, over and above the allowance made therefor last year, are due largely to diminished values of notes and accounts of customers of the Northwest General Electric Company.

GENERAL EXPENSES.

The general expenses decreased $774.882.09 as compared with the previous year.

Respectfully submitted.

J. P. ORD, Second Vice-President.

CONSOLIDATED BALANCE SHEET, JANUARY 31, 1895.

ASSETS.

Patents and franchises		$8,159,264.02
Manufacturing plants		3,900,000.00
Real estate (other than manufacturing plants):		
Edison Building, N.Y. City	$412,284.63	
Less mortgage thereon	200,000.00	
	$212,584,63	
Other real estate	211,198,79	
		423,783 42
Stocks and bonds (see Schedules A and B)		5,079,012.51
Cash	$404,236.48	
Notes and accounts receivable	6,550,499.50	
Work in progress	757,087.04	
		7,711,823.02
Inventories:		
At factories	$3,046,014.59	
At sales offices (including consignments	813.654,39	
		3,859,668.98
Sundry debits		27,989.09
Profit and loss		14,794,716.97
		$43,956,258.01

LIABILITIES.

Capital stock:		
Common	$30,460,000.00	
Preferred	4,252,000.00	
		$34,712,000.00
Five per cent. gold coupon debentures		8,750,000,00
Accrued interest on debentures	72,916.65	
Accounts payable	421,341.36	
		494,258.01
		$43,956,258.01

SUPPLEMENTARY CONSOLIDATED PROFIT AND LOSS ACCOUNT OF JAN. 31, 1894.

Balance January 31, 1994		$12,454,967.42
Losses chargeable to further liquidation of last year and previous years' business:		
Sundry liquidation accounts.	$264,048.36	
Claims against Northwest General Electric Company.	456,484.43	
On account of settlements with United Electric Securities Co. of bond transactions under T.-H. Electric Company's contracts	46,382,86	
Old notes and accounts receivable wholly charged off	234.973.69	
Sales of plants and real estate below book values	41,501.97	
		1,043,391.31
Special allowance		2.000,000.00
		$15,498,358.73

Profits belonging to last year's business:		
Discount on debenture's purchased	$141,931.67	
Sales of stocks and bonds in excess of book values	147,067,37	
		$288,999.04
Balance carried down		15,209,359.69
		$15,498,358.73

CONSOLIDATED PROFIT AND LOSS ACCOUNT OF JANUARY 31, 1895.

Adjusted balance of January 31, 1894			$15,209,359.69
Business of the current year:			
Cost of goods sold.	$9,557,827.69		
Legal and general expenses, taxes.	1,894,536.29		
		$11,451,863.98	
Interest on debentures		464,583,33	
			11,916,447.31
Losses chargeable partly to previous and partly to current years' business:			
Consignments and contracts written off		184,772.96	
Additional depreciation allowed for:			
On plants, consignments, contracts	177,417.50		
On notes and accounts receivable	130,833.50		
		308,251.00	
		443,023.96	
Further amounts now charged off:			
Patents and franchises	162,298.11		
Various inventories	288,401.14		
Sundry losses	38,798.34		
		489,497.59	
			932,521.55
			$28,058,328.55

Business of the current year:			
Sales	$12,540,395.12		
Royalties and sundry profits	420,818.17		
		$12,961,213.29	
Interest and dividends on securities owned	187,946.81		
Interest and dis.	114,451.48		
		302,398.29	
			$13,263,611.58
Balance, January 31, 1895			14,794,718.97
			$28,058,328.55

(Schedule A.)

STOCKS.

LOCAL COMPANIES.

CORPORATE NAME.	PAR VALUE.
Alamo (Texas) Electric St. Railway Co	$40,000 00
Amsterdam (N.Y.) Street Railway Co	9,900.00
Andover (Mass.) Electric Co	2,000.00
Appleton (Wis.) Edison Electric Co	15,000.00
Athol (Mass.) Gas and Electric Co	600.00
Austin (Minn.) Electric Co	50,000.00
Barberton (Ohio) Electric Co	89 250.00
Bay Shore (N. Y.) Electric Light Co., Ltd	1,000.00
Bethlehem (Pa.) Electric Light Co	675.00
Bridgeton (N. J.) Electric Light Co	25.000.00
Buffalo (N. Y.) General Electric Co	260,000 00
Cambridge Electric Light Co., Cambridgeport, Mass	2,700 00
Camden (Ark.) Power and Light Co	10,000 00
Canton (Ohio) Electric Light and Power Co	12,200.00
Chatham (N. Y.) Electric Light Co	1,100.00
Charlotte (N. C.) Electric Light Co	1,500.00
Charleston (S. C.) Light and Power Co	94,175.00
Chester (Pa.) Electric Light and Power Co	3,000.00
Chicago Edison Co	133,600.00
Cincinnati Edison Electric Co	383,300.00
Citizens' General Electric Co. (com.), Louisville, Ky	264,400.00
Citizens' General Electric Co. (pref.), Louisville, Ky	67,900.00
City Electric St. Railway Co., Little Rock, Ark.	20,000.00
Cleveland (Ohio) El. Illg. Co. (com.)	112,000.00
Cleveland “ “ “ “ (pref.).	59,400.00
Com. Ononima del Alumb. El. de Puebla, Mex.	15,000.00
Consumers' Light and Power Co., Little Rock, Ark	25,000.00
Consolidated Electric Light Co., Birmingham, Ala	414,511.63
Cooperstown (N. Y.) Gas and Electric Co	2,250.00
Columbus (Ohio) Ed. Electric Light Co	23,100.00
Crown Point (Ind.) Electric Co	10.000 00
Davenport (Iowa) Power and Light Co	50,000.00
Des Moines (Ia.) Edison Light Co	93,720.00
Dillon (Montana) General Electric Co	40.000.00
Dubuque (Ia.) Light and Traction Co	5,000.00
Eastchester Electric Co., Mount Vernon, N. Y.	32.645.00
Edison Illuminating Co., Easton, Pa	4,250.00
Edison Electric Light Co., Philadelphia	23,022.00
Edison Elec. Illuminating Co., Paterson, N. J.	31.500.00
“ “ “ “ New York, N. Y.	200,200.00
“ “ “ “ Cumberland, Md	8,500.00
“ “ “ “ Newburgh, N.Y.	29.650.00
“ “ “ “ St. Louis, Mo	40,000.00
“ “ “ “ Altoona, Pa	10,000.00
Edison Electric Light and Power Co., Kansas City, Mo	14,200.00

CORPORATE NAME.	PAR VALUE.
Edison Electric Light and Power Co., York, Pa.	18,200.00
" " " " " Erie, Pa..	11,400.00
Edison Electric Illuminating Co, New Brunswick, N.J.	9,500.00
Elgin (Ill.) City Railway Co	40,000 00
Essex County Electric Co., Orange, N. J.	5,000.00
Fairhaven (Wash.) and New Whatcom Ry. Co.	50,000.00
Fargo (N. Dak.) Gas and Electric Co	26,000.00
First Cincinnati Edison El. Illg. Co	8,700.00
Fort Clark Street Railway Co., Peoria, Ill.	177,750.00
Framingham (Mass.) Gas, Fuel and Power Co..	500.00
Geneva (N. Y.) Brush Electric Light and Power Co.	10,000.00
Glens Falls (N. Y.) Electric Light and Power Co., Ltd	550.00
Goshen (N. Y.) Light and Power Co	100.00
Grand Rapids (Mich.) Edison Light and Fuel Gas Co	29,000.00
Grinnell (Iowa) Electric Light Co.	1,000.00
Hackensack (N. J.) Edison Lighting Co	59,500.00
Hollister (Cal.) Light and Power Co	250.00
Hudson Electric Light Co., Hoboken, N. J.	275,000.00
Huntsville (Ala.) Electric Light Co	2,300.00
Jacksonville (Fla.) Electric Light Co	100.00
Jackson (Mich.) Light and Power Co	25,000 00
Johnstown (Pa.) Electric Light Co	18.900.00
Kingston (N. Y.) Electric Co	43,650.00
La Compagnie Electrique de Valleyfield (P.Q.)	1,000.00
Laramie (Wy.) E. G. L. and F. Co.	16,500.00
Little Falls (N.Y.) Electric Light & Power Co..	2,500.00
Los Angeles (Cal.) Edison Electric Co	40,000.00
Macon (Ga.) Consolidated St. R. R. Co.	490,000.00
Maryland Electric Co., Baltimore, Md	500.00
Metropolitan St. Railway Co., Macon, Ga	100.000.00
Milbury (Mass.) Electric Co	2,000.00
Napa (Cal.) Thomson-Houston Light Co	33,500.00
Narragansett Pier (R. I.) E. L. & P. Co	40,000.00
Natick (Mass.) Electric Co	37,500.00
Natick (Mass.) Gas Light Co	10,100.00
New Omaha (Neb.) T.-H. El. Light Co. (com.)..	30,600.00
Newport (R. I.) Illuminating Co.	36,700.00
Northwest Electric Co., Ltd., Winnipeg, Man..	20,000.00
Oshkosh (Wis.) Electric Light and Power Co...	2.300.00
Ottawa (Ill.) Electric St. Railway Co	68,000.00
Overland Railway Co., Nashville, Tenn.	5,000.00
Oxford Lake Line (pref.), Anniston, Ala	36,018.50
Portland (Ore.) General Electric Co. (com.)....	527,800.00
Pueblo (Col.) City Railway Co	50,000.00
Queen City Railway Co., Dallas, Tex	200.000.00
Queen City Electric Railway Co., Marion, Ind.	50.000.00
Raleigh (N. C.) Electric Co	3.000 00
Rensselaer (Ind.) Water, Light and Power Co..	30,000.00
Roseberg (Ore.) E. L. and P. Co.	20,000,00
Roanoke (Va.) E. L. and P. Co	5,000.00
Rome (Ga.) Gas Light Co	17,500.00
Rutland (Vt.) Electric Light Co	15,000.00
Scranton (Pa.) Illuminating, Heat & Power Co.	42,000.00
Seneca (N. Y.) Electric Co.	300 00
Skowhegan (Me.) Electric Light Co	4,300.00
Standard Light and Power Mfg. Co., Montpelier, Vt	1,000.00
Syracuse (N. Y.) Consolidated Street Ry. Co...	20,500.00
Tacoma (Wash.) Railway and Motor Co	45,000.00
Thomson-Houston Electric Co., Augusta, Ga.	3,000.00
Thomson-Houston El. Light and Power Co., Quincy, Ill	2,200.00
Toledo (Ohio) Electric Co.	600 00
Trenton (N. J.) Light and Power Co	62,500.00
Twin City General Electric Co., Ironwood, Mich	100.000.00
Union Street Railway Co., Dover, N. H	8.800.00
Utica (N. Y.) Belt Line St. R. R. Co (pref.)....	50,000.00
Vancouver (B. C.) Electric Ry. and Light Co..	3.100.00
Visalia (Cal.) Light and Heat Co	14,700.00
West Asheville Improvement Co. (pref.), Asheville, N. C.	80,000.00
West Asheville Improvement Co. (com.), Asheville, N. C	80,000 00
Westboro (Mass.) Electric Light and Power Co.	1,620.00
Weymouth (Mass.) Light and Power Co	5,000.00
Wilkes Barre (Pa.) Electric Light Co	10,100.00
MANUFACTURING COMPANIES.	
Brush Electric Co. (pref.), Cleveland, Ohio....	$122,800.00
Brush Electric Co., (com.), Cleveland, Ohio...	1,995,200.00
Canadian General Electric Co., Ltd., Toronto, Can	1,250,000.00
Excelsior Electric Co., New York City	387.000.00
Fort Wayne (Ind.) Electric Co	2,000 450.00
Ft. Wayne Trust Securities (Series A), Boston, Mass	9.776.00
Otis Electric Co., Yonkers, N. Y	174,000.00
Schuyler Electric Co., Middletown, Ct	50,000.00
Schuyler Elec. Mfg. Co. (com.), Hartford, Ct..	84,000.00
Schuyler Elec. Mfg. Co. (pref.), Hartford, Ct..	307,930.00
Short Electric Railway Co., Cleveland, Ohio..	2,000,000 00
Spanish-American Light and Power Co., Jersey City, N. J	4,000.00
Swan Lamp Mfg. Co., Cleveland, Ohio	33,000.00
Union Elecktricitats Gesselschaft, Berlin, Germany	50,026.00
United Electric Securities Co. (com.), Boston, Mass	500,000.00
United Electric Securities Co. (pref.), Boston, Mass	23,100.00
Total	$14,902,161.13

(Schedule B.)

BONDS.

CORPORATE NAME.	PAR VALUE.
Arkadelphia (Ark.) Water and Light Co	$9,000.00
Atlanta (Ga.) Consolidated Street Railway Co.	18.000.00
Barberton (Ohio) Electric Co	20.000.00
Bangor (Me.) Electric Light and Power Co	61,500.00
Binghamton (N. Y.) General Electric Co	2,000.00
Brooklyn H'ts R.R. Co. and L.I. Tr. Co., Brooklyn, N. Y	194,000 00
Camden (Ark.) Power and Light Co	10.000
Camden (N. J.) Lighting and Heating Co	30,500.00
Central Vermillion Iron Co., St. Paul, Minn...	3,500.00
Charleston (S. C.) Light and Power Co	25,000.00
Chattanooga (Tenn.) Electric Ry. Co	20,000.00
Cicero (Ill.) Light, Heat and Power Co	700.00
Cincinnati (Ohio) Edison Electric Co	225,000.00
Citizens' General Electric Co., Louisville, Ky..	70,000.00
City Electric St. Ry. Co., Little Rock, Ark	100,000.00
Concord (N. H.) Land and W. P. Co	119,500.00
Congaree Gas and Electric Co., Columbia, S. C.	500.00
Consolidated Electric Light Co., Birmingham, Ala	79,000.00
Consumers' Light and Power Co, Little Rock, Ark	27,000,00
Crescent City R. R. Co., New Orleans, La	129,000.00
Crown Point (Ind.) Electric Co	10,000.00
Cumberland Electric Light and P. Co., Nashville, Tenn	60,000.00
Dallas (Tex.) Electric Co	1,000.00
Dayton (Ohio) Electric Light Co	297,000.00
Decatur (Ala.) Light, Ill'g and F. Co	3,750.00
Dedham (Mass.) Electric Co	47,000.00
Dubuque (Iowa) Light and Traction Co	7.000.00
East Chester Electric Co., Mt. Vernon, N. Y...	39,000.00
Fort Wayne (Ind.) Electric Corporation	325.000.00
Gallitzin (Pa.) Electric Light Co	7,000.00
Greensboro (N. C.) Elec. Light and Power Co..	2,500.00
Hoosac Valley St. Railway Co., North Adams, Mass	809.00
Jackson (Mich.) Light and Power Co	33,000 00
Kansas City (Mo.) Pittsburg and Gulf R. R Co.	3,500 00
Kingston (N. Y.) Electric Co	7,000.00
Knoxville (Tenn.) Electric Light and Power Co	10,000.00
Knoxville (Tenn.) Street Railroad Co	6.000.00
Lee (Mass.) Electric Co	11,000.00
Los Angeles (Cal.) Cons. Electric Ry. Co	41,440.00
Macon (Ga.) Consolidated Street Railway Co..	300,000.00
Metropolitan Street Railway Co., Macon, Ga...	45,000.00
Millbury (Mass.) Electric Co	16.000.00
Madison (Wis.) City Railway Co	22,000.00
Manhattan Electric Light Co., New York City.	43,000 00
Milwaukee (Wis.) Street Railway Co	325,000.00
Narragansett Pier (R. I.) El. Light and P. Co.,	1,000.00
Natick (Mass.) Electric Co	17,500.00
North River Electric Light and P. Co., New York	2,000.00
Ocala (Fla.) Light and Power Co	10.000.00
Oskaloosa (Wis.) Edison Light Co	7,500.00
Oshkosh (Wis.) Electric Light and Power Co..	5,650 00
Otis Electric Co., Yonkers, N. Y	20,000 00
Ottawa (Ill.) Street Railway Co	51.000.00
Overland Railway Co., Nashville, Tenn	11,500.00
Oxford Lake Line, Anniston, Ala	175,000.00
People's Electric Light and Power Co., Oswego, N. Y	84.000.00
Petersburg (Va.) Street Railway Co	25,000.00
Piedmont Chautauqua Co., Atlanta., Ga	1,000.00
Piedmont Exposition Co., Atlanta, Ga	2,000.00
Plymouth (Mass.) Electric Light Co	61,000.00
Portland (Ore.) General Electric Co	67.000.00
Public Works Co., Bangor, Me	35,000.00
Pueblo (Col.) City Railway Co	50,000.00
Queen City Electric Railway Co., Marion, Ind..	5.000.00
Queen City Railway Co., Dallas, Texas	85,000.00
Rainier Power and Railway Co., Seattle, Wash	21.000.00
Rensselaer (Ind.) Water, Light and Power Co.	20.000.00
Rochester (N. Y.) Railway Co	35,000.00
Sacramento (Cal.) Elec. Power and Light Co...	10,000.00
San Francisco and San Mateo Ry. Co., San Mateo. Cal	15,000.00
Sea Shore Elec. Ry. Co., Asbury Park, N. J.	6,000.00
Standard Plate Glass Co., Pittsburg, Pa	1.600.00
Steubenville (Ohio) Street Railway Co	2.500.00
St. Cloud (Minn.) City Street Car Co	5.000.00
Tacoma (Wash.) Railway and Motor Co	200,000.00
Trumbull Electric Ry. Co., Warren and Niles, Ohio	74,000.00
Toledo (Ohio) Electric Co	6.000.00
Town of Buena Vista, Buena Vista, Va	1,600.00
United Electric Sec. Co., Boston, Mass	220,000.00
Watertown (S. Dak.) Heating, Lighting and P. Co	2,000.00
West Asheville Improvement Co., Asheville, N. C	100,000.00
West Street and North End Elec. Ry. Co., Seattle, Wash	4,000.00
Weymouth (Mass.) Light and Power Co	34,000.00
Winona (Minn.) General Electric Co	20 000.00
Total	$4,354,040.00

Total par value stocks and bonds	$19,256,204.13

Is the Report Correct?

Many Points Which Need Explanation.

Some Which Do Not.

The report of the G. E. Company here printed differs in points of its make-up from the two which have preceded it. The second vice-president of the company has evidently made progress in the art of bookkeeping. The report is ingeniously prepared, so much so that the experts of the daily press have been utterly flabbergasted in their efforts to analyze it. Analysis of it by any one not familiar with previous reports and with trade conditions would be an impossibility, and it is therefore with a pardonable sense of duty done to the 7,000 stockholders of the company, to its competitors and to the public generally that we have made a careful study of it, and present the results of expert work in a comparative table.

Almost in the first paragraph comes the admission of the worthlessness of Northwest G. E. In April, 1893, ELECTRICITY stated in clear and positive language that this concern was worse than worthless. A little later we charged that it would yet cost the parent company a large sum of money to make good its guarantees in financing the Northwest Company. A portion of this amount, only $500,000, is confessed to in this report. The sum is not large enough. The total liabilities of the G. E. Company through the Northwest fiasco is to-day nearer $2,000,000 than $500,000 and will so appear if looked into carefully.

The claim against the Ft. Wayne Company's receiver, $1,187,000, is clearly manufactured and absolutely worthless—why it should have been mentioned is a mystery. It is too transparent a humbug to pass muster even in a G. E. report.

The statement that $414,000 net was earned is an absurdity. No mention is made of the unpaid cumulative dividend on the preferred stock, which is piling up at the rate of $297,000 per annum. Two years' dividends are now due. Thus by this one item the so-called net earnings are reduced to $117,000, and the actual liabilities should have included the $594,000 now overdue and which must be paid before any other dividend can be declared.

Although in the first report great stress was laid upon the company's patent strength and the great value of its patents, this subject is passed lightly by this year. No mention is made of the loss of two of the most valuable patents, the Edison feeder and main and Thomson regulator patents, declared void during the year. The loss of the lamp patent is mentioned, but nothing has been taken off the patent account after the loss of the three strongest and broadest patents. This is not honest bookkeeping, but it should mislead no one.

Now we come to an item which fortunately does not rest upon mere opinion. The facts are all presented over the signatures of Messrs. Coffin and Ord. Mr. Coffin says: "The average terms of payment on all sales during the year were on 40 days after shipment."

Mr. Ord gives the total sales at $12,540,395.12.

Counting 300 days in 1895, then two-fifteenths of the total sales should be on the books. Two-fifteenths of $12,540,395.12 equals $1,672,052.68, whereas the book accounts are given at $6,550,499.50. The difference is $4,878,446.82.

The evidence is therefore plain that $4,878.446 of the book accounts have been carried for over a year—have been carried, in fact, because they were uncollectible. It is more than probable that $3,000,000 must sooner or later be written off from this item of assets. For the stockholders who hope to have an honest report of the condition of their property here is plenty of food for thought.

Moreover, the business was not all done on a cash basis. Over one million, or one-twelfth of the total, was done for stocks and bonds. What will be the shrinkage on this item next year?

With the views of business evidently held by the management we do not wonder that they have deemed it inexpedient to reduce the capitalization. Such a move would have created discussion, and it would take very little discussion to bring out the fact that, with the present report as a basis to begin with, the entire capital stock of the enterprise should be wiped out. Interest on the bonds is all that can possibly be earned under the present management, and the live assets are scarcely sufficient to cover the bonds.

When we reviewed the first report of this company it was charged that our criticism as to overvaluation of assets was too severe; but the appearance of last year's report, acknowledging a shrinkage of over $12,000,000, went a long way to convince the public that we knew exactly what we were talking about. We did. Moreover, we have not been without expert advice from men who know every detail of the Edison, T.-H., and G. E. Co's business from the beginning up to the present time. Last year, under the pretence of great frankness, another lying, or at least false, report was issued. We so charged. This year we find a supplementary profit and loss account acknowledging that more than $3,000,000 should not have been added to last year's total deficit. So it will be next year. The company will be compelled them to admit that the statements here made by ELECTRICITY are nothing less than absolute truth. There are stockholders who should profit by this review. They can profit only by organizing to overthrow the present management in its dishonorable entirety and put in new men who will conduct their business in a sensible manner and present honest reports of its condition.

This management has played upon the credulity of the public so long that perhaps nothing in the way of attempted deceit ought to surprise us. But in this report an attempt is made to mislead with such outrageous impudence that it is at least worthy of special mention. We refer to the manipulation of the stock and bond account.

In the balance sheets the two items are grouped together this year, and it is necessary to consult in detail Schedules A and B. In these schedules the par value of the different items is given with the totals. The fact to which we wish to call attention is that these holdings have apparently increased $5,440,944.34.

Last year, in the foot notes accompanying these schedules, it was stated that in addition to the holdings specified the company had other stocks and bonds to the amount of about $10,000,000 carried at about $5,000. It is, of course, from this list of cats and dogs, grouped together last year as practically worthless, that the additions this year have been made. But why, in the name of all that is honest, should Mr. Ord have turned resurrectionist and gone into a graveyard to find stuffing for his report?

There is only one answer. He places such a low estimate on the intelligence of the G. E. stockholders that he thinks they will swallow anything. The par values of these resurrected stocks and bonds look large as given, and help perhaps to create the impression that there are still good assets to be sold which will produce money enough to continue a losing business. Mr. Ord and the G. E. directors fool no one but themselves by these methods.

The accompanying comparative table is easily understood. It was made up by the same expert accountants who compiled the one we printed in 1894. It is correct. It is made up chiefly from the figures given in the four official statements of the company. Not one figure has been changed. Not one item manipulated. It is just such a table as is prepared annually by every concern desiring to know the actual results of business from year to year. It shows an average loss for the 32 months' business of this company of nearly $750,000 per month. If the estimates of assets given by the company were correct, the total deficit would be several millions larger. This charge will be proved to be correct before the year is over.

The following estimates were made after the publication of last year's report by three gentlemen who had assisted officially in preparing the report. The figures here given show their personal views on the matter, which they were not allowed to express as officers. The estimates explain themselves, showing the deductions which should have been made last year if the report had been an honest one:

Assets claimed		$33,478,481.81
Deduct from:		
Patents and franchises	$8,000,000	
Manufacturing plants	1,000,000	
Stocks of mfg. companies	2,200,000	
Stocks and bonds of local co's.	2,200,000	
Notes and accounts receivable.	4,000,000	
Inventories	1,000,000	
Sales office stocks	750,000	
	$19,150,000	$19,150,000.00
		$14,323,481.81
Liabilities acknowledged other than stock		$11,216,849.23
Deduct:		
Bonds retired	$1,000,000	
Notes (said to be paid)	744,341.31	
	$1,744,341.31	$1,744,341.31
		$9,472,507.92
Summary:		
Live assets		$14,323,481.81
Bonds outstanding		9,000,000.00
Leaving		$5,323,481.81

as against the $34,711,600 of stock issued; for it must be remembered that the preferred stock is not preferred in liquidation but as to dividends only.

Dividing $5,323,481.81 by $34,711,600.00 we find that the entire issue of stock was then worth about $15 per share according to the most liberal estimate possible twelve months ago.

In view of this year's report there is no denying that the condition of the enterprise is much worse than it was last year. If the report means anything it means that the present management have about reached the end of their rope. One more year and they will be wound up by the courts.

The manufacturer will first desire to learn, not the general condition of the company, but the results of the year's business. This is easily arrived at.

Total sales are given at		$12,540,395.12
Securities taken	$1,065.226.56	
Worth on basis of previous securities taken	361,775.52	
Shrinkage in securities		$723,451.04
Leaving cash values of sales without allowance for bad debts		$11,816,944.08
Cost of goods sold		$11,451,863.98
Interest on bonds and preferred stock		762,223.33
Total fixed charges		$12,214,087.31
Deduct cash value of sales		11,816,944,08
Loss		$397,143.23

In addition there has been charged off for the year's operations as follows:

Cost of patents, etc	162,298.11	
Depreciation of inventories	288 401.14	
Sundry losses	38,798.34	
Total		489,497.59
Actual loss for year's manufacturing business		$886,640.82

The above result is the only one that can be reached from the company's own figures.

Not one man in the trade, however, believes the total sales of the company to have been $12,000,000.

ELECTRICITY is perfectly familiar with the style of bookkeeping of this concern, and we charge that this account has been intentionally manipulated. The actual facts are that the total is a trifle over $9,000,000 for the year. The bookkeepers have done the rest.

There is absolutely no hope for the stockholders of the G. E. Company under the present management, and we call particular attention to the warning which Mr. Coffin gives:

"Prices are abnormally low and satisfactory results will largely depend upon the ability of your company still further to reduce the cost of production."

Prices are low, and the G. E. management are solely responsible.

And in estimating the probabilities it must be borne in mind that the prices during the year ended Jan. 31, 1895, averaged 25 per cent. more than present prices.

It is therefore not hard to forecast the ultimate end of this swindling enterprise.

The insiders will continue to manipulate the Wall Street annex to the business. They will make millions upon the millions already made. Every available asset will be sold to pay current expenses. Then the credit of the company will be forced to the full limit.

After this, humbuggery and thimblerigging will no longer avail and the courts will take control.

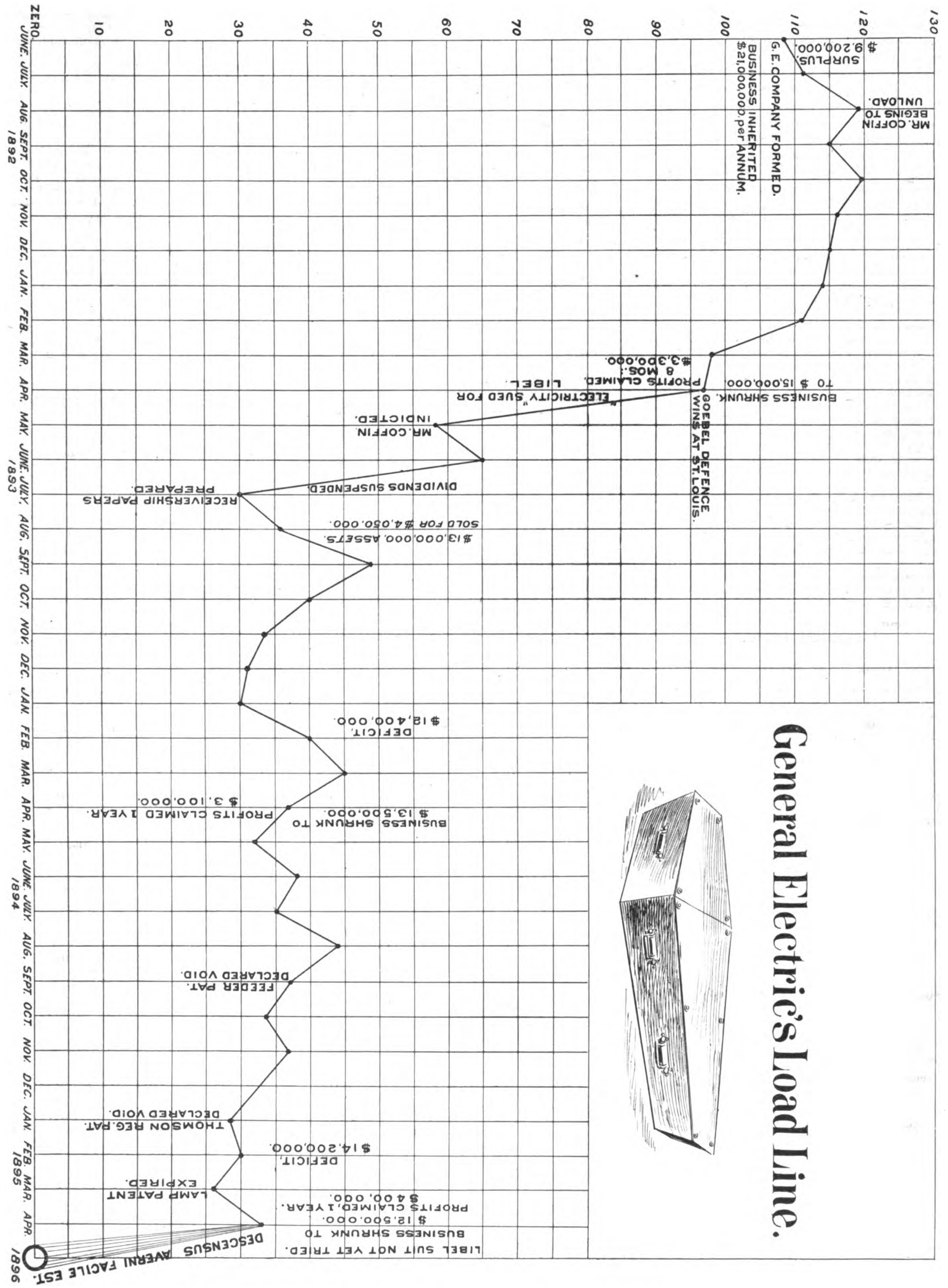
The end is near.

GENERAL ELECTRIC FINANCES—A COMPARISON.

	Total three co's May 31, 1892.	G. E. Co. Jan. 31, 1893.	G. E. Co. Jan. 31, 1894.	G. E. Co. Jan. 31, 1895.
ASSETS AVAILABLE.				
Inventories at factories	$6,471,441.06	$7,052,263.29	$3,349,042.94	$3,046,014.59
Work in progress	1,183,555.76	2,207,982.75	1.198,343.58	757,087.04
Accounts receivable	11,768,264.26	13,068,074.56	8,934.159.75	6,550,499.50
Cash	2,752,047.95	3,871,023.58	591,143.88	404,236.48
Inventories at sales offices	72,301.40	8 396.71	1,485,749.68	813,654.39
Totals	$22,247,610.43	$26,207,750.89	$15,558,439.83	$11,571,492.00
ASSETS UNAVAILABLE.				
Real estate		$298,726.74	$323,685.23	$423,783.42
Manufacturing plants	$7,353,312.27	4,199,762.62	3,941,128.98	3.900,000.00
Patents	670,905.51	7,628.520.39	8.159,364.02	8,159,264.02
Stocks of manufacturing companies	15,302,658.84	15,699,837.87	2,767,470.58	5,079,012.51
Stocks and bonds of local companies			2,723.493.17	
Sundries				27,989.09
Totals	$23,326,876.62	$27,826,847.62	$17,915,041.98	$17,590.049.04
Total assets	45,574,487.05	54,034,598.51	33,473,481.81	29,161,541.04
LIABILITIES.				
Mortgages	266,200.00		26,200.00	
Accrued interest			83,333.32	72.916.65
Debenture bonds		10.000.000.00	10,000,000.00	8,750,000.00
Capital stock, common		30,411,900.00	30,459,700.00	30.460.000.00
Capital stock, preferred	24,970.300.00	4,251,900 00	4,251,900.00	3,252,000.00
Notes	7,950,808.32	7,653,972.60	744,341.31	
Open accounts	1,112,844.86	691,871.82	323,084.32	421,341.36
Sundry credits	1,969,737.38		39,889.78	
Total liabilities	$36,295,890.51	$53,009,643.92	$45,928,449.23	$43,956,258.01
Surplus	$9,278,596.54	1,024,954.59		
Deficit			$12,454,967.42	$14,794,716.97
Decreases— 8 months to Jan. 31, 1893			$8,253,641.95	
" —12 months to Jan. 31, 1894			13,479,922.01	
" —12 months to Jan. 31, 1895			2,339,749.35	
Total decrease			$24,073,313.51	

STOCKS AND BONDS.

Stocks added to Schedule A year ending Jan. 31, 1895—manufacturing companies	$2,082,600.00
" " " " " —local companies	3,890,067.13
Total	$5,972,667.13
Bonds added to Schedule B year ending Jan. 31, 1895	$2,285,250.00
Total additions	$8,257,917.13
Stocks on Schedule A Jan. 31, 1894, and not on Schedule A Jan, 31, 1895	2,098,982.12
Bonds on Schedule B Jan. 31, 1894, and not on Schedule B Jan. 31, 1895	883,600.00
Total not accounted for	$2,982,582.12
Stocks, Schedule A, Jan. 31, 1894	11,030,019.79
Bonds, Schedule B, Jan. 31, 1894	2,785,940.00
Total schedules, 1894	$13,815,959.79
Stocks, Schedule A, Jan. 31, 1895	14,902,164.13
Bonds, Schedule B, Jan. 31, 1895	4,354,040.00
Total schedules, 1895	19,256,204.13
Increase schedules, Jan. 31, 1895, over Jan. 31, 1894	5,440,944.34



General Electric's Load Line.

The Westinghouse Machine Company's New Works at East Pittsburg.

Contracts have been let and ground broken for the Westinghouse Machine Company's new shops at East Pittsburg. A few years ago the Westinghouse Air Brake Company erected large shops at a point on the main line of the Pennsylvania Railroad about twelve miles from Union Station, Pittsburg, where the town of Wilmerding was laid out and built. The location at East Pittsburg of the Westinghouse Electric and Manufacturing Company's immense plant, and the Fuel Gas and Manufacturing Company's factory, to be followed now by the removal of the Westinghouse Machine Co. to the same place, will form, with the Union Switch and Signal Company's works at Swissvale, a concentration of Westinghouse interests practically at one point, within a half-hour's ride of the city.

The main building of the Westinghouse Machine Company's new shops will be 602 feet by feet.

Within the main building, through which switches are run direct from the main line of the Pennsylvania Railroad, will be the machine shop, erecting shop, foundry, pattern shop, warehouse, offices, etc. Two crane runways, each 60 ft. span, on which electric cranes will be used, extend the length of the building. The remaining space is taken up with galleries provided with lighter crane service. The present equipment of machine tools will be increased by the addition of whatever is best to facilitate the manufacture and handling of the company's enormous product.

The hammer shop will have every convenience that the best shop practice can suggest for doing work thoroughly and expeditiously. It will be equipped with one 8 ton, one 3 ton, one 2-ton and several smaller hammers, besides the usual cranes, etc.

It is estimated that the cost of the buildings alone will reach $400,000. The contracts call for completion November 1.

General News.

What is Going on in the Electrical World.

Oswego, N. Y.—Mr. A. Emerick, the receiver of the street railway, has appointed Charles S. Barrett general manager of the road.

Appleton City, Mo.—It is announced that an electric railway line will be built from this town to Monegan Springs, a distance of twenty three miles.

Auburn, N. Y.—The Auburn City Railway Company has been granted a franchise to operate an electric railway in certain specified streets of this city.

Conway, Ark—An electric light company is being organzed here for lighting the town and stores. Twenty arc lamps will be located on the streets.

Fayettevilie, N. C.—The General Assembly has had laid before it "An act to authorize the city of Fayetteville to establish and operate a system of electric lights and motive power."

Greenbush, N. Y.—The receiver of the Electric Manufacturing and Gas Engine Company of this place will sell the company's property on the 20th inst. at the city hall at Troy.

Poplar Bluff, Mo.—C. G. Brockman, of the St. Louis Electrical Engineering Company, has been granted permission to submit an ordinance to the council providing for the construction of an electric light plant in this city.

Port Huron, Mich—Detroit and Port Huron capitalists are to build an electric railway line from Port Huron to Algonac and Chesterfield. Mayor N. S. Boynton, of Port Huron, is one of the originators of the company.

Onaraga, Ill.—An electric light franchise for ten years has been granted by the Onaraga village board to J. E. Owen, of this place. By the terms of the ordinance the plant is to be in running order within ninety days.

New Brunswick, N. J.—The franchise of the local street railway has been purchased by Gottfried Krueger and Andrew Radel, of Newark. The road will be equipped with the trolley system and extended to Bound Brook, Milltown and South River.

Oneida, N. Y.—Charles E. Remick and other local moneyed men have formed a company and will apply for a charter with the purpose of putting in an electric light plant in this city because of the failure of the old company to furnish satisfactory lights.

Staten Island, N. Y.—The State Railroad Commissioners have granted the Staten Island Midland Electric Railroad Company permission to use the overhead trolley system from the Richmond turnpike to Clove road, to Oak street, to the Richmond road.

Buffalo, N. Y.—The Buffalo and Gardenville Electric Railway Company, capital stock $40,000, will shortly apply for incorporation. Assemblyman Schoepflin is the principal promoter and the other shareholders are Buffalo capitalists A large portion of the stock has already been subscribed.

Rahway, N. J.—The Regina Musical Box and Electrical Manufacturing Company of Jersey City, a branch of a concern in Leipsic, Germany, intend to remove their plant to Rahway and establish a large factory here, adding about 400 persons to the population.

Belleville, Ill.—The Belleville Electric Railway has been transferred by G. W. Atterbury to Col. Casimer Andel as trustee for Belleville creditors who advanced $23,000 a year ago to aid in its construction. Mr. Atterbury has an option of repurchase within thirty days.

Indianapolis, Ind.—The Rockwood Manufacturing Company of this city have made a shipment of paper pulleys to Osaka, Japan. They were purchased by the International Electric Light Company of Boston, to be used in an electric plant at Osaka to operate a street railway.

Brooklyn, N. Y.—It is reported that all the money needed to build a bicycle rail road on Long Island has been subscribed. A company will be organized in a few days to carry out the project.—The Nassau Electric Railroad Company will open its first line, that from the foot of Broadway in this city to Canarsie, on May 10.

Danville, Ill.—W. S. Mathias has obtained the privilege from the board of supervisors of Vermillion county to construct and operate for twenty years an electric railroad on the Chicago and Danville highway from Danville north to Iroquois county. The line will be over thirty miles long and will touch the towns of Bismarck, Alvin, Rossville and Hoopeston.

Middletown, N. Y.—The Rev. C. M. Winchester has planned for an electric road from Middletown to Slate Hill, Johnson, Westtown, Unionville and Deckertown, with a probable extension to Port Jervis, and has received assurances from parties interested in the construction and operation of electric roads that make him hopeful of the ultimate success of the scheme.

Long Branch, N. J.—The stockholders of the Long Branch Lighting Company have disposed of their gas and electric light plants at this place to the New York Gas Improvement Company, of New York City, at their par value, $187,500. The electric light plant takes in a larger territory than does the gas plant. It has seventy miles of wires. No change will be made in the local management.

Hempstead, L. I.—The Governor has signed the bill amending the charter of the village of Hempstead, N. Y., empowering the board of trustees of said village to contract with an electric light company or with any person or persons or corporations authorized by law to furnish electric lights for lighting the streets and public highways within the incorporated district of the village.

Wabash, Ind.—James Lynn, of this city, has applied for a franchise for an electric street railway in Wabash. He represents Worcester (Mass.) capitalists, who say that if a franchise is granted they will begin work on a complete system here within ninety days. It is the intention to lay about five miles of track at the outset, extending to the corporate limits at the four cardinal points of the compass, and to make extensions as needed.

Camden, N. J.—The Egg Harbor City Water, Electric Light and Power Company, which obtained a contract by ordinance to furnish Egg Harbor with light and water, organized at Camden recently by the election of the following officers: President, Theo. H. Boysen; secretary, Robert Ohnmeiss; treasurer, Harry May. Directors: John Roesch, Christian Atz. The contract for construction has been awarded to W. W. Taylor.

Richmond, Va.—The common council have voted to renew the contract with the local electric light company for another year. They had passed an ordinance opposing the making of a new contract for electric lighting and virtually reinstated gas, but the public would not stand such tomfoolery and became so determined in their demands that the councillors hastened to revoke the ordinance and Richmond remains in the list of electrically lighted cities.

Canton, O.—Hon. W. A. Lynch, president of the Canton and Masillon line, is manifesting an active interest in the projected electric railway from this city to Albion, and with him are citizens of New Berlin, Uniontown, Greentown, Krumroy and the other places along the way. The idea is to have the line connect with the line already commenced from Akron to Cleveland, thus giving a direct electric line from Canton to Cleveland.

New York.—The stockholders of the Edison Electric Illuminating Company have voted to issue the 100-year gold bonds to an amount not exceeding $15,000,000, bearing interest payable in gold at net rates as the board of directors shall determine from time to time as the bonds are issued, the rates not to exceed 5 per cent. per annum. The company will mortgage its property and franchises to secure the payment of such bonds.

Freehold, N. J.—Papers have been filed here of a million dollar mortgage given to the Knickerbocker Trust Company of New York by the Atlantic Coast Electric Company, which controls the trolley system through Asbury Park, Long Branch and other places along the coast, from Point Pleasant to Pleasure Bay, where it will connect with a line of steamers running to New York; and also controlling a line from Long Branch to Atlantic Highlands.

Dover, Del.—The Henlopen Electric Light and Railway Company have applied to the Legislature for an act of incorporation. The company is to operate an electric railway from Lewes to Rehoboth or to any other place in Sussex County. The incorporators are Dr. Hiram R. Burton, Harry V. Lyons, John Barnes, Charles C. Stockley, Robert G. Houston, Daniel Burton and John M. Richardson. The capital stock is to be $250,000, with power to increase to an unlimited amount.

Chattanooga, Tenn.—The light committee of the city council have decided to invite bids for a new contract for electric lighting, the present contract expiring on the 25th of August next. The city will ask bids for a lighting contract for 2,000 C. P. arc lights, on a basis of 175, 200, 225 and 250 lights, and 100 16 C. P. incandescent lights. Bids are also asked for the erection of a municipal electric lighting plant in the city with a maximum capacity of 300 2,000 C. P. arc lights and 100 incandescent lights, the bids to include everything for an electric plant except the building, the estimated area to be wired being four square miles.

Telephone and Telegraph.

W. B. Mullen has been canvassing Alice, Tex., in the interest of the Alice, Wade City and Corpus Christi Telephone Company with considerable success. The line will be extended to Santa Gertrude and likely to other big ranches. It will be a great convenience, especially to ranchmen and prospective buyers.

The Mammoth Spring Electric Light Company of Mammoth Spring, Ark., are authorized under their articles of incorporation to build and maintain telephone lines.

The construction of a telephone line from Winona, Minn., through Fountain City to Waumandee is being advocated. Nearly enough money has been pledged to build the line, and it is probable its construction will be begun at an early date.

The New York and New Jersey Telephone Company has completed arrangements for the extension of its lines at once to nearly all of the towns and villages of Long Island. Work is progressing rapidly on the new long distance telephone line extension from Glen Cove to Huntington and Northport.

Thomas Dixon, of Henderson, Ky., has been granted a patent on an invention which will prove important if Mr. Dixon's claims as to the advantages of the patent pan out. The name of the invention is the "Sextoplex." It is claimed that the invention will enable six telegraph operators to work on one wire at the same time.

Huddleston & Woodin of Chicago, grantees of the telephone ordinance recently passed by the Eau Claire (Wis.) council, have accepted, and have prepared plans and estimates for exchanges at Eau Claire, Chippewa Falls and Menomonie. They have a franchise at Chippewa Falls, and only await the granting of a franchise by Menomonie to begin work.

The Central Union Telephone Company has declined to accept the proposition of the Home Company at Wabash, Ind., to leave the field if the former company would name a rate of $2 a month for business houses and $1.50 for residences. The Central Union proposes to put in a first-class exchange, make a rate of $3 for business houses and $2 for residences and fight the local company to a finish.

Articles of incorporation are being prepared or the new Citizens' Telephone Company at Tampa, Fla.

Messrs. Wilkerson & Davis have organized a telephone company at Marion, Ala , known as the Marion Telephone Company. A local exchange is in operation, and the company are putting up lines connecting Marion with the business centers of South Alabama.

The Pittsburg, Pa., papers state that a new telephone company has been formed in that city and will apply for a charter at once. The company is composed of prominent business men who are desirous of giving Pittsburg a cheaper and better telephone service than it now enjoys.

The Jones Bros. Electric Company have applied to the authorities of Cincinnati for permission to string telephone, telegraph and fire alarm wires and erect poles therefor to enable them to start a district messenger company in that city. The matter was referred to the Committee on Light.

The Nolachucky Telephone Company, which intends to operate a telephone system, will make Jonesboro, Tenn., the central office. Charles Seymour, of Knoxville, Guy R. Johnson, general manager of the Embreeville Iron Company, Capt. A. S. Deadrick, J. H. Epps and W. P. Brownlow are the charter applicants of the company. The franchise embraces Jonesboro and Johnson City.

The Railroad Telegraphers' Convention, to be held at St. Louis on the 21st inst., is likely from present indications to have a large attendance of delegates from all parts of the country. A strong appeal will be made to the members to establish the national headquarters of the order at Peoria, Ill.

The Board of Public Works of Louisville, Ky., have approved the ordinance presented by the American Telegraph and Telephone Company for the right of way for its poles and conduits through the city. The ordinance provides that no poles shall be put in the center of the city, and that all of the wires there must be underground.

Through the efforts of Messrs. Sanborn & Randall a telephone system connecting Ostonville, Minn., and Big Stone City, S. D., has been established, and business men in both cities are having telephones installed in their offices and stores.

The Oshkosh Northwestern Telephone Company has been organized at Oshkosh, Wis., with a capital of $20,000. A franchise has been granted the company, and 280 subscribers are already assured. The exchange will be in operation by the last of June.

Dr. W. W. Bradley is extending his telephone line from Forman, N. D., to Lisbon and will eventually extend it to Fargo.

R. K. Van Etten & Sons have planted poles from Dingman's Ferry to Milford, N. Y., for a telephone line. The wire has not yet been strung and the enterprise is delayed somewhat by opposition, but the projectors hope to overcome all obstacles and have the telephone in running order this summer. It is their intention to extend the line to Port Jervis.

The Kearny Electric Light Company, of Kearny, N. J., incorporated a few days ago by Geo. F. Woolston, jr., and others, will conduct a telephone business as well as lighting.

The bill repealing the ordinance granting the franchise to the Mutual Automatic Telephone Company of Philadelphia has been favorably reported by Councils' committee on law.

The stockholders of the Oshkosh (Wis.) Northwestern Telephone Company have elected the following officers: President, W. J. Hay; vice-president, F. L. Humes; secretary, T. A. Rockwell; treasurer, Charles Schriber. Directors: E. E. Stevens, T. A. Rockwell, W. J. Hay, Charles Schriber and J. H. Jenkins. The work of construction will be pushed with all possible rapidity.

Secretary E. W. Stamm of the new telephone company, which has applied to the city council of St. Louis for a 50-year franchise to operate in that city, says: "We claim a system that is better than that used by the Bell people. William J. Kurtz, Vandalia, Ill., the inventor, has it in successful operation in Decatur, Ill., and St. Joseph, Mo. St. Louis, 600,000 strong, has 4,000 telephones, and ought to have 10,000. Why not? Because $80 for residence, $100 for business and $120 for public telephones is too steep. We will not charge over $60 and $48 for business and residence purposes."

Test of the Hogan Boiler.

The committee appointed in behalf of the invited guests to supervise the test of the Hogan Vertical Water Tube Boiler at Middletown, N. Y., on April 9, described in our issue of April 17, consisting of Paul H. Grimm, chief engineer National Starch Manufacturing Company, Glen Cove, N. Y.; M. N. Forney, editor *American Engineering and Railroad Journal*, and John Hopson, Jr., of Hopson & Chapin Manufacturing Company, New London, Conn., has made its report as follows:

Very complete arrangements were at hand for measuring the feed water in a tank which was graduated to read in pounds of water. The temperature of the feed water was read from a thermometer inserted in the feed pipe. The steam pressure was recorded by an ordinary steam gauge and also by a recording gauge. The coal, which was of lump anthracite kind, was weighed on a scale in the boiler house.

The members of the committee having satisfied themselves as to the correctness of the conditions, and having examined the fire and the water level as indicated by the gauge glass on the boiler, directed that the blower be started for a test of evaporation under forced draft, to last thirty minutes.

The blower was started at 2.23 P. M. The water in the feed tank at this time indicated 4,600 pounds. The temperature was 44 degrees Fahr. The steam pressure averaged during the test 120 pounds. The steam was allowed to escape through the safety valve, also through a pipe (controlled by a valve) into a tank outside and above the building. The pressure of the blast was not measured owing to an unfortunate disarrangement of the gauge, but in the opinion of the members of the committee was about 1¼ inches.

No facilities were at hand to make a calorimeter test of the steam, but a one-inch pipe located on the top of the boiler was from time to time opened full and the steam examined. It appeared to be practically dry. The temperature of the terminal gases was not taken.

At 2:53 the blast was stopped, and the pump, having been found unable to keep up with the demand for water, was allowed to run a few minutes longer in order to bring the water up to the mark. The fire was inspected and a little more coal put on to bring it up to what the committee considered was its condition at the start.

When the feed pump was stopped, it was found that the tank contained 2,200 pounds of water, thus showing an evaporation of 2,400 pounds of water in thirty minutes from 44 degrees temperature into steam of 120 pounds. The coal used was 350 pounds, which gives an actual evaporation of 6.86 per pound of coal, or an equivalent evaporation from and at 212 degs. of 8.35 per pound of coal. On this evaporation the boiler developed 168 H. P. The evaporation of water per square foot of heating surface per hour was 7.02 as follows:

$$\frac{\text{4,800 lbs. of water evaporated from and at 212 degs.} \times \text{1,215 factor of evaporation}}{\text{850 square feet of heating surface.}} = 7.02$$

The boiler contains 830 square feet of heating surface and 26 feet of grate surface and was rated by the company as a 100 H. P. boiler.

All things considered, the performance of this boiler was very remarkable, and those present expressed themselves well pleased, not only with the behavior of the boiler, but also with the general arrangement and mechanical construction of the boiler.

Cutter's Specialties.

George Cutter, of Chicago, issues a neat little booklet, illustrating many of his well-known devices for street-lighting uses.

Supplies for the War Department.

The War Department, through the Office of Public Buildings and Grounds, Washington, D. C., is asking for proposals until May 28 for the quantities of battery supplies, more or less, mentioned below, for the use of the public buildings and grounds in charge of that office during the fiscal year ending June 30, 1896:

300 gravity coppers, 5 x 7 and 6 x 8 inches. These coppers must be made from the best metal, the 5 x 7 inch to weigh not less than 1¼ ounces each; 6 x 8 inch to weigh not less than 2 ounces each.

100 crowfoot zincs, 5 x 7 inches, to weigh not less than 1¾ pounds each.

400 crowfoot zincs, 6 x 8 inches, to weigh not less than 8¼ pounds each. These zincs must be made from carefully selected spelter; if made from scrap metal or dross they will not be accepted.

2,000 pounds bluestone, best quality.

10 pounds sal-ammoniac, best quality.

300 pounds No. 12 K. K. line wire.

100 pounds extra best No. 12 galvanized line wire.

20 pounds No. 16 office wire, Phillips' patent braided.

24 6-inch battery jars.

6 zincs for Le Clanche battery.

10 pounds Grimshaw ¾ inch splicing compound.

Additional information may be had by addressing Col. J. M. Wilson, War Department, Washington, D. C.

Economical Steam Production.

Messrs. Babcock & Wilcox, who sold the first boilers to electric light plants in America, still maintain their position in the front rank of American boiler makers.

They have just issued two of the most artistic trade publications of the year, entitled "Steam" and "Facts."

The illustrations in the latter show the various stages of boiler development, and make clear the reasons for many of the failures that have marked the progress of steam production for fifty years.

Both books are bound in boards, and are worth sending for and preserving.

The Capo-Farad Battery and Appliance Works.

Jas. J. Pearson has taken the Capo-Farad manufactures entirely out of the hands of the Nassau Electrical Company, and will in future manufacture them, together with other electrical goods, under his own name. His offices are at Thames and Greenwich streets, New York.

Clark Electric Company.

The Clark Electric Company have moved their office from 192 Broadway to their factory, 478 and 480 Pearl street, between Centre street and Park Row.

Universal System for the Distribution of Light and Power from the Same Conductors.

Under the above title the Siemens & Halske Electric Company have recently published in pamphlet form a brief argument in favor of the direct-current low tension system. Among other things they say:

For plants in cities and towns where the power-house can be located near the center of lighting, we use the direct, 220 volt, two-wire (multiple arc) system of distribution, for the following reasons:

Public and private arc lights, incandescent lights, and electric motors can be operated from a single dynamo, preferably direct-connected to engine or water wheel.

The low pressure system involves no danger to life, eliminating the possibility of the owner of the plant being made a defendant in damage suits. This is important, as the long list of fatal accidents from high pressure systems (alternating incandescent and series arc) demonstrates.

The original cost of this system is usually less than that of a high speed, high pressure system. Recent determinations made for several cities show that while often more copper wire is needed, one dynamo is used in place of from four to six; and no countershafting, belting, friction clutches, transformers or other energy-wasting appliances: less real estate, and a smaller building is occupied.

The cost of operation is from 20 to 40 per cent. less. A single Siemens dynamo of slow speed direct-coupled to a good engine costs less to operate than half a dozen high-speed machines belted to a shaft. We save in friction, oil, repairs, attendance, wear and tear, and we obtain a higher efficiency.

The loss of energy due to the use of belts in installations operating under very favorable conditions, as assumed by leading companies in the United States, is as follows:

LOSS OF ENERGY IN—

Horizontal belts	6	per cent.
Vertical belts	10	"
Countershaft with horizontal belt	12	"
Countershaft with vertical belt	16	"
Slow-speed engine with main and countershaft and belts	25	"

By direct-connecting, these losses of course are eliminated.

We use 220-volt incandescent lamps, which make the third wire of the so-called three-wire system unnecessary, and we dispense with expensive energy-consuming equalizing rheostats and complicated machinery at the station.

We obtain, therefore, all the advantages of the so-called three-wire system, at the same time eliminating its weak points.

220-volt incandescent lamps are now being made and guaranteed by many prominent lamp manufacturers in the United States and by Siemens & Halske in Berlin, and we are now importing the lamps of our parent company.

ADVANTAGES OF ARC LAMPS ON A CONTINUOUS CURRENT CONSTANT POTENTIAL SYSTEM.

1. Low voltage, hence safety to human life, easy maintenance of insulation on lines.

2. Constant potential dynamos of any size may be used as the voltage does not increase with the number of lamps as in the common series system.

3. Constant potential dynamos are of a high efficiency. A 50 K. W. dynamo, for instance, can be guaranteed to be of at least 90 per cent. commercial efficiency.

Series arc light dynamos show an efficiency of about 80 per cent. when new, but after a few years their efficiency will fall to 70 per cent. and often as low as 50 per cent. (See "Electrical Engineer," July 4, 1894, page 5.)

4. Low potential dynamos are seldom affected by lightning. The low potential current cannot follow atmospheric discharges through the insulation.

5. Arc lamps burn absolutely steadily and give a uniform light similar to an incandescent light. Their mechanism is very simple.

6. In case of an accident to any part of the circuit or any lamp, only a few lamps are affected, while in the series system the trouble extends over the whole line.

7. Arc lamps require less energy for the same candle power.

8. The repair bill is very small in comparison with series arc dynamos.

9. Incandescent lights and motors may be operated from the same circuits.

10. Arc lamps may be adjusted to any amperage, hence lamps of various candle powers may be operated from the same dynamo and from the same distributing mains.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

MAY, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	......	1	......
2	12.40 A. M.	2	4.00 A. M.
3	1.10 "	3	4 00 "
4	1.30 "	4	4.00 "
5	2.00 "	5	4.00 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	7.30 P. M.	9	9.30 P. M.
10	7.30 "	10	10.30 "
11	7.30 "	11	11.30 "
12	7 30 "	13	1.00 A. M.
13	7.40 "	14	1.10 "
14	7.40 "	15	1.40 "
15	7.40 "	16	2 00 "
16	7.40 "	17	2.20 "
17	7.40 "	18	2.40 "
18	7.40 "	19	3.00 "
19	7.40 "	20	3.20 "
20	7.40 "	21	3.40 "
21	7.40 "	22	3.40 "
22	7.50 "	23	3.40 "
23	7.50 "	24	3.40 "
24	7.50 "	25	3.40 "
25	7.50 "	26	3.30 "
26	9.00 "	27	3.30 "
27	10.00 "	28	3.30 "
28	10.40 "	29	3.30 "
29	11.00 "	30	3.30 "
30	11.10 "	31	3.30 "
31	11.40 "	Jne 1	3 30 "

INCORPORATIONS.

The Collindale Street Railway Company, Collindale, Pa.—to build an electric street railway. Capital stock, $50,000. Promoters: Henry P. Collins, Mt. Vernon; Henry Delaplaine, J. M. West, Jr., Philadelphia, Pa.

The Grayville Water Works, Chicago, Ill.—to construct water works, electric light, heat and power or manufactories, and supply consumers with water, light, heat and power. Capital stock, $5 000. Promoters: Henry A. Gardner, Livingston Griffin, Arthur M. Morgan.

The Mammoth Spring Electric Light and Power Company, Mammoth Spring, Ark.—to maintain and operate a system of electric lights, generate power by electricity and build telephone lines and maintain the same. Capital stock, $100,000. Incorporators: H. G. King, W. D. Cook, M. J. King and M. H. Cook.

The Passaic and Newark Electric Traction Company has filed its certificate of incorporation at Passaic, N. J. Albert C. Jones, Charles A. Stelling and James W. Clinton are the incorporators and their authorized capital stock is $250,000. The paid in capital is $25,000.

The Smithville Water and Light Company, Smithville, Tex.—to furnish water and electric light. Capital stock, $40,000. Promoters: K. H. McCaskill, R. E. McCoy, L. L. McCoy, Smithville.

The Warsaw Water Company, Portland, Maine—to manufacture gas and electricity and machinery and fixtures for gas works, water works and electric light works in city of Warsaw, Kan., and elsewhere. Capital stock, $90,000. Promoters: Wm. C. Eaton, Edw. D. Noyes, Geo. F. Noyes, Portland.

The Eddy Milling Company, Edgecomb, Maine—to manufacture lumber, mill grain and establish an electric plant. Capital stock, $5,000. Promoters: Willis H. Clifford, Irving E. Chase, Fred W. Clifford, North Edgecomb, Me.

The Herbert Kraft Company, Red Bluff, Cal.—to buy, sell, use and construct all kinds of mechanical power, gas and electric lighting plants and works, etc. Capital stock, $100,000. Promoters: Herbert Kraft, Geo. H. Kraft, Edward F. Kraft, Gustave Kraft, Red Bluff.

The United Motor Company, Cleveland, Ohio—to manufacture and deal in electrical instruments, machinery, devices, etc., manufacture, sell, deal in and operate vessels, vehicles and engines propelled by electricity or other power, etc. Capital stock, $10,000. Promoters: H. H. McKeenan, Jas. H. Hoyt, A. C. Dustin, H. A. Kelley, Gustav von den Steiner.

The Sioux Rapids Electric Light and Power Company, Sioux Rapids, Iowa—to establish and maintain an electric light and steam plant. Capital stock, $8,000. Promoters: H. D. Smith, M. P. Smith, Sioux Rapids.

The Grafton Traction Company, Grafton, W. Va.—to own, build and operate an electric street railway from Grafton to Pruntytown, etc. Capital stock, $150,000. Promoters: F. A. Morlan, H. M. Somerville, E. M. Morlan, Grafton.

The Chicago and Montana Mining Company, Chicago, Ill.—to locate and operate mines, mining properties containing gold, silver, copper and iron ore or other ores; operate electric, cable and horse rail, tram and wagon roads, flumes, canals, ditches, etc., telegraph and telephone lines, steam, electric and water power and light plants, together with all machinery and appliances necessary. Capital stock, $500,000. Promoters: Malcolm Dale Owen, Thos. H. Kelley, Edw. Brackett.

The Weaver Jacquard and Electric Shuttle Company (incorporated in W. Va.), Norwalk, Conn.—to manufacture and deal in looms, textile machinery and accessories and mill supplies, etc. Capital stock, $2,500,000. Promoters: Wm. Weaver, Dexter Hitchcock, Edwin H. Mathewson, Norwalk.

The Consolidated Gas Company, Jersey City, N. J., and New York, N. Y.—to buy, build, own and operate gas and electric works. Capital stock, $750,000. Promoters: Jos. C. Davis, Maplewood, N. J.; Henry A. Jones, Geo. Place, New York, N. Y.; Thos. Ewing, Yonkers, N. Y.

The Cleveland, Painesville and Eastern Railroad Company, Cleveland, Ohio—to construct and operate an electric railroad, furnish electric light, heat, power, etc. Capital stock, $250,000. Promoters: Henry A. Everett, Julius E. French, J. A. Beidler, Edward W. Moore.

The Metropolitan Electric Street Railway Company, Chicago, Ill.—to construct, equip and operate street railways to be operated by horse power or electrical devices or other power except steam. Capital stock, $5,000,000. Promoters: Rob't P. Parker, Richard E. Breed, Jas. F. Dagley.

The Toledo Traction Company, Toledo, Ohio—to construct, maintain and operate street railroads and railroads operated as street railroads. Capital stock, $4,000,000. Promoters: Albion E. Lang, Chas. L. Wight, Winfield S. Jewell, Edgar H. Eckert.

The International Forging Company of New York City—to heat and work metals, and to smelt ores and engage in business in which electricity may be used as an agent. Capital stock, $6,000. Directors: James Seager, J. C. Seager, of New York City; Lorenzo Ullo and J. L. Ullo, of Brooklyn.

The Leroy and Northern Railroad Company of Leroy, N. Y.—to operate a steam and electric road in Genesee County, N. Y. Capital stock, $50,000. Directors: C. F. Prentice, D. C. H. Prentice, N. L. Keeney and C. N. Keeney, of Leroy.

The Esmond International Traction Company has filed articles of incorporation with the county clerk in Jersey City, N. J. The company will buy patents and patent rights of appliances for electric traction. They will also deal in material and supplies for electrical traction lines and will furnish equipments. The capital stock is $1,000,000. Incorporators: Chas. C. Dodge, Fred C. Esmond and Henry Seligman.

The Kearny Electric Light Company has filed articles of incorporation with the county clerk of Hudson County, N. J. The object of the company is to supply electric light, heat and power, and do a telephone business. Capital stock, $50,000. Incorporators: Geo. F. Woolston, Jr., Bertha C. Smith, Wm. Hanna and Jos. Randall. The same parties are incorporated as the Esmond Block Signal Company, capital $100,000, for the manufacture of an electric block signal and machinery.

The Freeport General Electric Company, Freeport, Ill. Capital stock, $125,000. Incorporators: William O. Johnson, Newton P. R. Hatch and Charles S. Hatch.

The Consolidated Electric Light Company, San Francisco. Capital stock, $300,000. Directors: G. G. Buckland, H. W. Quitzow, James E. Ball, D. Geary, R. W. King.

The Zanesville and Columbus Electric Railway Company, Zanesville, O.—to build and operate an electric railway between Columbus and Zanesville. Capital stock, $10,000. Incorporators: W. J. Dungwieler, Albert Adams, A. W. Evans, L. W. Doan and S. A. Patterson.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED APRIL 30, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

538,295. Trolley. Judson D. Swacick, Canton, Ohio. Filed Oct. 29, 1894.

538,325. Means for Ventilating Electric Motors on Cars. James J. Devine, Clifton Heights Pa. Filed March 14, 1895.

538,357. Underground Electric Railway John F. Smith, New York, N. Y. Filed Aug. 15, 1894.

538,378. Conduit System for Electric Railways. Frank H. Homan, Brooklyn, N. Y. Filed April 24, 1894.

538,390. Trolley-Breaker. Walter R. Scott, Buffalo, N. Y. Filed Dec. 19, 1894.

538,391. Trolley-Wire Hanger. Walter R. Scott, Buffalo, N. Y. Filed March 5. 1895.

538,408. Electric Transmission Wheel or Trolley. Charles C. Burton, Pittsburg, Pa., assignor of four-fifths to Curtis G. Hussey and John C. Des Granges, same place, Lewis E. Holden, Beloit, Wis., and George M. Ludlow, Chicago, Ill. Filed Aug. 11, 1894.

538,409. Trolley-Wheel Charles C. Burton, Pittsburg, Pa., assignor of four-fifths to Curtis G. Hussey and John C. Des Granges, same place, Lewis E. Holden, Beloit, Wis., and George M. Ludlow, Chicago, Ill. Filed Aug. 24, 1894.

538.569. Trolley-Pole Restrainer. Frank Wheeler, Meriden, Conn. Filed Feb. 8, 1895.

538,590. Block System and Apparatus on Electric Railways. Eugen Langen, Cologne, Germany. Filed July 16, 1894.

538,610. Overhead Trolley. Charles W. Hunt, West New Brighton, N. Y. Filed Feb. 4, 1892.

ELECTRIC LIGHTS AND APPLIANCES.

538,457. Electric-Arc Lamp. John A. Mosher, Chicago, Ill. Filed Feb. 9, 1893.

DYNAMO ELECTRIC MACHINERY.

538,344. Armature for Dynamos and Electric Motors. Harry Penn and Loftus Lowndes, London, England. Filed Aug. 13, 1894.

538.345. Dynamo-Electric Machine or Electric Motor. Edwin H. Porter, Radford, Va. Filed Aug. 11. 1894.

538,351. Electric Engine. Luther M. Sabin, Washington, D. C. Filed April 27, 1894.

538,377. Electric Elevator. Nils O. Lindstrom, Union Course, assignor to A. B. See Manufacturing Co., Brooklyn, N. Y. Filed Feb. 26, 1895.

538,617. Commutator-Brush and Means for Adjusting Same. Robert Lundell, Brooklyn, assignor of two-thirds to Edward H. Johnson, New York, N. Y. Filed July 20, 1893.

TELEPHONE AND TELEGRAPH APPARATUS.

538,327. Telephone Central-Office System. Ezra T. Gilliland, Pelham Manor, N. Y., assignor to the American Bell Telephone Company, Boston, Mass. Filed June 5, 1894.

538,328. Magneto-Transmitter. Ezra T. Gilliland, Pelham Manor, N. Y., assignor to the American Bell Telephone Company, Boston, Mass. Filed June 5, 1894.

538.329. Magneto-Generator. Ezra T. Gilliland, Pelham Manor, N. Y., assignor to the American Bell Telephone Company, Boston, Mass. Filed Nov. 28, 1894.

538,454. Telephone-Switch. Albert F. W. Meyer, Blue Island, Ill. Filed Jan. 11, 1895.

538,474. Art of and Apparatus for Transmitting Speech. John Absterdam, New York, N. Y., assignor, by mesne assignments, of three-fourths to A. Wilford Hall, same place. Filed Feb. 18, 1891.

MISCELLANEOUS.

538.243. Changeable Electric Headlight. William Dibb and Frank C. Rorabeck, Syracuse, N. Y. Filed March 19, 1894.

538.247. Electrical Signaling. Bradley A. Fiske, U. S. Navy. Filed Dec. 20, 1894.

538.271. Electrically and Chemically Heated Crucible. Henry G. O'Neil, Boston, Mass., assignor to Edward Jewell, same place, and Charles W. Welch, Stoughton, Mass. Filed March 24, 1894.

538,272. Electrical Cigar Lighter. Henry G. O'Neill, Boston, Mass., assignor to himself and Edward Jewell, same place. Filed Aug. 27, 1894.

538,275. Electrical Brake. Carl E. Pearson, St. Louis, Mo., assignor of two-thirds to Ernest G. Bruckman and Samuel E. Bruckman, same place. Filed April 2, 1894.

538,278. Boat Propulsion. James F. Place, Montclair, N. J., assignor of one-half to Charles S Upton, New York, N. Y. Filed April 23, 1894.

538,284. Thermal Cut-Out Device. Charles A. Rolfe, Chicago, Ill. Filed Feb. 21, 1895.

538,289. Manufacture of Carbon for Electrical Purposes. Charles P. Shrewsbury, London, and John L. Dobell, Modbury, England. Filed Sept. 10, 1894.

538,320. Magnetic Ore-Separator. John W. Carter, Brooklyn, N. Y. Filed Dec. 30, 1893.

538,359. Process of and Apparatus for Making Compressed Electrolytic Copper. Francois L M. Urruty, Paris, France, assignor to la Societe des Cuivres de France. Filed May 2, 1894.

538.417. Magnetic Ore-Separator. James Houlehan, Chicago, Ill., assignor of a part to Robert Laird, same place, Colin John Basil MacIver and William Henry Laird, Toronto, and James R. Barclay, Montreal, Canada. Filed June 6. 1894.

538,423. Electrical Coupling. Morris F. Koenig and Ira Mann, Hazleton, Pa. Filed Oct. 15, 1894.

538,469. Diffuser for Electric Fans. Charles W. McKeehan and Frederick B. Miles, Philadelphia, Pa. Filed Jan. 17, 1895.

538,628. Method of Making Electrodes for Secondary Batteries. William L. Silvey, Dayton, Ohio. Filed Jan. 23, 1894.

ELECTRICITY.

Vol. VIII. NEW YORK, MAY 15, 1895. No. 18

ELECTRICITY

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As Electricity reaches all classes interested in electrical work, its value as an advertising medium can be readily appreciated. Rates will be sent on application.

Changes for advertisements should reach the office not later than the Saturday preceding the date of publication.

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EDITORIAL NOTES.

"Patents and Prophecies." In January last, in discussing the condition of the G. E. Company, the utter absence of any reasonable ground upon which the stockholders might base a hope for return upon their investments, we stated that "$8,000,000 of patent assets must be wiped out this year or next."

Last week we printed comments of the *Evening Advertiser* as follows:

> It will be noticed at once that the "patent" item is unchanged. It seems to us that we have some faint recollection of the able editor of Electricity telling us about the middle of January that "the $8,000,000 of patent assets would be wiped out this year or next, making a further impairment." In justice to Mr. Greene we will defer remarks on this point until the next annual report comes out, so as to be strictly fair.

We suppose that our esteemed contemporary did not publish this so much for the purpose of announcing to the world that Electricity has an able editor as to point out that even an able editor may be wholly untrustworthy as a prophet. A valued correspondent, from whom at various times we have derived useful information concerning patents and their values, has sent us some comment on the subject which we may properly embody in a sermon on the general subject of Patent values and the value of Daily Paper opinions on the condition of large corporations.

Most of the trusts and trade combinations formed in this country in the last few years have been afflicted with a dangerous disease which has in many cases resulted in the utter collapse of the enterprise, and in nearly every case has caused serious injury to the confiding investors in the securities of these companies.

This disease, with its evil consequences, has not been confined to those companies whose securities are not listed on the exchanges, but has been equally prevalent among those so listed, which have been compelled to issue statements from time to time for the information of the public, and whose affairs have been the subject of popular newspaper comment.

Indeed it is among the latter class that the disease has been most virulent, the consequences the most severe. When one of these desires to list its securities a statement is filed with the Board of Governors which at once becomes public property. It is upon this preliminary statement that money is first raised and speculation begins. Then the company must issue an annual report, which becomes public property and usually reaches the financial editor and supposed financial sage of the daily press.

Probably a majority of the readers of the daily paper still labor under the delusion that these financial editors are specially fitted with some peculiar power or genius (either inherited or acquired, or partly both) for at once understanding the exact financial condition of a company and also at once determining the value of its assets and liabilities by mere inspection of the items given in the balance sheet, no matter how utterly ignorant these "financial editors" may be of the actual costs, say, of the production of the commodities, the actual costs of administration of the corporation and the actual market values of the commodities made and sold by it.

Let any man soberly think over the matter and he will at once perceive that a person would have to be vastly more than a walking encyclopedia of technical, scientific and financial knowledge of the most abstruse kind to understand the simple principles of the arts upon which the majority of these large enterprises are based. Combined with this vast fund of information (already too staggering for one human intellect to acquire or carry) he would have to have that keen insight into general business principles possessed by but very few persons connected with such enterprises and a knowledge of the vastly different forms of administration of the business affairs of corporations carrying on industries of such great variety and differing from each other in every particular.

Moreover, he would have to be a skilled accountant to understand the meaning of the complex terms and figures used in such reports, terms not always used in the same sense even in different enterprises and figures which have no real signification whatever of actual values, without a most intimate knowledge of the business to which they relate.

The possession of such knowledge and faculties by one person is manifestly beyond the possibility of human powers, and the assumption of the possession of them by any person may at once be accepted as a certain indication of insanity of a most virulent kind.

But such is the faith of some people in the gullibility of mankind that certain newspaper writers appear to be always ready to write upon any subject with perfect confidence notwithstanding the fact that they may not have the least knowledge of the subject.

We are pleased to say that the financial editor of the *Commercial Advertiser* is one of the few of his class who *try* to do their duty by the public. He does not knowingly print falsehoods, and is proof against the influence of the press agent.

We take Mr. Dow's item as a text, therefore, merely to point a general moral.

If the financial editors of the city would pay more attention to the discussions in the leading trade papers, they would absorb a certain amount of knowledge in regard to large corporations which is lacking now.

What ground have these writers now got to stand on in claiming to be safe guides for the public to follow in matters of investment? What company's affairs have they handled in a way to warn the public of impending collapse? Of the disastrous failures of the past five years in Wall Street, what one has been pointed out in advance by a financial writer? Yet this is exactly what the public needs. Discussion of the affairs of the Whiskey, Cordage or G. E. trusts, after the public have been robbed of millions, does not come up to the standard of what the daily press should do.

ELECTRICITY'S prophecies are on record; the progress of events is also on record. We have made no mistake in regard to matters in our own trade. We do not go beyond our sphere. What we discuss is limited to matters upon which we have full knowledge.

When G. E. stock was selling at 118-19 we went on record with a prophecy that it would sell at less than 50 inside of two years. We showed why it must do so. We endeavored to prevent the insiders from unloading their stock upon the public at fictitious values. We worked, not for spite, but to save the trade we represent the disgrace of another swindle; for the G. E. fiasco was nothing less. We did not wholly prevent it, but we did prevent the issuing of the remaining $16,000,000 of treasury stock, which, without our exposure, would have been sold. ELECTRICITY was SIX MONTHS IN ADVANCE of any other journal in the world in pointing out the rottenness of this enterprise.

If what the daily papers said in 1892 had been fully believed, G. E. stock would have gone to 150 and $16,000,000 more stock would have been unloaded.

What good is accomplished by these daily paper financial writers we fail to see. They would need more ability than a bank president or than a Secretary of the United States Treasury to treat the affairs of all the different companies intelligently and originally. It seems to us that the best thing they can do is just what our friend of the *Advertiser* is doing of late—copy the comments of the trade papers, which are supposably written by men who understand all the intricacies of the trades they represent. Then the public can do a little independent thinking.

The strongest proof of the inability of these writers to be of any service to the public is found in their treatment of the G. E. report this year. Many of them, we know, wanted to handle it fairly and intelligently. Yet not one analysis of it appeared worthy of the name. Why? Simply because they do not understand any of the details of this business.

They saw a claim of $12,500,000 gross sales and $400,000 net profits. They did not endeavor to forecast what would be the result of another year. Information was within their reach showing that the product of this company is now being sold at an average of 25 per cent. less than it was during the period covered by the report, and that any hope for an improvement, or for the concern even holding its own, is unfounded.

Who among New York's financial editors is competent to dissect the list of assets in the last report? Let us look at one list only, that of stocks of manufacturing companies. To handle it properly, we submit, requires expert knowledge of the electrical situation. The list is as follows:

MANUFACTURING COMPANIES.

Brush Electric Co. (pref.), Cleveland, Ohio....	$122,800.00
Brush Electric Co., (com.), Cleveland, Ohio...	1,995,200.00
Canadian General Electric Co., Ltd., Toronto, Can..................	1,250,000.00
Excelsior Electric Co., New York City..........	387,000.00
Fort Wayne (Ind.) Electric Co................	2,000,450.00
Ft. Wayne Trust Securities (Series A), Boston, Mass..................	9,776.00
Otis Electric Co., Yonkers, N. Y..............	174,000.00
Schuyler Electric Co., Middletown, Ct.........	50,000.00
Schuyler Elec. Mfg. Co. (com.), Hartford, Ct..	84,000.00
Schuyler Elec. Mfg. Co. (pref.), Hartford, Ct..	307,930.00
Short Electric Railway Co., Cleveland, Ohio..	2,000,000 00
Spanish-American Light and Power Co., Jersey City, N. J..................	4,000.00
Swan Lamp Mfg. Co., Cleveland, Ohio..........	33,000 00
Union Elecktricitats Gesselschaft, Berlin, Germany..................	50,026.00
United Electric Securities Co. (com.), Boston, Mass..................	500,000.00
United Electric Securities Co. (pref.), Boston, Mass..................	23,100.00
Total..................	$8,991,282.00

What daily paper has published anything assisting the public to make a correct estimate of these items?

1. There is a $500,000 mortgage on the Brush Works, covering everything the company owns of any value.

2. Excelsior stock can be bought for 5 per cent. of par value in this city.

3. The Schuyler Electric factory has been closed and dismantled. It is worth about $60,000 as against $443,000 of securities.

4. The Short Electric Railway Company never owned anything, not even a factory. It has been out of business for two years and owes the Brush Company (G. E. sub-company) $440,000.

5. Stock of the Swan Lamp Company, Cleveland, could not be sold there or here for five cents on the dollar.

Now, to go back to the Ft. Wayne Company. What daily paper writer could fathom the mysteries?

Last year the stock owned was given at $1,921,850 and carried at $1. This year it is $78,600 more, and carried at we know not what. It should not appear at all.

In the early 80's the Ft. Wayne Jenney Electric Light Company was organized. In 1889 all the stock, $500,000, was sold to the T.-H. people in Boston. Then the Ft. Wayne Electric Company was organized and capitalized at $4,000,000, *leasing* the factory of the former company for fifteen years, but the former company paying all merchandise bills, labor, etc., and billing the product to the latter, of which the T.-H. people had control until last year. In 1894 a receiver was appointed for the Ft. Wayne Electric Company. For every dollar of the G. E. claim of $1,137,000 against the receiver, there is a counter-claim for $1.50 by the receiver against the G.E. Company for various and sundry collateral, taken for loans in the five years and sold below value, and for other things. In 1894 the Ft. Wayne Electric Corporation was organized. They needed a factory. They therefore bought the factory of the Ft. Wayne Jenney Company, giving notes secured by bonds as collaterals which latter ($350,000) appear also as assets in this year's report. If the stock on the notes of the Ft. Wayne Electric Company held by the G. E. Company have any value, we would like Mr. Dow to give us an estimate of it.

Whose opinion is best on this whole subject—ELECTRICITY'S, the daily paper financial editors, or those who are parties to the swindle?

Now as to the value of patents. ELECTRICITY was and is entirely correct—$8,000,000 should be charged off. The value is gone.

If patents are worth anything, it is because they produce or are expected to produce in future a revenue to the owner. The value is proportionate to the revenue. In most cases, in order to be of any value, they must control some business or some feature of that business.

The G. E. Company's patents produce no revenue. No other manufacturer pays them any royalty. No light or railway company would pay $1 for the exclusive right to use their system in any territory. They control nothing. Not one article of manufacture in the whole range of electrical supplies but is made and sold by a dozen other companies.

At one time Edison patent rights were salable. They are not now salable. Edison did original work and had something to sell.

The Thomson-Houston patent rights were never worth the paper on which they were written. The company never produced original work. Their patents always were valueless. They always copied the work of others. They originated no system, no feature of any system.

The value of the Edison patents has passed away forever.

Patents have at full limit seventeen years of life. From the time they begin to produce full revenue they decrease in value each year. In all conservative bookkeeping they are so charged off each year. This has not been the policy of the G. E. Company.

They have, with almost unbelievable impudence, from the first year of the organization, depended upon the mysteries of a patent account to hide a deficit which existed the first day of their life, and which has been continually growing up to the date of this issue.

When permission was asked to list G. E. stock at the Stock Exchange in 1892, reports were filed of the condition of the companies forming General Electric. In that report patent values were given as follows:

Thomson-Houston..................	$338,354.29
Edison..................	332,551.22
Capital stock Edison Light and Sprague Railway Companies, whose only assets were patents..................	4,506,099.25
T.-H. International..................	286,110.99
	$5,463,114.75

This was the only valuation of these patents heard of from June, 1892, until April, 1893. Meantime the stock was listed, insiders had sold large blocks to the ignorant public above par, and $10,000,000 of bonds had been floated.

When it came to making up the next annual report it was necessary, for purposes of stock speculation, to make a false showing. The patent item was the easiest one to manipulate, and it was marked up to $8,159,264,02, an increase of $2,696,149.27.

And it must be remembered that the first valuation in June, 1892, was outrageously inflated. The patents had been proved to be of slight value. The business could not be controlled by them and competition multiplied. The Edison licensee idea was worked out. It had been proved that local companies buying the rights of either company paid something for nothing.

No new patents of any consequence have been added to the list. The three patents which were relied on to control the art have been declared void by the courts or expired by limitation. There is not one patent left which would bring $5,000 at auction. There are 3,000 patents which would not bring $1 apiece.

Now, what was the object and nature of this vast increase in the patent account in the first eight months of the break, and how much of the stock represented by this vast sum reached the pockets of the directors and other insiders engaged in the operation of bringing these three companies together? How much of the stock issued for this vast sum has been disposed of and used to line the pockets and swell the bank accounts of these persons?

Our point from the very first discovery of this transaction has been, and still is, that there never has been any reason for the transaction and valuation except *fraud*, and that the sum of $8,000,000 carried as an asset is not represented by anything upon which one-sixteenth part of that sum could be realized under the most favorable circumstances. Further, the patents controlled by the company have always been, and still are, a source of actual weakness and constant loss to the corporation by reason of the too reckless mismanagement of its patent matters, of which we shall in the near future have much to say.

Stated briefly, our position on this asset of patents is:

1st. There never was any just reason for placing the patents as an asset on the books on any other base than that given in the report to the Board of Managers of the New York Stock Exchange and embodied in the prospectus issued to the public upon which the insiders sold stock and $10,000,000 of bonds were floated.

2d. Any such increase in this patent account as that shown in the first annual report was legally and morally a fraud.

3d. Even the amount named as the value of the patents in the report to the Stock Exchange should have been reduced year by year rather than increased, unless indeed other and more controlling patents than those expired or declared invalid had been since acquired. This we know has not been the case.

Why have not our esteemed contemporaries of the daily press handled this subject correctly? Because they are ignorant of the special conditions of the electrical trade.

Of what value to the public, therefore, are their comments?

We trust we have made ourselves clear.

We cannot speak for other trade papers. As far as ELECTRICITY goes, however, we can assure our constituents and our contemporaries that they can learn through our columns the exact condition of the G. E. Company and of any other electrical company which tries to float securities upon the public market.

We are ready to answer in the courts for any thing printed here, and to prove the correctness of our views, however radical. We never speak without knowledge.

The curse and the disgrace of the entire business have been the misleading of the public, the robbery of innocent investors. From $500,000,000 to $600,000,000 of manufactured product has been sold at good prices. Less than $10,000,000 has been returned as dividends to stockholders.

Does the outside world wonder that the honest element in the trade, for which ELECTRICITY is the spokesman, smarts under the continued conditions of dishonor and disgrace which the trade is forced to endure, forced upon it by coteries of speculators whose only aim is individual gain by any methods, honest or dishonest?

* * *

Where Does the Waste of Coal Occur? We have probably published more matter in relation to central station economy than all of our electrical contemporaries combined. Some of this has been original, a good deal of it has been from papers read before the various engineering societies, and still more probably has been culled from the columns of the engineering press and properly credited. We believe that the question of central station economy is the most important one now confronting the electrical industry, and take pleasure in reprinting this week a long editorial on this subject from the *Engineering Record*, which, coming from one of the most authoritative journals on steam as well as other branches of engineering, is entitled to more than usual attention.

In order that we may supply our own deficiencies, it is necessary, first, that we know that they exist in the plant as a whole—this is now pretty well understood among central station men; and, second, that we should know in what *parts* of the plant they exist, and to what extent they are remediable. This is not so well known among central station men, and the editorial in question is peculiarly valuable for the reason that it emphasizes some sources of loss in central station practice to which adequate attention has not heretofore been called.

There has been some discussion as to just where the maximum losses usually occur, some arguing that that place is in the boiler house, while others maintain that the engine and steam connections must bear the brunt of it; and it is doubtless true that each is right when the question is viewed from his own standpoint and each wrong when it is viewed from the standpoint of his opponent.

The editorial of our contemporary is a continuation of a discussion that it has been called into by a paper read by Mr. Perry at the Cleveland Convention, in which the author claimed that the storage of energy was essential to central station economy and Mr. Perry's figures, whether correct or incorrect, did show that material economies could be effected by the employment of thermal storage, whereby the boilers could be maintained in continuous operation throughout the variable load at their most economical rate. Our contemporary maintained that the thermal storage could only produce a saving in the boilers, whereas those losses were in fact far less than those "due to the variable load on the engine and dynamo, and the various wastes of steam which accompany these conditions of operating a power plant."

Now it seems to us that whether the effect of variable load is greatest on the boilers or on the rest of the plant will depend very much, if not entirely, upon how that plant is operated. Our contemporary says that "Every electric light or power station is provided with a steam plant which contains a number of engines and a number of boilers. To make the plant flexible and adapt it to the variable load a multiplicity of units seem a necessity." Now if each of these units were subject to the effects of variable load throughout the period of work—ten hours or twenty-four hours, as would be the case in most industrial establishments where separate departments were operated by separate units—there would seem to be no question that the aggregate losses of all the engines and dynamos due to this variable load would exceed the aggregate losses in the boiler plant due to the same cause. But in central station practice this is never the case. The boilers alone maintain a continuous loss due to variable load, and even when banked or shut down continue those same losses. The engines and dynamos, however, are all but one of them working at very nearly their best rate—the load on them is *not* variable except in the case referred to and in that case the unit is purposely made small. The loss in this small unit may be large in proportion to its rated capacity, but it will still be very small in proportion to the total output of the station.

To take a concrete example: we may have in a certain station four units of 500, 200, 200 and 100 H.P. each. We will say that the load line is such that after awhile the load rises too high for the 500 H. P. unit to take care of it—the 100 H. P. unit is thrown in. The first unit is now and henceforth working at its best rate. The variable load of the station no longer affects it. Supposing for two hours the 100 H. P. unit averaged such a poor load that its efficiency was but 50 per cent—the loss would be 50 per cent. of 100 H. P., and not 50 per cent. of 500 + 100 H. P.; it would be but about 8 per cent. of the total output. For a while the 100 H. P. unit will work at its maximum rate and then as the load rises and it becomes necessary to have more power a 200 unit is substituted for the 100. This new unit will never work at less than 60 per cent. of its rated best load, and will gradually rise from an efficiency of say 75 per cent to 85 per cent., averaging perhaps 80 per cent. The 20 per cent. loss is not 20 per cent. of 500 + 200, but simply of the last unit thrown in. Of the total it amounts to less than 3 per cent. Then the 100 H.P. unit is thrown in again with whatever losses involved in the variable load, but the 500 and 200 units are now working at their best load, and so the load line is met as it rises and falls by the throwing in and out of the necessary units. The losses are not therefore cumulative as with the boiler plant and as they would be with an ordinary industrial plant such as that supposed.

Our contemporary well states that in an electrical plant "there are boilers enough under fire and steam to supply the plant when called upon for its maximum output." When the 500 unit is thrown in there are 1,000 H. P. of boilers under fire and throughout the twenty-four hours continue those wastes in firing to which it calls attention. Even when a boiler is banked it is found to consume as high as 20 per cent. or more of the fuel required to keep it in full steam. Balancing this against the losses in an engine or dynamo, when it is not in use, which are practically *nil* from a fuel standpoint, we feel unconvinced that the losses at the boilers *in a lighting station* are not the greatest of those incurred. But we are obliged to the *Engineering Record* for pointing out so clearly how the losses do occur and how many of them can be lessened, and commend the article most fully to the perusal of our subscribers.

* * *

"Electricity" Heads the Procession. It is the function of a trade journal not only to present all the news of its trade up to the hour of going to press, but to so treat the news editorially as to make sure of the proper understanding of that news by every reader of intelligence.

ELECTRICITY has led the race in *presenting* the news so often and in such conspicuous instances that it is hardly necessary to again draw attention to this feature of the paper. We have never been caught a week behind with the announcement of any important matter, and have almost invariably been from one to four weeks ahead of all contemporaries.

What we now wish to impress upon the trade is that in the second feature of a great journal ELECTRICITY leads the procession just as surely. We interpret the news correctly, and we never copy fake news from the daily press except as fake news and with proper comment.

Recent instances are many. ELECTRICITY was the *only* electrical journal to publish the G. E. annual report in full. It was the only one to present such analysis of it as to render it intelligible to the layman. Previously, and a full week ahead of all competitors save one, we gave an abstract showing the vital points. As an interpreter the *Electrical World* has the most grievous sin to answer for in its editorial comment upon this report, giving currency to the falsehood that 3¾ per cent. was earned on the capital stock. The others followed closely upon the *World's* heels in assisting the G. E. wreckers to prolong their war of extermination by the dissemination of flat untruths.

Two weeks ago a fishy story came from Cleveland and Buffalo that G. E. officials were looking in those cities for new factory sites. Our contemporaries made no effort to find out whether this news had any basis for truth or not. They copied it and helped to deceive their readers. It was untrue. ELECTRICITY explained the matter fully.

The same week the Buffalo *Express* printed from their special New York correspondent a cock-and-bull story about Tesla's discovery of a method of transmission which was to be adopted at Niagara. The high-class technical talent on the editorial staffs of the *Electrical Engineer* and *Electrical World* took this seriously, copied it without comment, and again helped to deceive their readers. This was little less than a crime. Popular ignorance is dense enough now without being fostered by the so-called leaders in the weekly literature of the art.

ELECTRICITY, although neither the oldest nor the most supremely and dryly mathematical paper in the field, is old enough to know what's what, and never has been compromised in this way. When that Tesla-salt-solution-in-a-tube story came out in the *Express* we wrote to that paper as follows:

[COPY.]

Editor the Buffalo Express, Buffalo, N. Y.:

DEAR SIR: The *Express* has treated the Niagara matter in the main so intelligently that we are somewhat surprised at the stuff you have published in your issue of the 21st in regard to transmission of electricity in a salt solution in an insulated tube. The matter seems to have been furnished to you by your special New York man, and if you will kindly recommend him to call on some technical man, he might save you future humiliation. The suggestion is simply idiotic, and we are more than surprised to find it in the Buffalo *Express*. Yours very truly,

ELECTRICITY.

We never gave the subject any space in our columns.

Last week the most important matter on either side of the water was the reading of the paper by Mr. Ewing, F. R. S., on a new magnetic tester for hysteresis—published in full with illustrations in ELECTRICITY, and not mentioned by any of our contemporaries.

Clearly, in the points which make success and command it, ELECTRICITY heads the procession.

Under the Searchlight.

Views and Opinions on Timely Topics.

WHO WILL EXPLAIN?

(From the Evening Advertiser.)

"ELECTRICITY" AND GENERAL ELECTRIC.

We must confess to a sneaking fondness for Mr. B. E. Greene, the able editor of ELECTRICITY. We think he is a crank in some respects, but he has a way of stating his opinions with an engaging frankness and clearness that leave but little to be desired. In the issue of ELECTRICITY published this week no less than five large pages are devoted to a consideration of the General Electric report, in addition to a number of amusing and pointed paragraphs in the editorial department. The whole thing is quite worth reading, for two or three reasons.

Mr. Greene, as readers of the journal are probably aware, is not a believer in either the General Electric Company or the General Electric management. In fact, this is putting it very mildly. Still, after allowing for all prejudices and eccentricities, there are certain things in Mr. Greene's article on the General Electric report that seem to call for answer of some kind from the General Electric people. As long as Mr. Greene confines himself and his experts to an analysis of General Electric's figures, as published in the official report, the General Electric management can say with propriety that they do not feel called upon to interfere in any way or to take official cognizance of Mr. Greene's wanderings among the figures. Every man is entitled to his opinion, but when Mr. Greene says that "in this report an attempt is made to mislead with such outrageous impudence that it is at least worthy of special mention," and then proceeds to charge the management with having marked up a number of stock and bond holdings, which were carried at a nominal valuation a year ago, we respectfully submit that it is quite time for somebody on the General Electric side to say something.

It is nonsense for the management of a company like the General Electric to affect to be above criticism from any responsible person. It is utter nonsense to say that ELECTRICITY is not a responsible paper, for it is quite as responsible as many other trade papers. A specific charge s made by ELECTRICITY and an answer to this charge would seem to be in order.

Another serious accusation is made against the General Electric management, which is as follows: "We charge that this account (income) has been intentionally manipulated. The actual facts are that the total (sales) are a trifle over $9,000,000 for the year. The bookkeepers have done the rest." Inasmuch as more stress has always been laid upon the company's earning power when the matter was referred to in this column than upon any other portion of the company's accounts, we feel a little interest in the answer of General Electric directors to this statement. It is plain enough, and amounts to an accusation that the company has "cooked" its returns of gross sales. We ought to mention, while on this subject, that there is a libel action pending against Mr. Greene, and that the present would be a good time for bringing the suit to trial, in view of these remarkable statements.

It is unnecessary to detail the result of the analysis of the General Electric report in the columns of ELECTRICITY. As already said, every man is entitled to his opinion. In order, however, to impress upon the management of General Electric the necessity for taking some notice of the things that are being said, we make one further quotation from Mr. Greene's article which is particularly commended to the immediate attention of directors:

"It is, therefore, not hard to forecast the ultimate end of this swindling enterprise. The insiders will continue to manipulate the Wall Street annex to the business. They will make millions upon millions already made. Every available asset will be sold to pay currant expenses. Then the credit of the company will be forced to the full limit."

We must not be understood to associate ourselves with Mr. Greene's opinions quoted above. But we should like to know particularly whether or not the company's income account has been grossly overstated, as has been charged. That is of more vital importance than anything else at the moment, because, as we said some time ago, the value of General Electric stock consists solely in the earning capacity of the company. Mr. Greene's charge deserves an answer from somebody.

It is understood that Mr. H. McKay Twombly and Mr. D. O. Mills will resign from the General Electric board next week or in the near future. We don't see that their doing so makes any difference in the management. Everybody knows they have not had very much to do with it. What about those directors who have been chiefly responsible for the actual management of the company? Are any of them going to resign? Or explain? Or do anything?

The present would be an excellent time for the trial of a libel suit from our standpoint. But how about the G. E. Company?

Their career has been one of fraud and swindling from the beginning. Their charter itself was procured by bribery. ELECTRICITY is ready to name the amount of money paid for this charter, the men who paid it, the date on which the money was paid, the men who received it, and the place where it was paid.

If there is anything we specially desire it is the trial of a libel suit brought by the G. E. Company. But history shows that few of us get just what we want.

* * *

OUR CHARGES VERIFIED.

"Electricity's" Advance News Is Always Correct.

(From ELECTRICITY, Jan. 2, 1895.)

Whatever may be said to the contrary, ELECTRICITY speaks with full information in asserting that the entanglements of the concern with such subsidiary companies as the bankrupt Northwest General Electric can never be unravelled except by the courts; that a thorough investigation will show that *contingent liabilities* of over $2,000,000 have never been referred to in the official reports, and that *some of them will become pressing liabilities* before April 10 next.

(From the G. E. Annual Report, May 2, 1895.)

THERE EXIST ALSO SEVERAL UNSETTLED CONTRACTS ANTEDATING THE FORMATION OF YOUR COMPANY, BUT WHICH YOUR COMPANY HAS TO RECOGNIZE, AND WHICH WILL COST, PERHAPS, $500,000 TO SETTLE.

This half-million acknowledged is only the beginning. Next year it may be nearer correct.

* * *

IN the G. E. report mention is made by Mr. Ord of the accounts of 466 debtors, $2,291,844.48 now carried at $466. It is the evident intention to have the stockholders believe that this result was due to the ordinary misfortunes of business. This is not true. A large part of this amount is owned by bankrupt central station properties, which were either created or taken over by Mr. Coffin, in line with his general financiering scheme. They were bonded to their inevitable ruin, the bonds sold, and the public mulcted. They had to have a line of credit with the parent company while they were being "financed." They were as worthless then as now. Any stockholder can verify this charge. There are, moreover, several stations which are still obtaining undeserved credits for the same reasons. They are practically owned by the G. E. Company or the financiering companies, and must be carried.

* * *

One of the Gems.

The Fort Clark (Ill.) Electric Road has been sold by the master in chancery for $275,000, the purchasers being the bondholders, Charles E. Cotting, Edwin Packard, Charles S. Tuckerman, Samuel Spencer and Frank G. Webster, of New York. The road never paid any interest on its bonds. It was capitalized for $250,000 bonds and $250,000 stock, the G. E. Company holding $177,750 of the latter. The Street Railway and Illuminating Properties also had $50,000 stock.

* * *

IF robbers break into the sick room of an invalid, the first duty of the man's friends is not to give him medicine, but to drive off the robbers, killing them if need be. This is exactly what ELECTRICITY held to be its duty in regard to the G. E. robbers who tried to appropriate everything belonging to an established industry. When we have driven off the robbers we will prescribe for the trade, which is certainly in need of medicine. We would be glad to hear from any of our critics who hold that our attack has been too violent just what methods would have been more effective than those we adopted. Our columns are open for any opinion on this subject.

* * *

THE Harrison lamp works last year sold about 7,000,000 lamps. The average price was 15 cents above those now ruling. The total loss of net revenue in this branch of the G. E. Company's business will therefore be for the current year at least $1,000,000. Stockholders who wish to forecast the condition of the property next year will bear this in mind.

* * *

WHATEVER else may be said of Senator Quay, it is certain that he plays a strong game at politics. His chief desire just now is to have more of the Philadelphia corporations investigated, and the committee has been appointed at Harrisburg. Mr. Quay's object is said to be the punishment of some of his political enemies. Whatever the object, the result will be beneficial and wholesome, and the man from Beaver may be relied on to see that the job is thoroughly done. The local lighting trust is to be the first combination looked into. We trust Brother DeCamp is not afraid.

* * *

IF the Legislature of this State does its duty, it will pass the bill which Mayor Schieren has asked for, giving an appropriation of $30,000 for an investigation of various franchise matters in the city of Brooklyn. ELECTRICITY can furnish such a committee with valuable information, and we should do it without any regard whatever for those who might be exposed as bribers and parties to bribery. It is time that the special agent and his line of operations were removed from this trade. The G. E. Company, in procuring its charter, showed its appreciation of the value of money spent at Albany in influencing legislation, but we doubt if it would have the hardihood now to use any money to prevent the appointment of the Brooklyn investigating committee. If it makes the attempt, so much the worse for it. ELECTRICITY is not asleep.

THE UTILIZATION OF ELECTRICAL ENERGY FOR COOKING AND HEATING PURPOSES.*

BY R. E. B. CROMPTON,
President of the Institution of Electrical Engineers.

Up to the present time the utilization of electrical energy laid on now so universally in our houses for lighting purposes, for the further purposes of heating and cooking, has been regarded by the public, and even by many who have technical knowledge, as impracticable and certainly as too costly to be seriously adopted.

It will be my object this evening to show you that far from this being the case heating and cooking by electricity have now advanced to a highly practical and useful stage.

No doubt these erroneous impressions have arisen chiefly from the fact that the advocates of electric lighting have from the first dinned into the ears of the public that one of the chief advantages of electric lighting is that bright light is furnished without heat; even those who put it more precisely showed that a 10 C. P. gas jet heated the air of a living room thirteen times more than a 10 C. P. electric glow lamp, and it was the knowledge of these facts that prevented electrical engineers from carefully examining the problems connected with electric heating.

However, at very early periods Siemens showed that where intense heat is required to be concentrated in a small space the electric arc forms a very convenient furnace and in many cases actually possesses economical advantages. His principle was practically adopted by Cowles for his earlier furnaces for reducing aluminum, and has been also used for electrical welding by the Benardos process.

But for the production of the heat we require for warming rooms or for cooking food, little or nothing was done until about four years ago, for although Lane Fox was the first to point out in his 1878 patent that electrical heating could be satisfactorily carried out by placing the food or other materials to be heated in a vessel surrounded by a coil of insulated wire, through which a current should be passed, nothing appears to have been attempted until about four years ago. Carpenter in America so far developed Lane Fox's idea as to take out a patent for manufacturing electrical heating apparatus by attaching these resistance wires to the surfaces of cast iron plates by an enameling process, and a considerable amount of apparatus was manufactured by him in America on this principle. Some of this was forwarded to England and was shown at work by Messrs. Crompton & Co. at the Crystal Palace Exhibition in 1891.

In practice it was then found that although Carpenter had done sufficient to show that electric heating could be usefully employed, yet that the apparatus at that time was not sufficiently durable to be of practical value.

A number of serious defects made themselves evident, principally connected with the enameling process; the enamel was found to crack and the surface of the wire used was thus exposed to the oxidizing action of the air. This action rapidly destroyed the wire and thus broke the circuit.

It occurred to us that this difficulty might be surmounted if sufficient time were spent on a research into the nature of the metals best suited to stand the frequent heatings and coolings to which the apparatus is subject, and which at the same time would have a coefficient of linear expansion so nearly the same as that of the enamels used, and of the plates to which the wire is attached by these enamels.

After a long course of experiments we found that several of the nickel-steel alloys, varying in composition from nearly pure nickel to others containing quite a large proportion of steel, were well suited for the purpose, and in all respects were far superior to the german silver alloys which had been used in America. We also found that if we substituted for the homogeneous enamel used by Carpenter a composite enamel consisting of two or more layers, the lower one being of the hardest and most refractory character, we were able to obtain very satisfactory results. We have been able to use an enamel consisting almost entirely of silica for the groundwork; this fuses only at an exceedingly high temperature almost approaching the welding point of wrought iron. We devised special machinery to artificially roughen the surface of the plates to which this first coat of enamel is to be applied, and we thus insure that the layer of enamel between the wire and the plate to which it is attached is never even softened at the temperature reached by our apparatus in ordinary working.

We apply our nickel-steel wire in the form of a waved or crimped ribbon; this crimping is carried out by a special machine devised for the purpose.

This crimped ribbon is mounted on the surface of a "transfer plate," afterwards to be described, and it is from it transferred to the surface of the first coat of enamel which has been already raised to a temperature sufficient to soften it but not to melt it. We then cover the first enamel and the wire with powdered enamel of a more easily fusible nature, and we then raise the temperature of the whole to a sufficient degree to enable the second enamel to melt down and incorporate itself with the upper surface of the first coat of enamel, at the same time completely covering and insulating our wires.

This process is one which has required much study and considerable manual dexterity on the part of the workmen, but once it was perfected it gave excellent results; it allows the wire to be heated to any degree desirable for ordinary heating or cooking operations, without any fear of the enamel cracking so as to allow of access of air to the wire.

Not the least part of our difficulties was the preparation of the crimped wire and the designing of the transfer plates above referred to. We found that if we attempted to crimp the wire or arrange it in wavy patterns by hand, the wire was always liable to become thinner at each of the bends, and consequently the electrical resistance at these points was higher and the heat developed greater than that of the points intermediate between the bends. To avoid this we had to devise a crimping machine which crimped or corrugated the wire in such a manner as to avoid altering its cross sections; this machine takes the wire from a reel, crimps it and delivers it in any desired pattern on to the surface of the transfer plates.

The transfer plates consist of a metal plate to the back of which are attached a number of electro-magnets in such a manner that when the crimped steel wire has been laid on its plate in any desired pattern or form, by exciting the electro-magnets they hold the wire and retain it firmly in position on the surface of the plate until it is desired to transfer it to the heated surface of the enamel; this can be done instantaneously by breaking the exciting circuit so that the wire no longer adheres to the transfer plate.

We have other methods of rapid transfer but it is unnecessary to take up your time by describing them here, as the above method is fairly representative of the others.

By the above described methods we are able to apply the wire in somewhat complicated patterns to the surface of any metal plate and to insulate it therefrom in a very thorough and permanent manner by our compound enamel.

The only other difficulties which have arisen in connection with the enamel have been those due to unequal expansion and contraction of the terminals at the ends of the wire. At first we had some difficulty in arranging these so that the enamel did not crack and allow the terminals to be burnt or oxidized at the point at which the wire leaves the enamel.

The simplest form of apparatus, in which we heat a plate by a current passing through a wire enameled to its surface, is that which we call a heater; it is a cylindrical plate mounted on short legs, to the underside of which wire is applied and fixed by the enamel, the upper side being ground flat and polished. Such a heater can be put to many useful purposes; it can be used as a radiator of heat or as a means of heating dishes on the breakfast table or for the purpose of drying linen or for warming or drying any article which it is inconvenient or dangerous to place near the fire. It can also be used for cooking purposes if the food is placed on flat dishes or pans, care being taken that the lower surface of the pan comes into close contact with the upper surface of the heater; but although cooking *can* be carried out in this manner, we do not recomend the use of separate heaters as there is always a loss from the lower surfaces of the pans not making sufficiently good contact with the upper surface of the heater, and we therefore prefer to insure this contact by making the heating plate form part of the kettle, saucepan, frying-pan or other similar culinary utensil.

In the course of our experiments to determine the best and most efficient arrangements of our apparatus we met with great difficulties in what would appear a comparatively simple matter—the measuring of the temperatures we obtained. We found that the ordinary mercurial thermometer however carefully it may be made is not suitable for accurately indicating the temperature of the heated surfaces as it really indicates the temperature of a stratum of air near to the heated surface instead of that of the surface itself. After trying Callender's improved form of the Siemens electric pyrometer, we eventually adopted for our measurements of temperature my own form of platinum thermometer, a description of which may interest you at this stage. This platinum thermometer, which measures temperature by showing the increase in resistance due to the rise in temperature of a delicate coil or platinum spiral placed in close contact with the heated surface, is made and used as follows:

The spiral consists of a thin strip of platinum only two-thousandths of an inch thick by one twenty-fifth of an inch wide. A sufficient length of this strip to have about five ohms resistance at the temperature 0° C. is wound in a form of double spiral on to a strip of mica sheet about half an inch wide by four inches long; this is enclosed and held between two similar sheets of mica fastened together at their edges by a sewing of very fine platinum wire. The total thickness of the spiral and its covering is not greatly in excess of that of a sheet of paper, so that the whole of the spiral can be brought within a distance of one-hundreth of an inch from the surface to be measured.

It is arranged on an electrical circuit in series with a standard resistance made of manganin. The standard made of this alloy has practically no change in resistance due to change of temperature, i. e., within the limits of air temperature change of an ordinary room or laboratory. Both platinum spiral and the standard manganin resistance are provided with couplings or terminal screws, by which any desired number of platinum spirals may be coupled in series with the manganin standard. A very small constant current from an accumulator cell is passed through the whole of them. Each of the platinum spirals as well as the manganin standard is provided with a pair of potential terminals, and at the time of first calibration they are carefully adjusted so that the P. D. measured on a potentiometer is exactly equal when the platinum spirals are plunged in melting ice and the manganine resistance is at the ordinary laboratory temperature. It is convenient to balance them at this point at 1,000 on the potentiometer scale; the platinum spirals are then exposed to the temperature of boiling water in a hypsometer and if the platinum employed be pure the P. D. of the platinum spirals when now compared with that of the standard will be as 1362 : 1000. If this portion of the potentiometer scale between 1000 and 1362 be divided into 100 parts each of these will be equal to 1° C. It is evident that any desired number of temperature readings may be taken by employing a corresponding number of platinum spirals and comparing them in turn with a standard.

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*Lecture delivered before the Society of Arts, London, Eng., on Wednesday evening, April 24th, 1895.

It is obvious that this method of taking temperatures presents many advantages over the employment of ordinary thermometers, as when these have to be used for taking temperatures of ovens, or of the interior parts of meat, or of other food, the act of removing the thermometers to take the reading introduces errors of considerable magnitude, whereas with the arrangement I have just described it is possible to take accurate readings, practically simultaneously, of the temperature in various parts of the oven or other apparatus and of various parts of a joint of meat, and in this way a great many interesting facts respecting cookery have come to light.

(*To be continued.*)

WASTE OF COAL.*

In a recent issue, when commenting on Mr. Nelson W. Perry's paper read at the Cleveland meeting of the National Electric Light Association, we advanced the opinion that the thermal storage system of boiler plants is not likely to secure the economy which its advocates expect, or to materially reduce the cost for fuel below what can be realized by careful work on the lines of existing practice. The reports of the performance of ordinary electric light and power steam plants reveal an absence of fuel economy which is remarkable when compared with the records obtained from steam plants connected with most other industries. Electrical engineers attribute this state of things quite properly to the variable character of the load. Some seem to think that thermal storage which tends to overcome the variable nature of the work in respect to the boilers has a good chance of securing needed benefits. In this they are partly in the right, but largely in the wrong. We believe that much of the waste of coal attributed to variable loads is only an incidental accompaniment of these conditions, and not by any means a necessary consequence. It requires little insight into the practical handling of boilers and engines in electric central stations to understand the real causes which make the coal records so unfavorable. As a supplement to the editorial referred to, this matter ought to be taken up, and the real status of the subject explained, a thing which we now propose to do.

Every electric light or power station, whether large or small, is provided with a steam plant which contains a number of engines and a number of boilers. To make the plant flexible and adapt it to the variable load a multiplicity of units seem a necessity. The steam plant, or a portion of it, is in operation as a rule night and day during the whole twenty-four hours, and two or more gangs of attendants are employed to care for it. There are boilers enough under fire and steam to supply the plant when called upon for its maximum output, and a sufficient number of engines are kept warmed and ready for duty to meet the ordinary requirements of the service and any unforeseen emergency caused by change of weather or extra demand. One of the rules of electric light operation is that the power must be "on tap," as it were, whenever it may be called for, and every attendant is imbued with the importance of this idea. Under these circumstances how does the man who shovels the coal and handles the dampers of the boilers, or the man who starts and stops the engines and controls the valves of the station, perform his duties? If these men follow the natural bent of workmen in their positions, the result will be this: A greater number of boilers are maintained with live fires than are needed for the moment, and those not required for immediate use are thrown out of active service by opening the firedoors and closing the ashpit doors, leaving dampers open, and coal on the grates in the active condition of burning. Dependence is here placed on the cooling produced by the inrush of cold air to the furnaces and deadening of the effect of the fires, to prevent too great generation of steam. This practice certainly checks the generation of steam, but it does not stop the consumption of coal. That goes on, though at a reduced rate, the resulting heat being carried off with the air to the chimney. In the same line, the boilers which have banked fires are left with draft on and doors wide open, thereby causing a more rapid combustion of the bed of coal in the bank than would otherwise occur, and, what is worse, cooling down the boiler and its contents through the introduction of the cold air. The loss of heat thus caused must be made good by burning new coal when the boiler is again set to work. There is no need of thermal storage tanks to prevent the waste caused by these practices. Proper oversight of the firemen and the right sort of instruction on these points is sufficient.

The engineman has a different class of duties. His great object is to have the engines ready in time and keep them in reliable operation. One important foe he has to fight is water in the steam. He must keep the pipes well drained, run the engine long enough when first starting without load to insure free pipes and free cylinder; and there is no guide save judgment to show him when this condition is realized. The result is that engines are run a longer time underloaded than the legitimate light load of the station represents, and generally longer than needed for the purpose in view. During the preliminary running drips of steam pipes and cylinders are, as a further precaution, kept wide open, which adds much to the wastefulness of the practice. Furthermore, when the engine is out of use the drips are left open to a greater or less extent so as to keep the pipes drained, and too often the drains of the engine pipes, and of the main system of piping of the boilers as well, are without adequate trap protection. The matter of how the drips are handled is one which is often lost sight of in many kinds of steam plants beside the electric, but it is important everywhere and it provides an avenue of waste which is frequently serious. In the electric plant it is peculiarly liable to be important, owing to the exigencies of the service. The loss from careless handling of drips bears a much larger proportion to the legitimate output when the load is small, as much of the time occurs in electric work, and for this reason waste in electric plants is liable to be extravagant where the matter is neglected. It should not be understood from these statements that the thorough drainage of water from the pipes and cylinders is uncalled for. It is in reality one of the most important matters in the care of engines. With the unthinking engineman, however, it may be abused, and it is the abuse of the practice which is the cause of much of the waste in electric stations.

Still another reason exists for the wastefulness of steam plants in electric work. The demands of the service sometimes require a multiplicity of engines. When this is the case the engineers in charge of such plants should keep close watch to prevent the waste of steam through leakage of valves and pistons of the engines, and through disordered stop valves and drip valves in the piping.

With these facts in mind it is far from remarkable that the consumption of coal reported by electric plants appears so excessive. If the steam plant in an electric station, or for that matter in any class of industry, is wasteful, let the work of the individuals who handle the shovel, the assistants in the engine-room, and of the mechanic who makes repairs be critically scrutinized, and the cause of large coal bills will not long remain unknown.

UNDERWRITERS' RULES.*

BY WILLIAM A. ANTHONY.

DISCUSSION—(*Concluded.*)

Mr. James I. Ayer—It is very gratifying to me, having worked with the Electric Light Association in relation to these rules for some years, to see the interest taken by the Institute in this matter. I think that if any additional arguments were needed I can cite a case which perhaps touches the engineer a little more directly and forcibly than some of the points made to-night; that is, the tendency of the inspection department of the Board of Fire Underwriters to usurp the prerogatives of the electrical engineer, in other words, to issue certificates to contractors which pass as current coin as evidence that they have got what they paid for—a first-class electrical installation. There is not an engineer here engaged in practical work who has not run against it, who has not seen passed what should not have been passed, and the investors, the men who are paying for the installations, would have been very glad to pay the engineer's fees if they did not feel they were getting something for nothing from the Board of Underwriters. A case of that kind came up only a few months ago where a very large installation was being made. The specifications were made partly by the manufacturing company and by the architect who had a little assistance in getting them out. But after the contract was awarded, while there were unusual electrical problems involved in the construction work, the parties paying for the installation declined the services of an engineer because they thought they did not need one. They had a competent contractor and realized that it was all right. Later on, when the installation was about to be completed, some comments were made by engineers who observed the work and said it was bad and all that. The question was raised in the Board of Directors—it was a very large corporation—as to whether it was right or not. Some thought it was; they advocated the acceptance of the contract as tendered by the contractor, but the point was raised that there was a lack of thorough workmanship. Immediately the contractor brought in the argument that the insurance certificate that he possessed was an evidence of what they had got; that they had everything that they could demand or desire under the contract. The work was accepted. A month later they paid a considerable fee to an engineer to tell them what the matter was—why they could not successfully operate the plant. It took about $20,000 to correct the evil, and they paid an engineer to tell them how little value an insurance inspector's certificate is. It is not often they come out that way—that the engineer profits in the end by it. But it is a fact that the Fire Underwriters are stepping into the shoes of the electrical engineer; they are interfering with his profession, his business, and I know, as Mr. Hammer has well said here, some of the members are anxious to have papers read here that "get within five miles of the earth occasionally." We all know that this question of insurance rules was regarded by many as something beneath the dignity of the Institute. It has been so expressed; it has been so treated. But I think that as the thing has taken shape it is clear to all the members that it is essential that this Institute take some definite action.

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* From "The Engineering Record."

* A paper presented at the 96th Meeting of the American Institute of Electrical Engineers, New York and Chicago, April 17, 1895.

Mr. C. J. H. Woodbury—I came here this evening as a guest and to listen, not expecting to take any part in debate. My former position for a number of years was in technical relation to underwriters of manufacturing property, and I had occasion to have an intimate knowledge of the policy of the insurance companies in regard to electric light and power installation, and as that is now with me something of the past, I can perhaps look at the subject from a disinterested standpoint. There were a great many electric lighting rules, so called, made by local bodies of underwriters, at times conflicting bodies. In 1893, shortly after the last issuance of the rules of the National Electric Light Association, there was formed in Chicago what was known as the Underwriters' International Electric Association, the name of which has since been modified by the change of International to National. Suffice it to say that they adopted a set of rules which were in most respects along the lines of those of the National Electric Light Association. There were, however, some points of difference, and these rules have had several amendments which have been prepared and promulgated from time to time. Two months ago I had occasion to make definite inquiries throughout this country in regard to these electric lighting rules. I found that whereas the rules of the Underwriters' National Electric Association are at the present time very generally adopted, yet there is a great difference in their promulgation and enforcement, and that is a difficulty which seemed to be an inevitable one in the early stages of the work, but will grow less and less pronounced as time goes on, because the insurance companies will have a better trained set of men. At the meeting of the National Electric Light Association I had some unofficial assurances which I was able to present to the committee, and they made a report which has been received with a great deal of favor in insurance corporations. At the present time the affairs of the National Electric Underwriters' Association on the subject of these rules are in exceedingly good and competent hands. The chairman of the Electrical Committee is a member of this Institute, an electrician of accomplishments and standing, and one who in addition to his technical education has had a very extended practical experience in electric lighting and in telephony and telegraphy. All of these parties perceived the necessity of certain amendments and also the necessity of a unification of the whole set of rules, because this question of the function of these rules is not one which can be sub divided and separated one part from another by any line of demarcation. It begins with the design and extends to the construction, the installation and the maintenance of all electrical apparatus of whatsoever kind or nature, whether it uses all these quantities of energy which can be converted into heat sufficient to cause a fire, or whether it pertains to the inherently harmless instruments from battery circuits but which may be and are in certain conditions a possible source of danger by reason of their exposure to the heavier currents used in lighting and in power. These questions are fully recognized and can be treated in only one way, and that is by a conference representing all of the various tributary interests. I am sure that the Underwriters are alive to it and that they aim toward that end, because I judge from their representations to me to the extent to which I represent one of these interests of electricity in this matter. I am looking forward to a conference which will occur in the immediate future representing—I do not care under what head—all of these various electrical interests and which will result in the unification of the electric lighting rules, and it is through that means and through that means alone that such a result can be obtained. It should be conceded that it will take time for the training and development and selection of persons competent to enforce these rules adequately and justly.

The Chairman—The importance of this subject seems to demand that it be referred to a committee. We have a letter here received from one of our members who is ill. The secretary will please read it.

The Secretary—This letter is from Mr. Fremont Wilson, a gentleman who I think has been referred to this evening. I will read an extract referring to the subject:

"If Prof. Anthony's paper is discussed, I hope it will be deemed of enough importance to have a committee of five appointed and a resolution passed, and a letter sent to the New York Board of Fire Underwriters requesting that the privilege of an audience be given our committee by the New York Board in relation to the non-observance of standard rules, etc., and to prove to the representatives of the New York Board the injury they are doing to the electric light and power interests throughout the country by the peculiar methods that have been in vogue for the last two or three years."

Mr. Hammer—I would like to suggest, as has been stated here to-night, that the matter is already in the hands of the National Electric Light Association and that their committee will extend an invitation to the Institute of Electrical Engineers as well as representatives of the other interests, and that the matter will then be taken up, not dealing with specific cases, but with the whole thing in a broad gauge way. While we may move a little bit more slowly in that way, I think perhaps by joint action, going about it thoroughly, we will accomplish more than by having the Institute refer the matter to a committee in the way proposed.

Mr. Mailloux—I agree with Mr. Hammer that the matter ought to receive more deliberation before we act. At the same time I feel that there ought to be a committee representing the American Institute of Electrical Engineers on the subject. I also feel that further discussion ought to be had on the subject. I think that there are others, who would be present at another meeting perhaps, who would be able to contribute to the discussion. This subject is too important and it is of too much interest not only for the welfare of the society but for the individual welfare of its members to be passed over lightly. So far as the appointment of a committee is concerned, I would be willing to leave that to the Council. I think the Council is competent to appoint such a committee and to give it proper constitution, but I think the whole matter might be well laid over to the next meeting. I would make a motion to that effect. (Seconded.)

An Electric Weed Killer.

An electric weed killer for destroying the weeds and other vegetation along a railroad track—which are a source of considerable expense to railroad companies—has recently been invented, and is described as consisting of an alternating generator mounted on a car and producing electricity at 2,000 volts pressure and stepped up to from 6,000 to 24,000 volts, depending on the kind and quality of the vegetation which it is wished to destroy.

The conductivity of vegetable bodies varies as the moisture within them varies; the greater the moisture the less resistance they offer to the current. The current, after being stepped up to the voltage noted, is conducted through a series of fine wires or brush to the top of the weeds or grass; the other side of the circuit is made through the wheels of the car, as a matter of course, to the ground; the current, therefore, will leap from the brush suspended over the weeds through the weeds to the ground, and thus complete the circuit; but in doing so the current traverses the entire length of the plant, including the roots, and ruptures the cellular tissues, thereby totally destroying it. This destruction seems to be equally distributed throughout the entire system, the root suffering perhaps more than the body of it from the fact that the roots generally contain more moisture. It is said that in many cases the current in passing through the plant heats it to such an extent that it cannot be held in the hand without discomfort.

A New Battery of Extraordinary Strength.

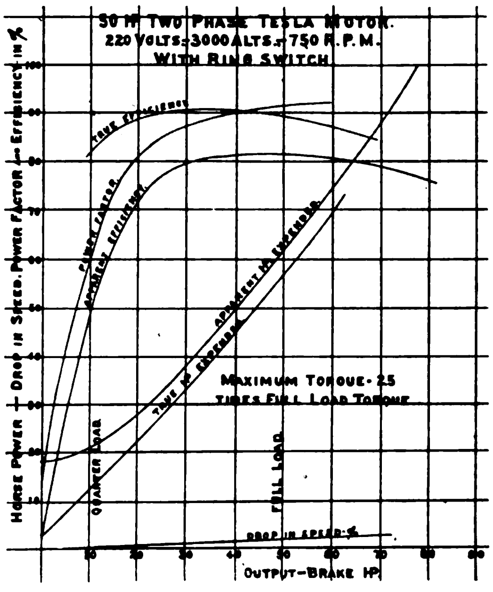
A new primary cell has recently been described, which consists of a plate of metallic magnesium in a solution of ammonium chloride, and a plate of copper in a solution of cupric chloride and hydrochloric acid. The electromotive force of this cell is given as three volts and its internal resistance is quite low. The current is said to be constant for long periods. If these reports be true, this is certainly the most powerful cell known.

THE PERFORMANCE OF THE TESLA MOTOR.

Supplementary to Mr. Perry's article on the new Westinghouse Electrical Works at East Pittsburg, which appeared in our issues for April 10th and 17th, we give the following curves of performance made especially for this purpose but completed too late for insertion with the rest of the matter. The motor under test was one of those referred to in the article rated at 50 H. P. It is running on the regular shop two-phase currents, 220 volts—3,000 alternations, 750 revolutions per minute. The switch for throwing in and out the starting resistances was of the ring or most recent type, and was illustrated in Fig. 4 on page 176.

The curves will sufficiently explain themselves, but it seems worth while to draw particular attention to several points in the performance of the motor.

The maximum starting torque of which the motor is capable is a little over 2½ times the full load running torque, but as in ordinary practice such a starting torque is not required, the starting resistance in the secondary of the motor is given such value that the torque at starting is about 1½ times the full load running torque. This is done to avoid the excessive current which is necessarily required by any motor, whether for direct or alternating currents, for the development of an abnormal torque. With such a resistance the current taken by the motor at the instant of starting is about 50 per cent. in excess of that taken at full load. When the motor has nearly attained full speed the starting resistance is short-circuited.



The motor when running unloaded takes only 18 apparent H. P., or 36 per cent. of the full load output.

The falling off of speed from no load to full load is less than 2 per cent.

The apparent and true efficiencies rise very rapidly as the load increases. At one quarter load the apparent efficiency is 57 per cent. and true efficiency 84 per cent. At full load the apparent efficiency is 81.5 per cent. and the true 89.5 per cent. The full load efficiency is better than is ordinarily attained by direct current machines of the same output, and the light load efficiencies are much better. Such a motor as this will have, therefore, a much higher all-day efficiency than a direct current motor of the same output in places where the power required is variable. It is claimed for this type of motor that, in addition to its electrical superiority, the simplicity and durability of construction and the consequent freedom from breakdowns, its ability to carry severe overloads without any harm resulting, and the ease with which it can be controlled both as to speed and as to direction of rotation, make such a machine as this much superior to any direct current motor for all ordinary purposes for which an electric motor can be used.

Annual Meeting of G. E. Stockholders.

IMPORTANT CHANGE IN THE DIRECTORY!

Two of the Leading Directors Resign Without Giving Reasons.

D. O. Mills and H. McK. Twombly Leave the Sinking Ship.

(Special Dispatch to ELECTRICITY.)

SCHENECTADY, N. Y., May 14—3:30 P. M.—The stockholders of the General Electric Company held their annual meeting here to-day.

The number of shares voting was 10,000 more than last year, when 210,436 shares were represented.

Directors D. O. Mills and H. McK. Twombly resigned from the Board. George F. Gardner and Thomas Cummins, both of Boston, were elected to fill the vacancies. Mr. Cummins serves temporarily only, as the resignations came so suddenly that none of those present were fully prepared for the situation either as aspirants or voters.

Mr. Cummins, who represents the Edison Company, will, it is understood, be succeeded by another representative of that interest.

Messrs. Mills and Twombly's resignations were tendered arbitrarily, no reason being given, but the supposition is that they were dissatisfied with the management of the company's affairs, or took a gloomy view of the future of the concern.

Five stockholders only were present.

The new Board of Directors is as follows :

Gordon Abbott.
Oliver Ames, 2d.
C. A. Coffin.
T. Jefferson Coolidge, Jr.
C. H. Coster.
Thomas A. Edison.
Eugene Griffin.
F. S. Hastings.
Henry L. Higginson.
J. Pierpont Morgan.
Robert Treat Paine, 2d.
George F. Gardner.
Thomas J. Cummins.

The old officers hold over temporarily.

Closing of the Brush Works.

(From the Western Electrician.)

> We are pleased to learn from no less authority than S. M. Hamill that there is little prospect of the Brush Works shutting down. In response to an inquiry, the following dispatch was received from Mr. Hamill :
>
> > Answering your telegram, these rumors have been circulated against us for the last three or four years. If the Brush Works are going to shut down, I have not heard of it.

Rubbish. A little over a year ago an order was issued by authority of the G. E. Board, directing the closing of the Brush Works and the transfer of the business to Schenectady. This order was countermanded by telegraph, because of pressure exerted by Messrs. Coffin and Lawrence and some Cleveland banks where the G. E. Company had call loans.

We do not wonder that Mr. Hamill dislikes to accept our news as correct, because ——. But *it is correct.*

ANOTHER shortage in accounts is said to have been discovered in the Chicago office of the G. E. Company recently. We wonder when Mr. Sunny will wear out the patience of Mr. J. Pauline Ord?

To Enlarge Its Business.

The Standard Electric Company, Chicago, has increased its capital stock from $1,000,000 to $1,500,000 in order to provide increased facilities. It also elected A. G. Spalding president, relieving S. P. Parmly, who will remain in the directory. E. E. Crepin will continue treasurer and D. P. Perry general manager. The remaining members of the directory are Gilbert B. Shaw, J. P. Whitney, of Philadelphia, and G. A. Rollins, of Boston.

The stockholders are well pleased with the results of the past two years, notwithstanding adverse general conditions.

Are They Cramped For Room?

(From the Schenectady Union.)

> Bids are being received by the General Electric Company for the early erection of a new machine shop for use at the plant in this city. The new building will be of the same form as the one erected last summer by the managers of the Schenectady Locomotive Works. It will be of brick, two stories high, absolutely fire proof, of the dimensions of 360 x 80 feet. The estimated cost is $175,000.

Personal.

The engagement is announced of Dr. Frederick Bedell, of the physical department of Cornell University, to Miss Mary L. Crehore, of Cleveland.

Mr. George M. Russell, of the firm of Russell & Officer, Denver, has been in New York for several days.

Mr. James I. Ayer has lately returned from a brief visit to his home in St. Louis.

The Future of Coal Gas.

A recent editorial in the *Progressive Age* (the Welsbach journal) and our reply to the same in a recent issue render the following from the London *Electrical Review* pertinent at this time :

> We are greatly concerned about the future of coal gas, and with our well-known large-heartedness have been constrained to indicate certain directions in which the monopolists may exercise commercial activity when that time shall arrive, which they are aware is not far distant, when they will be re-echoing Othello's mournful plaint up and down the land. If they are wise the gas companies will then become what mankind have been defined to be, namely, "cooking animals"; and thankful should they be that total effacement should not be apportioned to them. Some time ago, when the danger of obliteration first began to threaten them, Dr. Siemens, we believe, was kind enough to suggest that they should make two grades of gas, one for lighting, the other for heating purposes. He proved a very Job's comforter, for these companies shrank from the expense of a second installation. So they, with fear and trembling, sat down and awaited events. Their patience is rewarded; their savior has arrived. Mr. Lewis T. Wright has recently claimed that as the lighting power of coal gas is increased its carbon density and hydrogen density are also increased, and, per cubic foot with that increase, a corresponding increment of heating power is obtained. In other words, make the gas give more light and it will give more heat, and there will be no necessity for having two separate installations. Don't they wish they could do it and still pay the big dividends! All the world knows, especially the miserable consumer, that in spite of every effort the light from coal gas does not always attain the low standard laid down by law.

To Cut Hair by Electricity.

To have your hair singed off by electricity is the latest development of the tonsorial art. The apparatus to perform this operation consists simply of a platinum wire stretched over a comb. By pressing a button in the handle of the comb current is applied to the wire, and it is heated to a white heat. The comb is passed through the hair, and as the wire comes in contact with the hair it is burned off, the end of each hair being cauterized as cut, which process prevents the loss of the oily substance with which the hair is filled. The apparatus is connected by flexible cord and attachment plug to a lamp socket, and can be used by any barber of ordinary skill.

The Bell Electric Company, 26 Church street, are manufacturers of the device.

General News.

What Is Going on in the Electrical World.

Mauch Chunk, Pa.—East Mauch Chunk is talking of putting in an electric-light plant.

Mechanicsburg, Pa.—Bids for electric street lighting in Mechanicsburg will be opened May 23.

Elmwood, O.—A bill providing for an electric light plant for this place is now before the council.

Albany, N. Y.—The Governor has signed the bill authorizing Green Island to establish an electric lighting system.

Portland, Ind.—The city has purchased of F. Bimel the waterworks and electric light plants, the price being $65,000.

Towanda, Pa.—The borough council has granted a franchise for an electric road to the Towanda Traction Company.

Darlington, Wis.—Dexter, McDonald & Co. have been granted a franchise to put in an electric lighting plant in this city.

Quincy, Mich.—A waterworks system has recently been put in here, and the people are now hankering after electric lights.

Bardstown, Ky.—This town has voted to purchase an electric light plant by an overwhelming majority—237 for, 9 against.

Athens, Mich.—The subject of placing electric lights in Athens is being discussed quite strongly by some of our enterprising citizens.

Frederick, Md.—The board of aldermen has voted to adopt an electric fire alarm system, probably that of the Gamewell Company of New York.

Westminster, Md.—At the recent municipal election the ticket favoring lighting the streets by electric arc lights was elected by a large majority.

Belleville, N. J.—The people here by vote have decided to abandon kerosene lamps for street lighting and put in an incandescent electric light system.

Nebraska City, Neb.—Mayor Bartling says he will substitute electricity for mule power on his street railway as soon as the new opera house is completed.

Boone, Iowa.—The people of the new part of this town are making a move to have the motive power of the present street car line changed from horses to electricity.

Thayer, Ark.—The Thayer *Tribune* and Mammoth Spring *Monitor* have succeeded in waking up the councilmen of this city to the necessity of electric lights.

Warren, O.—An electric railway from Warren to Jefferson is again being talked of. The route suggested is through Cortland, Mecca, Greene, Colebrook and New Lyme.

Milwaukee, Wis.—It is announced that the work of changing the motive power of the Milwaukee and Wauwatoso Motor Company to electricity will be begun at once.

Holland, Mich.—This city now owns an electric light plant, having purchased all the Wolverine Company's outfit except the boiler and engine. The price paid was $6,000.

Halifax, N. S.—It is understood that all the capital necessary to build and equip the Halifax electric street railway has been secured. The company will shortly be organized.

Natick, Mass.—The Natick Electric, Natick Gas and Eliot Falls Electric companies have been consolidated. The Eliot Falls Company will furnish motive power as well as electric lighting.

Boston, Mass.—The trolley mail service is now in full operation in this city and giving entire satisfaction. Postmaster Coveney is delighted with the workings of the new system.

Gretna, La.—Capt. Thomas Pickles, owner of the Algiers and Gretna Street Railroad, has applied to council for permission to change the motive power of his road from animal to electricity.

Staten Island, N. Y.—The trustees have granted a franchise to the Staten Island Electric Railway Company to construct and operate an electric road on several of the streets of the village of Edgewater.

Bucyrus, O.—The latest project in electric railroads here is a line from New Washington to Galion via Leesville and Knisely Springs. It is claimed that a stone company at Leesville is behind the deal.

Fort Wayne, Ind.—A company is being organized here, with Perry A. Randall at the head, for the purpose of building an electric railway from this city to Blue Lake, near Churubusco, a distance of 15½ miles.

St. Petersburg, Fla.—The Plant Investment Company has purchased the Pinellas Hotel property, about one and one-half miles out, and will build a fine hotel there and also an electric railway connecting with this place.

Springfield, O.—John J. Webb and W. H. Hanford have secured the right of way for an electric railroad from Urbana to Springfield, and are hopeful of getting the right of way into and through this city.

Cornish, Me.—An electric railroad from here to the New Hampshire line through the towns of Baldwin, Parsonfield, Hiram and Porter is the latest proposal to the railroad commissioners. Sufficient capital has been pledged.

Bangor, Me.—Work has begun on the new line of electric railway connecting Bangor, Orono and Oldtown. The first shovelfull of dirt was tossed by Hon. I. C. Libby, of Waterville, one of the prominent members of the company.

Toronto, Can.—The trouble between the Canadian General Electric Company and their employees at Peterboro has been settled.—Among the latest Canadian incorporations is the Ingersoll Electric Power and Light Company, capital $45,000.

Hoboken, N. J.—The Bonta Manufacturing Company have secured a location in Fourteenth street in this city. The company will engage in the manufacture of an electric brake invented by Supt. Bonta of the North Hudson County Railway Company.

Rushville, Ill.—C. W. Wainman has under consideration the construction of a freight and passenger electric railway between Rushville and Mt. Sterling. It will require, according to estimates, $75,000 to build and put the road in running order.

Chicago.—In less than three months the horse car will have utterly departed from the streets of Chicago. By June 1 all the North Side horse cars will probably be operated by electricity, and by the end of August most of the West Side lines will have discarded horses.

Independence, Mo.—The franchise and properties belonging to the Citizens' Electric Light Company of this city have been purchased by the Western Electric Light Company, who will improve the plant by putting in new dynamos. The purchase price was $25,000.

Eau Claire, Wis.—Judge Jenkins has appointed George B. Wheeler, of this city, receiver of the Eau Claire Street Railway, Light and Power Company. The receivership is the result of foreclosure of its mortgage of $400,000 by the Atlantic Trust Company of New York.

Topeka, Kan.—Postmaster A. J. Arnold, T. M. James, L. Stair and F. C. Downey, of Topeka, have organized a company to build and equip an electric railroad from North Topeka to Silver Lake and Rossville this summer. The capital stock of the company is to be $1,000,000.

Vicksburg, Miss.—The Mayor has received letters lately from a number of cities in regard to municipal lighting, in reply to a circular sent by him requesting information as to the cost and operation of plants installed. The sentiment here is in favor of the city having a plant of its own.

Knoxville, Tenn.—Bids will be received at the office of the Board of Public Works in this city until May 23 for lighting the streets of the city with 200 or more electric lights of 2,000 C. P. each for the term of one or five years. A bond of $10,000 will be required for faithful compliance with the contract.

Watkins, N. Y.—The Watkins and Havana Electric Railway Company have sent their incorporation papers to Albany to be filed. The company is composed of Watkins, Montour Falls and Elmira men, and the capital stock is $50,000. The road will extend from the Northern Central station in Watkins to Havana Glen.

St. Louis, Mo.—The St. Louis and Jefferson Barracks Railroad Company has filed its acceptance of the franchise granted by the county court some time ago to construct an electric railroad from the southern terminus of the Southern Railroad, in Carondelet, to Jefferson Barracks, and deposited $1,000 as a guarantee of good faith.

Richmond, Va.—The sub-committee on streets of the city council are still wrestling with the question of introducing electricity as the motive power for a railway in Broad street, this city. Several propositions have been submitted to them for overhead and underground systems, and it will probably take them a few weeks to decide the matter.

Troy, N. Y.—It is thought probable that the proposed railroad from Troy to Averill Park will be built. The road will be constructed so that either steam or electricity or both may be used as a motive power.—The State railroad commissioners have granted the application of the Troy City Railroad Company to change their motive power from horses to electricity.

Montpelier, Vt.—J. S. Viles has bought land along what is known as the Middlesex Narrows, and will dam the stream and build a plant to furnish electricity for lighting and power. He is confident that the fall is strong enough to furnish electricity for the lighting of Middlesex, Waterbury, Moretown, Waitsfield and Stowe if the towns care to try the new light.

Phelps, N. Y.—At a citizens' meeting held recently to consider the advisability of bonding the corporation for $35,000 to put in a water and electric light plant, the Board of Trustees, together with E. D. Mead, W. C. Edmonston and W. H. Edson, were appointed a committee to investigate the matter and report at a meeting to be called by the president of the board in the near future.—The trustees have issued a call for bids for a five years' contract for lighting the village by electric light.

Seneca Falls, N. Y.—The *Reveille* says: "The Geneva, Waterloo, Seneca Falls and Cayuga Lake Traction Company has issued a mortgage in the sum of $500,000 to the West End Trust and Safe Deposit Company, which has been filed in the county clerk's office at Ovid. The former company expect to issue stock of the road to the amount of $450,000 and to bond it for $500,000, making a grand total of $950,000. This does not include the park nor the electric plant at Geneva, which are to be stocked and bonded separately."

Reading, Pa.—The Citizens' Electric Light, Heat and Power Company has been organized in Reading and has applied for a charter of incorporation. The directors are: John R. Bechtel, Charles N. Frame, Milton H. Schnader, L. V. Halberstadt and Henry C. England. Mr. Bechtel is president, Mr. Frame secretary and Mr. England treasurer. The capital stock is $100,000. The objects of the new company are to manufacture, distribute and supply light, heat and power by means of electricity to the public in the city of Reading and suburbs.

Annapolis Md.—The route of the Baltimore, Severn Park and Annapolis Railroad has been located. The line begins at Brooklyn, Anne Arundel county, and will extend to Annapolis, its entire length being about twenty-three miles. At Brooklyn, the northern terminus of the line, connection will be made with the Baltimore Traction Company. The officers of the new company, which obtained its charter rights a year ago, are: President, G. Howard White; secretary, R. J. Dungan; treasurer, D. F. Simons; chief engineer, Lee Martin; attorney Arthur M. Easter; general manager, Robert B. Johnstone

Greensburg, Pa.—The *Press* states that "the Pittsburg, Greensburg and Latrobe Electric Railway Company will become a reality in a short time as a result of the Monongahela Traction Company being granted a charter at Harrisburg with a capitalization of $5,000. The charter members are Alan D. Woods, John F. Davitt, L. G. Woods, Richard Fickling and J. Harper Adams. The purpose of the company is to secure rights to govern the White Electric Traction Company, now operating two miles of track from McKeesport to Duquesne; the Homestead and Highland railway to the proposed bridge at Walnut street, McKeesport; and the McKeesport, Wilmerding and Duquesne line, operating between twelve and fifteen miles of road through McKeesport.

Pottsville, Pa.—The new power house of the Schuylkill Electric Railway Company at Palo Alto, Pa., will be 515 feet long, 85 feet wide and two stories high. It will be composed of iron and brick, the whole to be covered by a metallic tile roof, highly ornamented and surmounted by several towers. The structural iron will weigh over 7,000 tons, and a massive carriage is employed in hoisting the heavy girders, stringers and pillars into position. The building will be so arranged that its roof will cover everything necessary in the operation of a large trolley line. Engines, generators, boilers, machine shops, car house, paint shop, elevators and offices, all will be under the same roof and part of the mammoth structure.

Baltimore, Md.—Among the rapid transit facilities engaging the attention of some of our most enterprising citizens, the Boynton electric railroad system is attaining some prominence and a line on the bicycle plan is to be built at Windsor Hills, a suburban locality. The company which proposes to build the road was incorporated on the 1st inst. The name of the incorporation is the Gwynn's Falls Railway Company. The capital stock is $30,000, divided into 600 shares of $50 each. The total mileage of the company is not to exceed twelve miles.—The Maryland Electric Company will shortly erect a new electric light and power plant on West Pratt street in this city.—It is stated that the two 90-ton electric motors to be used by the Baltimore and Ohio Railroad Company on the Belt Line, will be here and ready for use before June 10. The motors are being built at the Schenectady Locomotive Works, Schenectady, N. Y.

Telephone and Telegraph.

The Cape May, N. J., city council has passed an ordinance granting the right to the South Jersey Telephone Company to establish a local telephone, and passed to third reading the ordinances giving franchises to the Cape May City Electric Light and Power Company and to the Postal Telegraph-Cable Company to operate in the city.

At a meeting of the stockholders of the Harrison International Telephone Company at Chicago on the 6th inst., the following directors were re-elected: Stephen B. Elkins, R. C. Kerens, George R. Peck; William Warner, C. M. Ferree, Dr. E. M. Harrison, H. M. Holden, Kansas City; H. J. Hanford and Patrick Egan, New York. Gen. Robert R. Porter, of New York, was succeeded in the directory by H. S. Smith, consulting engineer of the Illinois Steel Company. J. T. Blake, a capitalist of Kansas City, was added to the list. According to a statement of one of the stockholders, the company is now actively engaged in putting in plants in 81 cities.

The Central New York Telephone and Telegraph Company has made arrangements for improving its service between Utica and Syracuse by putting in a new copper metallic circuit. The company expects to extend its copper metallic circuit northward from Lowville to Watertown.

Among the ordinances introduced at a recent meeting of the city council at St. Louis was one granting for a period of fifty years to J. A. Schultz, Thomas J. Ward, August A. Busch, Charles F. Joy, M. Greenwood, Jr., E. W. Stamm, Joseph M. O'Shea, Andrew Haley and T. J. Hennessey the right to erect, maintain and operate an electric system in St. Louis, and to supply electricity for transmitting and carrying on the business of sounds or messages by telephone or other electrical or mechanical devices, by renting space from any underground companies where it can be had, and by poles and wires where it cannot. It is provided that the prices shall not exceed $60 per year for business houses and $48 for residences.

Representatives of the Harrison International Telephone Company have been visiting Hot Springs, Ark., with a view to the organization of a local exchange in that city.

A State Association of home telephone companies is in process of organization at Columbus, Ohio. The object of the association is to provide for the construction of toll lines from county seats to their county lines in order to connect the various cities of the State. One of the objective points is to reach Columbus. Under the new system it has been found impossible to make connections with the Bell telephone exchanges, and the plan is to have a system of their own. The plan discussed is to allow the city originating the business 85 per cent. of the tolls, and the city receiving the same 15 per cent. It is claimed that by this system the tolls would be made uniform.

The temporary telephone line established by the Mutual Automatic Telephone Co. at Chicago as a test proved highly successful, and everybody who used it pronounced the system superior to the Bell. Steps are being taken to capitalize a company to handle the system in Chicago. It will have a capital stock of $500,000.

The project of putting in a telephone exchange in Tomah, Wis., is being worked up by F. H. Johns, with pretty good prospects of success. In addition to a local service, it is the intention to secure connections with other towns by putting up a line to Sparta, through Tunnel City, and using the line already established to Warren and points beyond.

George Metheany is to be the manager of the new telephone company at Lima, Ohio. The new company is hustling in a manner which looks decidedly like business. They are planting poles all over town, and have undoubtedly come to stay.

A telephone exchange has been established at Verdi, Nev. There is talk also of lighting the streets with electricity.

The Louisiana Telephone Company of Louisiana, Mo., has been organized, with officers as follows: S. C. Hassler, president; Charles G. Ruffman, vice-president; Frank W. Buffum, secretary; F. M. Flegle, treasurer; M. J. Hassler, manager.

The Unity Telephone Company of Chicago, incorporated on the 1st inst., with a capital stock of $100,000, intend to introduce telephones into the small towns in the South and West. The incorporators are W. R. Crompton, John C. Adams and Thomas V. Strain, all having offices in the Unity Building, Chicago. The company controls the use of the Hunning transmitter.

The Northwestern Telephone Exchange Company has lately erected several new long-distance lines in Texas. They will shortly begin work on a line from Fargo, N. D., to Grand Forks, and other lines in North Dakota will be constructed during the summer.

Griffith Coit, secretary and general manager of the Central Standard Telephone Company, stated at St. Louis a few days ago that the work of organizing local companies throughout the territory covered by the parent concern will begin at once. The Central Standard is a branch of the original Standard Telephone Company of New York, and is capitalized for $5,000,000, covering the States of Missouri, Arkansas, Kansas and Nebraska.

At Harrisburg, Pa., on the 6th inst., three Pennsylvania telephone companies were chartered. They are the Anthracite Telephone and Supply Company, Shamokin, capital $10,000; the Mutual Benefit Telephone Company of Northeast, Erie County, capital, $1,000; the Columbia Telephone Company of Columbia, capital $5,000.

Dr. McWayne, of Poysippi, and John Boysen, of Tustin, Wis., have just put up a telephone line between Poysippi and Omro, and are contemplating the construction of a telephone line between Oshkosh and Tustin, via Butte des Morts, Winneconne and Bay Boom.

The Trades League of Philadelphia has addressed a letter to the Select and Common Councils, calling attention to the high rentals paid for telephones in the city departments, and suggesting that "the city advertise for bids for the furnishing of telephones by purchase for the city's use, that the contract be awarded to the lowest and best bidder, and that the city enter into no more contracts for the rental of telephones; also suggesting that in this connection there is nothing to hinder the city from manufacturing her own telephones."

Arrangements have been completed and contracts let by the Salina Telephone Company for putting up three telephone lines centering in Salina, Kan., and connecting with neighboring towns. One line will extend southeast and connect Salina with Kipp, Chico and Gypsum City. The second line will extend directly south through Mentor, Assaria and Bridgeport to Lindsborg, and the third will extend west to Bavaria and Brookville. It is the intention of the company to build a line to Topeka and Kansas City within the next year.

A proposition has been made to the city of Sedalia, Mo., by which it would become the northern terminus of a long-distance telephone line. J. H. Childers, of Hermitage, and A. S. Munsell, of Kansas City, Mo., propose to build a line from Springfield to Sedalia if the people of Sedalia will buy coupon tickets to the amount of $1,000.

At a meeting of stockholders at Kingston, N. Y., a few days ago, James W. Gardner was elected president of the West Shore Telephone Company vice Dr. Snow, and Dr. C. V. Sahles chosen as vice-president. A mortgage of the company's property will probably be made to raise funds to pay off its indebtedness and place it on a sound basis.

Muscatine, Iowa, has refused to grant a franchise to the Postal Telegraph Company to run its lines through the town. The reason given is that no monetary consideration was offered.

Efforts are being made at Girard, Kan., to establish a telephone exchange.

A local telephone company is being organized at Tecumseh, Neb.

F. E. Bell is trying to interest the citizens of Baraboo, Wis., in a telephone exchange, which he proposes to establish in that city through a stock company to be known as the Baraboo Telephone Exchange.

The Home Telephone Company has leased quarters for their telephone exchange in Chillicothe, O., and everything is now in shape for the construction company to put in the plant.

The Bell and Escott telephone systems at Big Rapids, Mich., have been consolidated.

J. W. Davis, W. A. Williams and others have secured a franchise for a new telephone exchange in Texarkana, Ark., after signatures for 75 'phones had been agreed upon by individuals and firms there. These parties are under obligation to stand to their agreement. The rates will be much lower than those of the old company.

W. G. Kendal and J. S. Bowman, of Weatherford, Tex., are in consultation with the business men of Mineral Wells in regard to putting in a telephone exchange.

George Burham, Jr., and others have presented a petition to the city council asking for the right to establish and maintain a system of telegraph or telephone in the city of Portland, Me.

It is said a deal has been consummated at Madison, Wis., by which a company in which the principals are Madison capitalists has secured exclusive control of the French Milne telephone patents in the United States. The system will be extended over the whole country as a competitor of the Bell.

The Electrical Construction and Supply Company of Wilmington, Del., was the lowest bidder for placing a telephone system in the Department of Justice in Washington.

The city council of Mitchell, S. D., has passed an ordinance granting a local telephone company an exclusive privilege to operate a telephone system in that city for five years.

A stock company has been formed at Neosho, Wis., to put in a telephone line from Neosho to Woodland and Iron Ridge.

The contract for building the exchange of the Northwestern Telephone Company at Oshkosh, Wis., has been awarded the Northwestern Telephone and Electric Company of Milwaukee.

Sycamore, Ill., has organized a local telephone company, and will rent telephones to private parties for $18 per year and to business men for $24.

A Grand Rapids, Mich., paper states that the Harrison Telephone Company has already secured over 1,200 subscribers at Grand Rapids, and efforts are being made to induce those who have already subscribed to lengthen their contract to three years. The local company expects to organize some time this month, when the location for an exchange will be selected.

J. W. Blakely, representing the Mississippi Valley Harrison Telephone Company, has asked the council of Pine Bluff, Ark., for a telephone franchise, with rates of $2.50 per month for business houses and $1.50 for residences. Subscribers are asked to sign a contract for five years providing the service rendered is satisfactory.

The People's Telephone Company at Knoxville, Tenn., has reduced its rentals for residence 'phones to $24 a year, and the company's new contract with subscribers binds it never to raise the present rate. In the meantime the East Tennessee Company is not charging anything for its services and cannot see the People's one better unless it begins to pay people to take the instruments.

The Mount Vernon Telephone and Messenger Company, recently incorporated, has elected the following directors: Horace Granfield, Franklin T. Davis, Charles H. Ostrander, S. H. Gray, John Dawson, John Berry and William Archer. The company has a capital of $40,000, and is allowed to operate anywhere in Westchester County, N. Y.; it has about 200 subscribers, and the work of constructing an exchange at Mt. Vernon and stringing wires will be commenced in a few days.

The American Telephone Construction Company has been granted a franchise to establish an exchange at Brookville, Ind. The company has completed an exchange at Newcastle.

The Unity Telephone Company of Chicago, has been incorporated by W. R. Crompton, John C. Adams and Thomas V. Strain. Capital stock, $100,000.

Carthage, Mo., is to be connected with Webb City and Joplin by a new telephone line. The plant will be put in by T. J. Clark and George Wheeler, of Carthage, and a war in rates is likely to result, as the Missouri and Kansas Telephone Company already has a line in operation there.

A franchise has been granted to Fred S. Haines and J. A. Melone for the construction of a telephone exchange in Rochester, Minn., the system to be inaugurated within six months. The company will place nearly 100 instruments. The exchange is to be operated by a patent device.

Frank H. Sweet and Waldo Sweet have applied to the council at Fond du Lac, Wis., for a franchise to establish in that city a new telephone exchange. They claim to have 200 subscribers among the present users of telephones and expect to get 300. Their rates are $2 a month for business houses and $1.25 for residences.

Articles of incorporation for the Fox River Valley Telephone Company have been drafted, and the capital stock placed at $10,000. Upon the granting of a franchise in Neenah, Wis., the articles will be filed with the Secretary of State. The incorporators are D. K. Gilles and O. L. Huie of Neenah, and Charles Churchill and J. W. Evans of Waupaca. It is the intention of the company to construct an exchange at Neenah and connect with the Badger Telephone Company's line which runs from Waupaca to Berlin.

COMMERCIAL PARAGRAPHS.

The Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, has secured the exclusive agency for the United States for the Ayer Self-Locking Windlass. This windlass has several important improvements over other makes now on the market and commends itself on first sight to all practical stationmen.

The Elbridge Electrical Manufacturing Company, Elbridge, N. Y., is about to move into quarters better suited to its increased business.

The Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, report a good demand for the Dayton Electric Ceiling Fan, for which they are the Chicago agents. They have already closed some nice orders this season.

Line Material at First Hands.

The Central Manufacturing Company of Chattanooga Tenn., one of the largest concerns manufacturing and dealing in lumber in the South, is turning out a line of cross arms, insulator pins and brackets suitable for line construction of all kinds.

The Eddy Electric and Manufacturing Company.

(From the New Britain Herald.)

The Eddy Electric Works at Windsor, Conn., is experiencing a brisk revival of business. Large orders from all over the country are coming in every day and the company find it necessary to work overtime.

Additions to the force are being made and wages have been increased 10 per cent.

Telephone Apparatus of Danbury Electrical Works.

Of the complete line of telephones manufactured by the Danbury Electrical Works, Danbury, Conn., two instruments are shown in the accompanying engravings. In Fig. 1 is shown a type of disk set combining both receiver and transmitter in one piece. This instrument possesses an advantage that will commend it to busy office men. The receiver and transmitter are so arranged that the operations of sending and receiving messages can be carried on without change in position of the operator's head, leaving him free use of his hands while engaged in a telephone conversation.

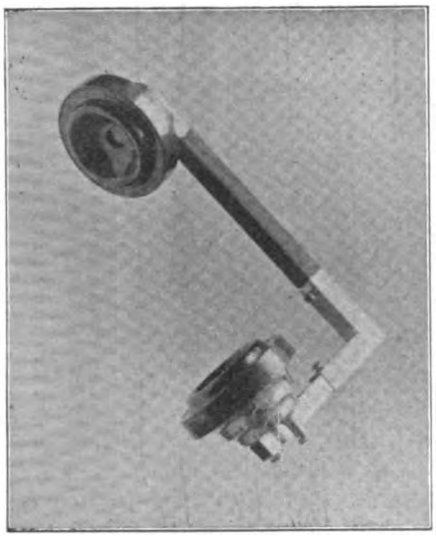


FIG. 1—DESK TELEPHONE.

In Fig. 2 is shown the "Russell, No. 40," or local and long-distance instrument. The granular carbon transmitter is of a special pattern embodying all those essential features and improvements requisite in a powerful transmitter adapted to long-distance work.

This company manufactures other types of instruments designed for local exchange, private line and interior service. All parts are well made and handsomely finished. The cabinet work is neatly designed and highly polished. In all types of telephones manufactured by this company silver diaphragms are used, insuring perfect contact. In addition to the above-described instruments, this company manufactures a very complete line of telephone parts and accessories.

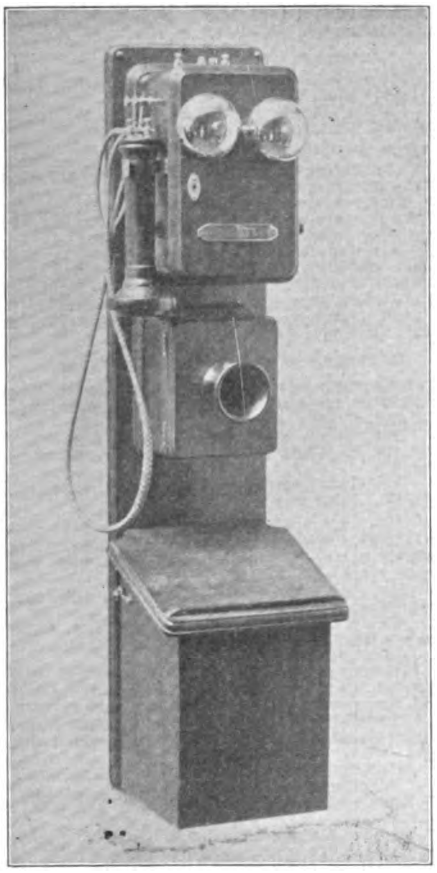
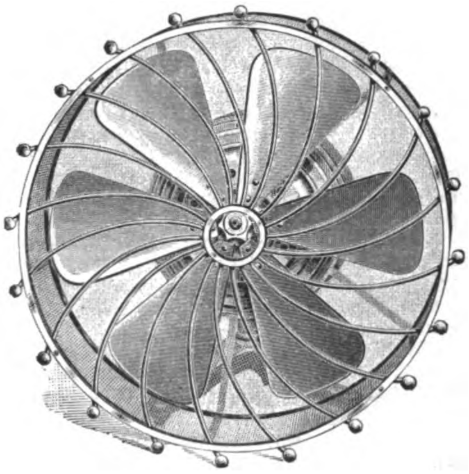


FIG. 2—LONG DISTANCE TELEPHONE.

The New York office of the company is at 143 Liberty street, Mr. E. E. Smith being in charge. A number of contracts have already been closed, and the prospects for a large and profitable trade are very flattering.

Wagner Fan Motors.

The Fan Motors manufactured by the Wagner Electric Manufacturing Company, St. Louis, embody all the improvements which five years of manufacture and service have suggested. These motors are wound for both direct and alternating currents. They are guaranteed perfect in workmanship and design, and to run, with proper care, for three months without repairs of any kind. Each motor has self-feeding carbon brushes which will run a season without renewing, and self oiling bearings which hold an ample supply of oil for several months' run.



FAN MOTOR WITH GUARD.

All motors are finished in black enamel with gilt trimmings and polished brass fan and end caps. These caps entirely enclose the ends of the motor, protecting armature, commutator and bearings from dust and dirt. The weight of the motor and spread of the legs make it very stable, rendering fastening unnecessary, while the rubber feet effectually prevent all noise and vibration. Speed regulators are attached to both alternating and direct-current motors.

The above cut shows a front view of fan and motor with close-meshed fan guard.

The Vance Electric Company.

The Vance Electric Company, with offices at 136 Liberty street, New York, has been incorporated, with A. S. Vance president and J. H. Cheever secretary and treasurer. Mr. Vance is also general manager of the company. His experience in electrical work extends over a period of eleven years. First, three years with Leonard & Izard Company of Chicago, then two years in central station work. In 1889 he became assistant general manager of the United Edison Manufacturing Company until it was merged in the Edison General Electric Company. He then became assistant general manager of the lighting and power department of that company, holding the position until September, 1891. From September, 1891, until September, 1894, he was general superintendent for H. Ward Leonard & Company, and had entire charge of all the construction departments of that company.

The new company will devote its attention to general electrical construction work in buildings and central station lighting, particularly to the lighting of private residences and the installation of decorative work. In this line some new features for interior decoration and appliances for lighting private grounds by means of automatic disappearing lamps will be brought out. The company will also give special attention to isolated and telephone plants for private buildings as well as central station work.

Some of the most recent work completed under Mr. Vance's supervision is the signal plant of the Metropolitan Traction Company on Columbus avenue, New York; complete plant for lighting the Canton Court House; H. L. Terril's house and grounds, Rumson Road, Red Bank, N. J.; J. L. McBirney's residence, No. 41 West 36th street, New York; six private residences on West 74th street, New York; Zabriskie Memorial Church, Newport, R. I.; residence of Lispenard Stewart, 6 Fifth avenue, New York, and residence of Mrs. Anson Phelps Stokes, Lenox, Mass.

The Western Telephone Construction Company.

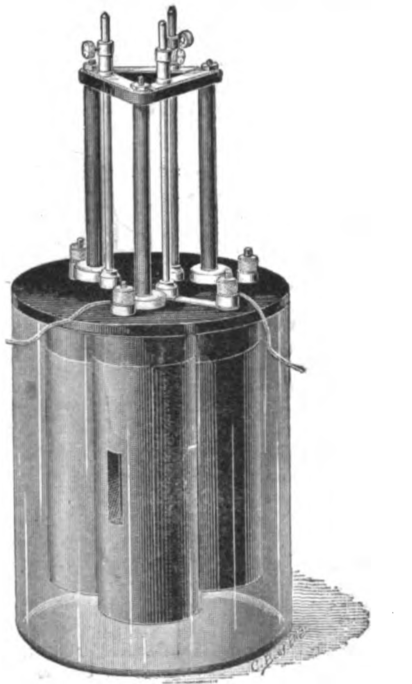
The Western Telephone Construction Company, Chicago, has moved into new manufacturing quarters having a productive capacity of ten times their old one. The company has been having more orders than it could fill, but with increased facilities will soon catch up on delayed shipments.

The company is now producing more telephones daily than the Bell Company ever produced in its best days. The new switchboard of this company is acknowledged to be the most perfect board yet manufactured, and is now being turned out in quantities sufficient to meet the large and increasing demand for exchange equipment.

The Boynton Multivolt Battery.

In the Boynton Multivolt Battery, E. S. Boynton, the inventor, believes he has achieved results heretofore unattainable in battery work. In a 6 x 8 jar with a singl solution and an ingenious arrangement of carbons, the whole of which is denominated a cell, he has produced a battery capable of supplying a current of five amperes at five volts. The carbons are of cylindrical form, carefully made from special mixture. They are arranged with their axes equidistant from each other. To attain the maximum output of the battery the cells are connected in series. As a consequence the resistance of the cell becomes higher than that of the circuit to which the battery is attached, and the voltage is increased in proportion t the number of the cells.

Perforations in the sides of the carbons permit a circulation of the battery solution, which, by contact with th surface of the jar, prevents the rise in temperature exceeding 3 or 4 degrees above that of the surrounding air.



BOYNTON MULTIVOLT BATTERY.

The Multivolt Battery of the Grenet type, the inventor claims, will deliver approximately 25 watts of energy for 13½ consecutive hours. The consumption of zinc is small, and to renew the battery any good commercial battery fluids and amalgamated zincs can be used at a cost not exceeding 16 cents.

The battery is made in plunge pattern and in any and all of the well known types. It is adapted to any purpose to which primary batteries can be applied. It is well made and handsomely mounted.

The battery is manufactured by the Boynton Multivolt Battery Company, 10, 12 and 14 Whipple street, Brooklyn, N. Y.

The Adams-Bagnall Electric Company.

Brief mention was made by us a few weeks ago of the resignation of five of the leading men in the Brush Electric Company. These gentlemen have now formed a new company at Cleveland and will soon be ready for actual business. A brief mention of the members of the firm shows that it starts off well equipped for a successful career.

Mr. Thomas E. Adams had been with the Brush Electric Company for a number of years, during which time he had made some important and valuable inventions in arc lamps, one of them, the Brush-Adams lamp, bearing his name, appears prominently in the new company's list

Mr. E. J. Bagnall was for eight years with the Brush Electric Company, but more recently has been in St. Louis, where he gained a reputation as a consulting engineer.

The business interests of the company will be looked after by its manager, Mr. L. H. Rogers, whose reputation was earned as assistant general manager of the Brush Electric Company and manager of the Sperry Electric Railway Company.

Mr. C. W. Phillips had been connected with the Brush Electric Company almost from its beginning, representing it in this country, Europe and Japan, where he spent several years.

Mr. S. E. Cox, formerly with the Swan Incandescent Lamp Company, will have charge of the incandescent department.

Mr. George Arnold had also been connected with the Brush Electric Company for many years and held various positions of responsibility. His last connection with said company was at the head of the drafting department, in which position he had shown a decided aptitude in the line of dynamic engineering.

Associated with the above-named men are some o

Cleveland's active business men, who will look after its financial affairs and see that it has ample capital to carry on its business so as to secure the best results.

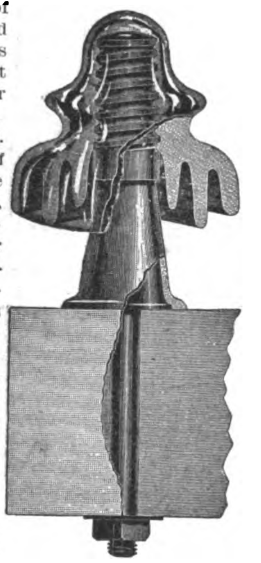
Regarding the output of the company nothing definite can be officially stated at this time, but it is known that they will make arc lamps, incandescent lamps, and possibly railway motors.

The officers of the company are as follows: Charles G. Hickox, president; George W. Howe, vice-president and treasurer; L. H. Rogers, manager; S. E. Cox, secretary; C. W. Phillips, superintendent. They have leased the factory at 47 East Prospect street. The company is organized under the laws of the State of Ohio with a capital stock of $150,000.

Mr. S. T. Dodd, formerly instructor at Princeton College, subsequently with the Brush Electric Company in the dynamic engineering department, and now of the New Jersey Traction Company, has been secured as consulting electrical engineer.

Indestructible Line Material.

The weak points in line construction have heretofore been in the insulator pins, break arms, etc. A wooden pin, however strong when new, soon becomes decayed and under the severe strain of a heavy or tautly stretched wire often breaks and throws the light or power station out of service until the ground or short circuit is repaired.



Fred M. Locke, of Victor, N. Y., is manufacturing a line of indestructible material, the use of which, it is asserted, renders line troubles impossible. His Steel Insulator Pin, illustrated in the accompanying cut, is easily attached and its use strengthens the cross-arm, avoiding as it does all tendency to split the arm. These pins are now used by railway, lighting, telephone and telegraph companies throughout the United States and have everywhere given the utmost satisfaction.

In addition to this specialty Mr. Locke manufactures insulator pins, break arms, side brackets, ridge irons, triple petticoat glass and porcelain insulators for high potential circuits, cross arms, braces and all kinds of line material, suitable for electric light, railway, power, telegraph or telephone purposes.

INCORPORATIONS.

The City Park Railway Company, Portland, Ore.—to build and operate electric railways, electric light plants, own property, etc., in Oregon, Washington, etc. Capital stock, $25,000. Promoters: S. Z. Mitchell, C. N. Huggins, J. A. Cranston, Portland, Ore.

The Cleveland and Painesville Railway Company, Cleveland, Ohio—to construct and operate an electric street railroad between Cleveland and Painesville, Ohio. Capital stock, $200,000. Promoters: John J. Shipherd, M. H. Solloway, Nelson Moses, J. S. Casement, C. O. Child.

The Proctor Heating Company, Chicago, Ill.—to prosecute the general business of plumbing, gas fitting, sewerage, electrical, steam and hot water heating in all branches. Capital stock, $10,000. Promoters: Thos. H. Fitzgerald, Alfred D. Proctor, Hart J. Fitzgerald.

The Metropolitan Electric Street Railway Company, Chicago—to construct, maintain, operate and equip street railways in the counties of Cook, Du Page, Kane, Lake and Will, Ill.—to be operated by electric, cable or horse motive power. Capital stock, $5,000,000. Incorporators: Robert P. Parker, Richard E. Breed and James F. Dagley.

The Edenwald Street Railway Company—to construct and operate an electric street surface railway within and outside of the corporate limits of the village of Wakefield in the towns of East Chester and West Chester, N. Y.—Capital stock, $50,000. Directors: Jefferson M. Levy, of New York City; John M. Digney, of White Plains; Matthew Clune, of Peekskill; Herbert D. Leat, of Mount Vernon; Theodore H. Silkman, of Yonkers; George J. Penfield, of Wakefield; G. Waite Tubbs, of New York City; John Duffy, of White Plains, and David H. Hunt, of Williamsbridge.

The Freeport General Electric Company, Freeport, Ill.—to construct, own and operate an electric street railroad in Freeport, furnish and sell electricity for power, heating and lighting purposes, manufacture and sell all kinds of electrical appliances. Capital stock, $125,000. Pr moters: Wm. O. Johnson, Newton P. R. Hatch, Chas. H. Hatch.

The Multifuse Switch Company, Chicago, Ill.—to manufacture, buy, sell and deal in electrical and mechanical devices and instruments of all kinds, and also do a general manufacturing business. Capital stock, $100,000. Promoters: Howard M. Carter, Chas. B. Carter, Edwin C. Lancaster.

The Chapin-Douglas Electric Company, New York, N. Y.—to manufacture and deal in electrical and mechanical apparatus and supplies. Capital stock, $10,000. Promoters: Chas. E. Chapin, Greenwich, Conn.; J. S. Douglas, F. W Douglas, New York, N. Y.

The Chicago Subway Arcade and Traction Company, Chicago, Ill.—to construct, own, maintain and operate a system of subways and dummy railways; maintain and furnish necessary system of power, light, heat, ventilation, pavements, conduits and other constructions. Capital stock, $15,000,000. Promoters: Chas. F. Griffin, Marvin E. Barnhart, Jno. K. Nelson.

The Phœnix Construction Company, Crawfordsville, Ind.—to construct and operate telephone exchanges, steam and electric railways, etc. Capital stock, $100,000. Promoters: Noah J. Clodfelder, Crawfordsville, Ind.; Jacob Frank, Isidore Grohs, John W. Paris, of Indianapolis, Ind.

The Warwick Street Railway Company, Philadelphia, Pa.—to build an electric street railway in Delaware County, Pa. Capital stock, $50,000. Promoters: Harry P. Collins, J. Mortimer West Jr., Henry Delaplaine, Philadelphia, Pa.

The Edgewood and Sulphur Springs Passenger Railway Company, Williamsport, Pa.—to operate an electric passenger railway. Capital stock, $10,000. Promoters: W.E. Ritter, G. L. Crouse, Jno. L. Kelly, Williamsport.

The New England Turbine and Fuel Company, Portland, Maine—to generate, apply and use motive power of all kinds. Capital stock, $1,000,000. Promoters: Isaac W. Derby, Boston, Mass.; Dexter B. Wentworth, Chas. H. Crane, East Somerville, Mass.

The Lawrence Water Company, Portland, Maine—to manufacture gas and electricity and machinery and fixtures for gas works, water works and electric light works. Capital stock, $200,000. Promoters: Wm. C. Eaton, Edw. D. Noyes, Geo. F. Noyes, Portland.

The Abilene Water Company, Portland, Maine—to manufacture gas and electricity and machinery and fixtures for gas works, water works and electric light plants. Capital stock, $125,000. Promoters: Wm. C. Eaton, Edw. D. Noyes, Geo. F. Noyes, Portland.

The Shelbyville Water and Light Company, Portland, Maine—to manufacture gas and electricity and machinery and fixtures for gas works, water works and electric light plants. Capital stock, $225,000. Promoters: Wm. C. Eaton, Edw. D. Noyes, Geo. F. Noyes, Portland.

The Paola Water Company, Portland, Maine—to manufacture gas and electricity and machinery and fixtures for gas works, water works and electric light plants. Capital stock, $150,000. Promoters: Wm. C. Eaton, Edw. D. Noyes, Geo. F. Noyes, Portland.

The Crawfordsville Water and Light Company, Portland, Maine—to manufacture gas and electricity and machinery and fixtures for gas works, water works and electric light plants. Capital stock, $300,000. Promoters: Wm. C. Eaton, Edw. D. Noyes, Geo. F. Noyes, Portland.

The Three Cities Electric Company, Colorado Springs, Col.—to acquire, manufacture, own, let, lease, sell and supply electric light, heat and power. Capital stock, $100,000. Promoters: A. A. McCovney, A. L. Lauton, E. J. Eaton, of Colorado Springs.

The San Mateo Electric Light Company, San Mateo, Cal.—to maintain and operate the business of manufacturing ligh, heat and power by means of electricity, gas, steam, etc.; construct plants for same. Capital stock, $25,000. Promoters: F. M. Greenwood, E. A. Greenwood, San Francisco, Cal.; Phil. M. Roedel, Alfred B. Ford, C. E. Knapp, of San Mateo, Cal.

The Perry Water, Light and Ice Company (incorporated in Indiana), Perry, Oklahoma. Capital stock, $150,000. Promoters: Wm. E. Caldwell, Benj. J. C. Howe, Indianapolis, Ind.; Edw. S. Gaylord, E. D. Nims.

The Nunda Electric Light Company, Nunda, Ill.—to furnish electric light and power to the residents of Nunda and Crystal Lake. Capital stock, $5,000. Promoters: E. C. McCollum, H. H. McCollum, E. E. McCollum.

The Western Light Company, Kansas City, Mo.—to do a general electrical and gas business. Capital stock, $3,000. Promoters; Chas. A. Gray, Lessia A. Hull, Edw. F. Littleton, John W. Hull, Kansas City, Mo.

The Bonta Manufacturing Company, Hoboken, N. J.—to manufacture all kinds of machines and equipments for electrical plants and railways. Capital stock, $150,000. Incorporators: Arthur K. Bonta, Wilber C. Anderson and Alexander Young, all of Hoboken.

The Savannah Telephone Company, of Savannah, Mo. Capital stock, $10,000. Incorporators: B. E. Egan, John Donald, L. N. Hooper, Jr., J. M. Hughes and J. A. McLean.

The Western Illinois Telephone Company, Augusta, Ill.—to operate telephone lines. Capital stock, $5,000. Incorporators: P. P. Newcomb, Moses Weinberg and Jacob W. Klepper.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

MAY, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	......	1	......
2	12.40 A. M.	2	4.00 A. M.
3	1.10 "	3	4.00 "
4	1.30 "	4	4.00 "
5	2.00 "	5	4.00 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	7.30 P. M.	9	9.30 P. M.
10	7.30 "	10	10.30 "
11	7.30 "	11	11.30 "
12	7.30 "	13	1.00 A. M.
13	7.40 "	14	1.10 "
14	7.40 "	15	1.40 "
15	7.40 "	16	2.00 "
16	7.40 "	17	2.20 "
17	7.40 "	18	2.40 "
18	7.40 "	19	3.00 "
19	7.40 "	20	3.20 "
20	7.40 "	21	3.40 "
21	7.40 "	22	3.40 "
22	7.50 "	23	3.40 "
23	7.50 "	24	3.40 "
24	7.50 "	25	3.40 "
25	7.50 "	26	3.30 "
26	9.00 "	27	3.30 "
27	10.00 "	28	3.30 "
28	10.40 "	29	3.30 "
29	11.00 "	30	3.30 "
30	11.10 "	31	3.30 "
31	11.40 "	Jne 1	3.30 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MAY 7, 1895

ELECTRIC RAILROADS AND APPLIANCES.

538,649. Closed Conduit Electric Railway. George E. Baird, Chicago, assignor of one-half to William D. Henkee and Andrew Reiner, Blue Island, Ill. Filed April 30, 1894.

538,650. Closed-Conduit Electric Railway. George E. Baird, Chicago, assignor of one-half to William D. Henkee and Andrew Reiner, Blue Island, Ill. Filed June 11, 1894.

538,786. Electric Railway. Henry R. MacLean and Gustav A. Kornetzke, Schenectady, N. Y. Filed Aug. 3, 1894.

538,838. Supply System for Electric Railways. William Lawrence, New York, N. Y., assignor to the Lawrence Electric Company, same place. Filed April 28, 1894.

538,844. Trolley Bar. Clarence Parker and Arthur R. Trepagnier, New Orleans, La. Filed July 13, 1894.

538,904. Electrical Connection. James M. Faulkner, Philadelphia, Pa. Filed Feb. 28, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

538,999. Electric-Arc Lamp. Samuel S. Allin, London, England. Filed Oct. 29, 1894.

539,019. Electric-Lighting System. Rufus N. Chamberlain, New York, N. Y. Filed Oct. 22, 1894.

DYNAMO ELECTRIC MACHINERY.

538,648. Alternating-Current Motor. Engelbert Arnold, Zurich, Switzerland. Filed July 10, 1894.

538,669. Safety Device for Electric Motors. Rudolf Eickemeyer, Yonkers, assignor to the Otis Brothers & Company, New York, N. Y. Filed July 13, 1892.

538,757. Dynamo-Electric Machine. Addison G. Waterhouse, Pittsburg, Pa., assignor, by mesne assignments, to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 4, 1889.

538,825. Commutator. Jonathan P. B. Fiske, Alliance, Ohio. Filed Feb. 9, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

538,651. Telegraph-Key. Charles W. Bradford, Clinton, assignor of one-half to E. W. Boyer, Fairfield, Me. Filed Jan. 24, 1894. Renewed Feb 21, 1895.

538,816. Telegraphic Sounder. Jesse H. Bunnell, New York, N. Y. Filed April 19, 1893. Renewed June 21, 1894.

538,975. Telephone System. James W. McDonough, Chicago, Ill. Filed May 21, 1891.

MISCELLANEOUS.

538,670. Electric Transfer-Switch. Axel Ekstrom, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Sept. 7, 1893.

538,686. Electric Time-Alarm Clock. Max Leibecke, St. Paul, Minn. Filed Feb. 28, 1895.

538,695. Electric Soldering-Iron. William H. Osborne, Prince's Bay, N. Y., and George R. Meitzler, Cincinnati, Ohio. Filed Feb. 13, 1895.

538,758. Preventing Electrolysis of Street-Pipes. Richard Watkins, Sacramento, Cal., assignor of one-half to John W. Guthrie, same place. Filed June 25, 1894.

538,764. Electrotherapeutic Apparatus. Franz Borsodi, Magyar-Banhegyes, Austria-Hungary. Filed Oct. 22, 1888.

538,773. Electric Tower-Clock. James H. Gerry and Frederick M. Schmidt, Brooklyn, assignors to the Self-Winding Clock Company, New York, N. Y. Filed Nov. 15, 1894.

538,777. Electric Watchman's Clock. Otto E. Hausburg, New York, N. Y. Filed April 17, 1894.

538,871. Electrically-Operated Switch. Henry A. Hartman, Philadelphia, Pa. Filed Jan. 12, 1895.

538,919. Absorptive Material for Storage-Batteries. Edward R. Knowles, Brooklyn, N. Y. Filed Oct. 15, 1891.

538,971. Cautery-Electrode. Michael F. Laughlin, New York, N. Y. Filed March 7, 1894.

538,983. Interior Conduit. Oliver G. Traphagen and Francis W. Fitzpatrick, Duluth, Minn. Filed Feb. 4, 1895.

539,000. Electrical Hose-Signaling Apparatus. William Fowler, Colorado Springs, Colo. Filed June 20, 1894.

539,017. Electrically-Arranged Hose-Coupling. William Fowler, Colorado Springs, Colo. Filed Nov. 30, 1894.

DESIGN.

24,292. Electric Heater Case. Jamas F. McElroy, Albany, N. Y. Filed March 7, 1895. Term of patent 14 years.

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EDITORIAL NOTES.

The Patent Situation and Other Things. So much has been said and written in regard to the deficiencies of the United States patent system that those who have not looked deeply into the matter have been led to think that it was utterly bad, without one redeeming feature. So great, in fact, has been the expressed dissatisfaction in certain quarters with some of the provisions of the Patent Office that there is and has been some danger that the law would be changed. If a change can be made for the better, well and good, but we should be absolutely sure before taking any step that it is not a step in the wrong direction.

"No man e'er felt the halter draw with good opinion of the law."

If we look back to see who these grumblers are and what their grievances, we usually find that they are people who have felt the tightening cord at some time or other in their existence or else who see the noose hanging over them like Damocles' sword, ready to descend at the next turn of the legal mill.

A most noteworthy illustration in point was brought to light in the Bate Refrigerator case where a patent of little public importance was made to assume an importance justified only by very much larger interests than those involved. The law says: "*But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent.*" There would seem to be no ambiguity about that, and yet the General Electric and American Bell Telephone Companies, who owned valuable inventions that had been patented in foreign countries before they were patented here, turned heaven and earth to have this read differently so that it would mean that if it had been previously *applied* for in this country, although first patented abroad, its life should not be limited to the life of the foreign patent, but should continue throughout the full term of seventeen years notwithstanding the fact that the foreign patent might have expired a few years before. The General Electric Company and American Bell Telephone Company came into this case—not their own—and supplied the best talent at their command to prove that the law meant something which it did not say. Fortunately for the world, and we think for the best interests of the public at large, the United States Supreme Court could not be convinced that y-e-s spelled *no* and the result is probably that these two companies have not a good opinion of the law and would doubtless have it changed. Now let us suppose that the law is changed to meet these views. Would the inventor be the gainer thereby? In individual cases yes, but take the Berliner patent, for instance, which rightly or wrongly (it matters not which) was kept in the Patent Office fourteen years. Could the United States Government or the individual expect protection for the invention during this period of delay in foreign countries while protection was refused at home? Further, supposing that a rival becomes aware of the substance of your invention and straightway patents it in a foreign country. His patent is issued first and it is impossible to prove that he is not the original inventor. The law must assume that he is until it is proved that he is not. If it cannot be proved that he is not, then can the Patent Office grant the rightful inventor a patent on that which bears *prima facie* evidence of having been invented by another? From another point of view: If the inventor knows that by causing delay of issuance of patent he has everything to gain and nothing to lose, delays like the Berliner and Edison microphone patents will become more and more frequent and the verbal limitation of the law to seventeen years will become a dead letter. Provided the invention has been patented abroad, and it is known that a previous application for a patent for the same thing is pending in the United States Patent Office, the latter will act as a patent and thus serve not only as a check to the growth of competing enterprises but serve to foster a monopoly not contemplated by the founders of the patent system.

We believe that some changes in our patent system would be advantageous, but we also believe that no changes should be made until they are fully considered and their desirability established upon something decidedly more substantial than *ex parte* arguments.

We are of those who believe that most of the trouble arising from patent and other litigation involving the technology of the arts and sciences is due far more to an abuse entirely outside of the laws affecting the cases. We refer to the weight given so-called expert testimony. Do we have any expert testimony in our courts? Rarely, if ever. Experts in plenty are called to testify, and they do testify, but they are not there to assist the judge—they are there to assist the attorneys who are their clients just as the parties to the suit are the clients of the attorneys. They are selected by the attorneys and paid by them (or through them) just as and for the same purpose as the attorneys are selected and paid by their clients. The only difference is that the expert is sworn before he presents his argument and the attorney is not. The attorney is an expert in his way, but when he goes on the witness stand and testifies under oath his testimony has no more weight than that of any other reputable witness who is qualified to speak.

Here is the usual procedure in procuring expert testimony: Attorney A. comes to electrical expert B. and says—"B., I have the following case in court and I want your assistance. I wish you would look over this matter and tell me where, from an electrical standpoint, our strong points are and where are our weak points." B. takes the documents home and after studying them over finds, we will say, that the strong and weak points are about equally divided between the two sides of the case. Does he go onto the stand and tell that to the judge? By no means. He is employed to help the attorney to present the strongest case possible for his client and to slur over as insignificant or unimportant those points in which his client's case is weak.

He sits by the attorney and in addition to having drawn up a series of questions for him, intended to expose the weak points of the other side, coaches him with other questions suggested by the evidence given.

We know of a case, and it is not an isolated case by any means, but rather the rule, where the expert directed the whole of the examination both direct and indirect during a three days' examination, the attorney, one of the ablest in the country, being merely his mouthpiece, yet that expert himself went onto the stand and gave expert testimony. All this is considered legitimate, since it is done by both sides with the full knowledge and consent of the court. But is it expert testimony within the proper meaning of that term? Does the judge himself give it the weight attaching to unbiased expert testimony? By no means. This practice, which custom has established as legitimate, has brought the profession into disrepute, and we not infrequently see an expert who has testified to one thing in one suit testifying to another in the following trial of the same case, simply because his clients have changed in the meantime. And he does this with no more compunctions than has the attorney who has changed clients.

Absurd as this is it is no more absurd than to find well known experts upholding by the weight of their testimony that which they *know* is not true. They do not consider that they are lying any more than does the attorney who seeks to throw doubt upon the guilt of his client whom he *knows* to be guilty.

The positions of the two advocates, however, are not the same. The law says that everyone accused of crime is entitled to a defence, and carries this idea so far that it will not condemn a self-confessed criminal until it has been proved that he is a criminal, and if the latter have no one to defend his case the law will provide him with an attorney at the expense of the State, and expect that attorney to use every honorable means within the law to clear his client. Not so the infringer of a patent or a defendant in a civil suit. The law does not presuppose the invalidity of the patent upon which it has itself set its seal of validity. The defendant, let us say the infringer, however, may retain in his behalf the best expert testimony in the country, who, though knowing better, may still (and in the ordinary acceptation of the term) honorably give such preponderance of evidence in his behalf as to completely overshadow that adduced by the rightful inventor. But does this help the court in any way? Is it calculated to increase our respect for the laws? Does it not tend towards the subversion of that which, properly interpreted, is good and just? Is it not this very kind of testimony more than the inherent defects of our patent and other laws that have brought them into disrepute?

What can be more ridiculous, to cite a recent example, than the testimony of Prof. Henry Morton that the Attix wire was in fact a tube! There was one thing more ridiculous than this, viz., that tube or no tube it would serve the purposes of a conduit.

Such men as Prof. Henry Morton, C. F. Chandler, Chas. R. Cross, and others derive a large part of their income from expert testimony of this kind. Does any one doubt that Prof. Morton would have testified with better grace that the Attix wire was not a tube, and did not and could not serve the purposes of a conduit, if he had been employed on the other side? Does any one doubt that Dr. Chandler would have defined the functions of the Edison feeder and main arrangement in a very different manner had he been retained by the Westinghouse Company instead of the Edison Electric Light Company? Does any one doubt, in fact, that Prof. Chandler, Prof. Morton, or Prof. Cross would have expressed entirely different views if he had been retained by the *other* side in any case where these gentlemen have appeared as experts?

Does any one believe that any of these gentlemen assisted the court to a clearer understanding of the subjects of which they testified than he had before, or that it was intended that they should do so?

We do not wish to disparage testimony of this kind any more than we would disparage the functions of a skillful attorney, but we do believe that it should be relegated to its proper place, and not be weighed as "expert" when it is avowedly interested and partisan.

We believe our courts should call to their assistance when necessary the best expert talent available, but this assistance should be sought and paid for by the State and not by either of the parties to the litigation. We believe that When this is done there will be less fault found with our, generally speaking, admirable patent system. We believe that when this is done justice will more often be meted out, and we *know* that when this is done the reproach which now attaches to the expert witness and the suspicion of expert testimony will be removed.

* * *

The Lamp Situation.

The only sane reason why individuals or companies engage in business is that they expect to make money by doing so. There is no escape from this statement of fact. It is beyond dispute, and yet the present condition of the entire electrical trade indicates that many of those engaged in it do not believe in the axiom.

Goods in almost every branch are being sold at a loss; failures multiply. Reviving business throughout the country is not felt in our trade, except that more goods are being sold.

Looking below the surface of affairs, however, we find that even those responsible for present conditions believe fully in the statement of fact made above. Their only reason for being in business is to make money; they care little what becomes of the money of the stockholders in their various enterprises. They know that bankruptcy for the company they manage is inevitable. Meantime the *individual* draws his salary, and if he be a "prudent" man lays away something to carry him over a period of idleness.

There are at present engaged in the manufacture of incandescent lamps twenty-five or thirty concerns. The price of lamps has fallen to about one-quarter of what it was five years ago. At the ruling prices of January last, however, a fair margin of profit was left.

A few weeks ago the G. E. Company reduced the price to a point ensuring a loss of *three cents* on each lamp. The quality of the lamps was cheapened at the same time, but the lamps *still burn* for a time.

The question in which competing manufacturers are now chiefly interested is just what shall be their policy in the matter of price. There may be—indeed there are—some makers who do not know what their product costs and who will endeavor to meet the Edison price. They will last but few months.

There are others in control of some of the companies on salary who will display their business acumen by deceiving their stockholders as to costs, and who will advise meeting any price made by others.

There are others, and to these we look for the ultimate re-establishment of the lamp business upon a sound, profit-earning basis, who have large financial investments in their own companies, knowledge of the lamp business, sound business sense and common honesty, who will refuse to sell a barrel of lamps below the price which will return a fair profit.

The people who buy lamps may be led away for a time by the venders of cheap goods, but they must come back to those who make a reliable article. And in no line of manufacture is it easier to demonstrate the fact that the cheapest is not the best than in incandescent lamps. The user of lamps wants light. It is the light he gets which establishes the value of the lamp. The best lamp will win just as surely as the laws of commerce, established for centuries, still stand.

To take hold of as complicated a matter as the lamp trade, to straighten it out and purify it, is not an entirely pleasant task; but it is just what Electricity proposes to do, with the assistance of the leading lamp makers themselves. We shall make the campaign partially in our own way, but guided largely by the advice of others.

According to our judgment, one of the first things necessary to accomplish the desired result would be an open test conducted by some well known firm of experts, each lamp maker entering to pay a pro rata share of the fee. Electricity would take entire charge of this matter without any fee, the lamps to be bought in the open market by the experts themselves.

It would be found that the Edison lamp, the chief stumbling block in the way of a solution of the problem, is below a half-dozen other makes.

If any of the independent makers survive the present fight, which must be made once for all, it will be because they take concerted action and find some common ground upon which they can stand and give battle. No other basis upon which the business can be conducted at a profit is now apparent except perfect harmony and unity of purpose.

Electricity will do its full share. Patent suits are now being prepared on many detail patents. They will be used to intimidate purchasers and to drive out competition by reason of the expense necessary to defend them. It will be a part of our mission to keep the public informed, and any suggestions from our constituents will be gladly received.

The fight is on. It means to nine out of ten makers extinction unless an aggressive and harmonious policy is adopted.

Only a Small Part of Our Mission.

(From the Quebec Mercury.)

Electricity steadily brings the millennium nearer.

Mr. H. M. Littell has resigned his positions as general manager of the New Orleans Traction Company and president of the City and Lake and the Crescent City Railroads, and will take active charge of the Atlantic Avenue system in Brooklyn, N. Y.

Under the Searchlight.

Views and Opinions on Timely Topics.

THE MICROPHONE-TRANSMITTER IS NOT ESSENTIAL.

It will be learned with astonishment and disappointment by a great many that the United States Circuit Court of Appeals (Justices Colt, Putnam and Nelson) has endorsed the practices of the Bell Company and the Patent Office in the Berliner telephone case to the extent of reversing the decision of Judge Carpenter, of December 18, 1894, declaring the Berliner patent void. Judge Carpenter in the above decision said: "I think that their (the American Bell Telephone Company) acts were so gross as to forbid any inference except that they dishonestly delayed the issue of the patent." These words appealed so strongly to the sense of justice of the public that few expected the United States Circuit Court to do otherwise than concur in Judge Carpenter's decision. No reasons for this last decision have as yet been made public, and we must withhold further comment until they are made known. An appeal has been taken to the United States Supreme Court.

If the present decision stands, it gives the Bell Company a practical monopoly of the microphone transmitter for thirteen years longer. This is not the disaster that many people will suppose, however. The Bell Company have been industriously instilling the idea that the microphone is essential to the art of telephony for so long that the public has been led to believe that it was true.

As a matter of fact, however, a better transmitter can now be made without the use of the microphonic principle than has yet been made with it, and the simple magneto has been many times demonstrated to give good articulation between New York and Chicago.

* * *

Why Not Be Honest?

The G. E. report this year stated that new securities to the amount of $1,085,226.56 had been acquired during the year. We assumed, of course, as did every one else, that these securities were taken in exchange for apparatus. A gentleman who is closely connected with the United Electric Securities Company, writes that we are in error. He says the G. E. Company was compelled to take back worthless securities last year from the Securities Company for $394,000 at 80, the original price paid therefor. This is no doubt correct. Why did the G. E. directors try to conceal the truth? What is the further liability in this direction?

* * *

The Niagara Enterprise and G. E.

Is the Latter to be Used to Pull the Former Out of a Hole?

(From the U. S. Investor.)

We are informed that the Niagara Falls Power Company has proved a mistake. This company, it will be recalled, was organized to generate electrical power at Niagara Falls and convey it to Buffalo, where it was to be sold at a much lower cost than steam. In fact, there was no end to the expectations of the promoters of the scheme, it being claimed that power could be carried at a profit to Rochester and possibly New York City.

It transpires, we are informed, that the engineers promised more than they could fulfil, it being demonstrated now that the tunnels are a failure and that the loss of power is so great as to make electricity cost more in Buffalo than steam.

Only one thing remains to be done, namely, to build up a big manufacturing city at Niagara Falls, and this, we understand, is what the Niagara Falls Power Company intends to do.

It is reported that the Niagara Falls Power Company has agreed to give the General Electric Company forty-five acres of land at Niagara Falls and all the necessary buildings. Furthermore, provision will be made for taking its Schenectady property off its hands. It is surmised that this will be accomplished through the New York Central Railroad, which may find a use for it. The connection of the Vanderbilts with both the General Electric and the Niagara Falls companies might make this possible.

* * *

Methods of the Carbon Trust.

ELECTRICITY has already expressed its views with clearness and emphasis upon the situation of the various companies manufacturing electric light carbons in this country.

There can be no doubt in the mind of any consumer who gives the matter careful thought that the success of the National Carbon Company of Cleveland (the Carbon Trust) in their proposed plan of bottling up the entire business would be detrimental to the best interests of the community. The ideas of business put into practice by the managers of this Trust are almost identical with those of the G. E. Company, with which they are intimately connected. They will not tolerate competition if they can prevent it, and they hesitate at nothing that will operate to their supposed advantage. This similarity is natural. An inspection of the stock list of the Carbon Trust shows the same names exactly as the list of men who were instrumental in forming the G. E. Company. The two concerns are closely allied, and the reasons which would impel a station manager to withhold his patronage from the G. E. Company would be equally potent in regard to the Carbon Trust.

G. E. salesmen throughout the country have taken a hand in the carbon fight, and are trying wherever possible to sell Trust carbons.

At Minneapolis the General Electric Company sold a lot of apparatus at a very low figure, just about cost, and three carloads of arc light carbons at a fair price. At Paterson, N. J., they sold the local Edison Company a lot of central station apparatus and carbons sufficient to run the company for a year or more on about the same basis. This means that the G. E. management (or that part of it under the hat of Mr. Coffin) will sacrifice G. E. profits in order to make profits for the Carbon Trust, in which Mr. Coffin is a large stockholder.

The same fraudulent scheme of bidding is resorted to by the carbon people that made the T.-H. and G. E. Companies so malodorous. Purchasers who suppose there is any competition between the Brush, National, Standard, G. E. or T.-H. companies are very much mistaken. There is nothing of the kind; it is flat misrepresentation.

Some time ago the city of Jacksonville, Fla., asked for bids on arc lighting carbons and the following were the results:

Brush Carbon Company	$12.00 per M
National " "	11.00 per M
Standard " "	9.00 per M
Boulton Crown Carbon Company,	8.75 per M
General Elec. " "	8.25 per M
Washington " "	7.65 per M
American " "	7.53 per M

In the above bidding, if it had been found that the independent companies were the highest bidders the bids of the National, Standard and other Trust companies would have been withdrawn, leaving the contract to the highest Trust bidder. Of course the G. E. Company must supply National carbons.

It is well for large purchasers to give this matter careful consideration. The system of bidding is little better than a bunco game.

The Carbon Trust must stand on its own bottom.

* * *

Wheeler Gets the Atlantic Trust Company.

(From the Milwaukee Journal.)

George B. Wheeler, of Eau Claire, receiver for the Eau Claire Street Railway Light and Power Company, is now in possession of the Atlantic Trust Company of New York, having foreclosed its mortgage of $400,000.

Mr. Wheeler must have taken possession by proxy, as the old officers are still on deck.

She's Turned West by South.

In our last issue we printed an article on the performance of the Tesla motor which was illustrated by curves obtained from a 50 H. P. machine, showing the true H.P. expended, the apparent H. P. expended, apparent and true efficiencies, power factor and drop in speed. It was altogether a rather remarkable performance, but one of our friends who is well posted in direct current machinery, but evidently not up in alternating current motors, writes this kindly advice. We withhold the name of the gentleman through respect for his feelings, but the trunnions of our Searchlight being well greased, we follow his advice and turn it "west by south":

To the Editor of ELECTRICITY.

I judge from the article in your paper of this week, giving some very interesting data on a 50 H. P. two-phase motor operating in the Westinghouse shops at Pittsburg, that you are paving the way for a libel suit in a new direction.

If a statement that a modern 50 H. P. motor of any make, "when running unloaded, takes *only* 18 apparent H. P., or 36 *per cent.* of the *full load output*," is not a libel, it represents a condition of inefficiency which I hardly think any of our polyphase friends would care to have you publicly admit.

Surely you should not take the editors of the *Electrical World* and *Electrical Engineer* to task for reporting on a salt water pipe line between Niagara Falls and Buffalo as a proposed electrical conductor between these two points, when you report on such a motor as it is proposed to use at the Buffalo end of this power transmission, which requires 36 per cent. of its full load output to run it empty or unloaded. At this rate, we may expect to read soon in your columns the statement that it is estimated that it will require the full capacity of one of the largest dynamos installed at Niagara Falls to furnish sufficient energy in Buffalo to operate a fan outfit to keep the flies off Brother Huntley, though I believe it is reported that there are no visible animalculæ on Huntley.

Will you please let us know in your next issue, Mr. Editor (giving also an arrangement plan if entirely convenient), the tools operated (size, type and make), and length and sizes of shafting between this 50 H. P. motor and the tools.

If the trunnions on your "Searchlight" are not rusty, just head her about west by south from No. 6 Park Place, and give us the information asked for in the foregoing paragraph.

You have on more than one occasion honored me by a request for an article on Electric Power for your paper. Favor your many interested readers with the information and diagram asked for, and you will soon thereafter have an article on Electric Power from —— ——.

We refer our correspondent to the diagram published on page 243 as fulfilling his request, and now bespeak an early contribution from his pen, suggesting that it be on electric power as transmitted by *direct current.*

* * *

THE G. E. Company use their wonted bad judgment in bribing employees to get information as to the business of their competitors. If they will only make their wants known to ELECTRICITY we will tell them in our columns anything they have a right to know about any company in the United States. And ELECTRICITY has never paid one dollar to obtain information surreptitiously.

* * *

CHARGES of attempted bribery of inspectors and various other acts of corruption are now being openly discussed in insurance circles in this city. If the fight between the old Board of Underwriters and the Bureau of Electrical Inspection gets hot enough, considerable rascality will no doubt be uncovered and an improvement in methods will result.

* * *

"AN EXPLANATION DEMANDED.

But Criminals Do Not Usually Explain Their Crimes.

(From the Boston Standard.)

The public, as well as common decency, demands of the directors and officers of the General Electric answers to these absolute and direct charges by ELECTRICITY of fraud, swindle and corruption. They must answer and defend themselves against these criminal charges of wrong doing and rascality, or else it must be taken for granted that the charges are absolutely true. Silence no longer fits ;or shelters the directors and officers of an honest concern. Every sensible man must consider these charges to be correct until the directors prove them to be otherwise.

I believe that Electricity is correct, and that Dr. Greene, its able and accomplished editor, deserves a monument of bronze for exposing the doings of a vile set of manipulators, who have caused the people of Boston and New England to lose so many millions.

The country owes Electricity profound gratitude for its masterly expose of corruption.

* * *

G. E. FINANCING METHODS APPLIED AT LONESOMEBURG.

The manager-purchasing agent-secretary-treasurer-chief lineman-superintendent of the Lonesomeburg Electric Light, Heat and Power Company sat on an empty wire reel at the pine desk in the corner of the corrugated iron power house. The 4,000-hour lamp above his head burned at 19.9 watts per each of its 7 candles, casting a mellow light on the troubled multi-official. His brain revolved 999 r. p. m., cutting 1,000,000,000,000 lines of thought per second. Before him lay the unbalanced balance sheet of the year's business. The stockholders were to hold their annual meeting on the morrow and a good showing was expected by them. Figured as it might be, or had been for weeks past, there remained a deficit of $48.93. How to convert that into a profit the perplexed financier knew not.

The engineer-fireman-dynamo-tender-watchman had fallen asleep on a bale of waste half an hour before. The Lonesomeburg Stove Foundry and Plow Company's Monkey Wrench Variable Speed engine sped away at a 150-294 gait, delivering from 8 to 80 H. P. to the 800 light alternator. Just as the manager's multi-lobed brain reached the point of complete thought saturation the bartender at the Chalkdowne Hotel turned the switch on the three 50 C. P. lamps in the bar. At that instant the needle of the voltmeter on the station switchboard flew up against the case and stuck fast at 130 volts. The lamp above the manager's head glared at him with a Welsbachian glare. He started as if shocked from an Earth Magneto and an Electropoise coupled in parallel. Suddenly his eye rested on a copy of the third annual report of the General Electric Company. With an eagerness born of despair he snatched the pamphlet up and hastily scanned its pages. When he reached the column of "available assets" his attention was riveted for a moment by the item : "Fort Wayne Electric Company, $1,137,555." He read it a second time, then with an above C. P. glow illuminating his face he jumped to his feet, exclaiming :

"I have it. I'll just credit earnings with that bill of Jim Suttle's, which was 'dead horse' even before the sheriff sold him out. It was carried on the books for two years, then dropped as n. g., but I guess I can ring it in here and show the stockholders that we've made $3.08 instead of having lost $48.93 during the year."

Obituary—A. M. Wellington.

Mr. A. M. Wellington, the well-known civil engineer, and one of the editors of the *Engineering News*, died of heart failure in New York City on Thursday evening, May 16. Mr. Wellington was born at Waltham, Mass., December, 1847. His education was that of the civil engineer, and for twenty years he followed his profession, devoting his attention chiefly to railroad work. After a very wide experience in this line in this country, he was in 1881 made chief engineer of the Mexican Central Railroad, afterwards becoming assistant general manager of the same road and chief engineer of the Interoceanic Railway from Vera Cruz to the City of Mexico and the Pacific Coast.

As a result of his wide experience in railway location, he published in 1877 a treatise on the subject which attained a wide popularity. In 1885 he turned his attention to technical journalism, and after two years' service as an editor of the *Railroad Gazette* became in 1887 one of the editors-in-chief and proprietors of the *Engineering News*, which latter position he occupied until his death.

He was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Canadian Society of Civil Engineers, the British Institution of Civil Engineers, and the Engineers' Club of New York City, and contributed many important papers to the published Transactions of these societies.

Mr. Wellington was a man of original mold, an inventor in the line of applied thermo-dynamics, and an authority upon the subjects which he made his specialties. As a writer he was clear and trenchant, and the engineering profession as well as technical journalism has sustained in his death a loss which will be keenly felt.

His wife and daughter survive him and will receive the heartfelt sympathy of his very wide circle of professional and personal friends.

Bribing Young Men To Steal.

The G. E. Company Again Caught in a Criminal Conspiracy.

Paying Westinghouse Employees for Confidential Information.

Proof has been secured of another attempt of the G. E. Company to obtain information from the Westinghouse works by bribery. The disgraceful plot differs from the blue-print steal only in scope and detail. In principle both are the same.

Among the correspondence which has been turned over to the Westinghouse officials are the following :

(From E. D. Mullen to E. G. Waters.)

Dear Sir : Schenectady office has written us desiring us to find out in any manner possible, even approximately, what the present output of the Westinghouse factory is, say the number of street railway motors, number of alternating lighting machines, etc., that are turned out each week or each month. They are very desirous of getting some idea of how much business the Westinghouse Company is doing in this direction.

I wish you would kindly take up the matter promptly and energetically, and use every means within your power to secure said information, sending it here as soon as you are able. (Signed) E. D. Mullen.

Dear Sir : I am glad to have gotten the information contained in your letter of the 18th, regarding the output of the Westinghouse factory and trouble with their men. You have started well, and if you can continue in like strain it will be a matter of a great deal of satisfactory information. (Signed) E. D. Mullen.

Dear Sir : I have your favor of the 13th, giving a very complete report on the output of the Westinghouse factory. I trust the same is reliable, and it is no doubt as thorough as it was possible to obtain. You will be justified in including the $25 in your expense sheets.

(Signed) E. D. Mullen.

(From the Go-Between.)

Then comes this important letter, dated "New Hotel Mahaney," Uniontown, April 25, and addressed to Mr. Waters :

"Mr. Van Cleve spoke to me before leaving the city about his fee for securing the Westinghouse data. I told him we would send him a draft for it at once. Will you please mail him a draft for $25, and send me the receipt, which I will sign, as he does not want his name to appear on our records ; also please send him his letter, and the original list, so that he can destroy it. Address it John M. Van Cleve, Wilkinsburg, Pa.

"Yours very truly,
"William S. Beatty.

"P. S.—I inclose herewith Allegheny Traction Company pass to power house. Please pardon my negligence for not returning it before. B."

Mr. Mullen, named above, is the manager of the G. E. Company's Philadelphia office, and Mr. Waters holds the same position at Pittsburg.

COPIES OF RECEIPTS.

In connection with this letter the Westinghouse people have a copy of a receipt signed J. M. Van Cleve, dated May 4, reading that he had received $25 from W. S. Beatty for services rendered. They also have a copy of a receipt dated May --, signed W.S. Beatty, acknowledging that he had received from the General Electric Company $25 for payment to J. M. Van Cleve.

In the blue-print steal it is on record that Mr. Coffin himself was cognizant of the whole transaction.

In this matter it is different. Mr. J. P. Ord, Mr. Edward Clark or Mr. Henry W. Darling must have been aware what the money was paid for. It is time for these gentlemen to explain.

The transaction of itself is of slight importance, but coming at this time it shows clearly that there must be no cessation in the warfare against the corrupt management of the G. E. Company. That management is actuated by the same motives as it was two years ago, and has no more conscience.

Starting into business with a charter procured by bribery, bribery has been the watchword ever since. Dishonesty and thievery have been so common, from the heads of the company, down that proficiency in roguery has been accepted by the employees as a sure way of getting promotion.

When a travelling-bag full of stolen blue-prints arrived at the G. E. office in the former case, the young man who disgraced himself and ran the risk of going to the penitentiary to save Mr. Coffin from a like fate, called in office boys and officers of the company alike to inspect the contents of the bag and glory with him in the great coup.

Doubtless Mr. Mullen has received congratulations from his superiors for his part in this later conspiracy.

If the Westinghouse Company does its full duty to the public it will bring some of these rascals to trial.

Personal.

Mr. Charles D. Shain left New York on Friday to spend a week in Chicago.

Mr. S. A. Douglass has gone on a hurried trip to Cleveland, Detroit and Toronto.

Mr. L. A. Ferguson, purchasing agent of the Chicago Edison Company, was in the city last week.

Mr. C. E. Stump, late of the *Street Railway Gazette*, will sail for England this week, to be gone two or three months.

Mr. Frank Mason, superintendent of the Brooklyn city service, sails on the same steamer in company with Mr. Stump.

Mr. Eugene Phillips, of Providence, was in New York last week to attend a meeting of the leading wire manufacturers.

Among our out-of-town visitors this week have been Mr. S. M. Hamill and Col. L. H. Rogers, of the Brush Company, Cleveland.

Mr. P. H. Alexander, who has been confined to his bed for some weeks, has gone on a vacation of a few weeks to recuperate.

Mr. Charles A. Merritt, of Birmingham, Ala., is in the city and will endeavor to make arrangements for the manufacture of his new incandescent lamp.

Mr. Jamas W. Godfrey recently returned from a successful hunting expedition. Mr. Godfrey expects to sail for Southampton in a few weeks to meet his family, who are now abroad.

Mr. Gilbert Wilkes, who is well remembered here through his connection with the Edison General Company, is now doing a good business as consulting engineer in the city of Detroit. He has recently been in New York on business.

Col. H. C. Adams has taken charge of the New York offices of the Ft. Wayne Electric Corporation. It is understood that Mr. McDonald's outside interests are taking more and more of his attention, and that he wants to be relieved as far as possible of the active management of the Corporation's affairs.

THE STATUS OF THE GAS ENGINE.

A Statement and Discussion of the Subject Before the American Society of Mechanical Engineers at Their Monthly Meeting April 10, 1895.

The subject of the gas engine, which has been so fully treated in these columns from time to time and is attracting such wide attention among central station men as likely to assume importance in their future practice, warrants us in reproducing with considerable fulness the interesting discussion which took place on the date named:

Mr. Reeve—Mr. Chairman and gentlemen: The subject before the meeting to-night is the present status of the gas engine, and, as I understand, my sole duty here this evening is to state the case for discussion.

The status of the gas engine, as the status of every other thing whatever in the world, depends entirely upon the surrounding conditions. A plant exists merely because the sun shines and the seed has been planted. Unless the surrounding conditions are favorable the plant cannot exist, and the amount of its growth and the character of its growth depend entirely on the surrounding conditions. The gas engine follows this general law, in that its status to-day is what it has been forced to be and what it has been allowed to be by the general commercial and engineering conditions of the world. The status of the gas engine, therefore, is the status of the power question of the world, and the importance which the gas engine takes in the field depends as much upon the condition of other forms of power as it does upon the condition of the gas engine itself. Now practically all other power that is in use is steam power. I do not mean in saying this to lose sight of the tremendous amount of water power that is in use in this country or the world to-day. But water power is restricted to certain localities and the gas engine is not. It comes into competition only with those forms of power which are applicable to almost any locality or set of conditions; and, aside from gas power, steam power is almost the only other occupant of that class of prime movers.

The condition of steam power engineering has very rapidly altered during the past few years, at any rate within the past ten or fifteen years. The steam engine started off as the forerunner really of the factory. Perhaps the factory started first on water power. But practically the factory and the steam engine grew up together; and the idea that we, nearly all of us, have carried in our minds of a commercial manufacturing plant driven by any power was a set of tools driven by a central motor through the medium of a line of shafting and a number of belts. That scheme of industrial works grew in size and importance until it had reached tremendous proportions, and in certain lines of industry it still survives and will continue to survive in the future in still larger sizes and on still more important a scale. But for the vast majority of industries, those species of manufacturing which involve a varied number of processes and departments and involve the production of a comparatively complex commodity—such, for instance, as the building of steamships or railway cars, or the complicated machines involving wood work and iron work and steel forging work, and all that sort of thing—the modern factory is a collection of factories. The various factories may be merely departments, merely various rooms in one building or on one floor. But at any rate the factory now consists of a large number of departments, and those departments are quite distinct. They often run entirely independently, have separate foremen or superintendents, run different hours and have different classes of labor. In some, labor is a small item and power is larger. In others, power is a small item and labor is the principal feature. All these varied conditions make it almost impossible for such an establishment to be driven by one central prime mover. In the first place, distance of transmission comes in and consequent losses. In the second place come in varying conditions. Every engineer knows that no piece of apparatus can work well under varying conditions. We have therefore seen grow up in the last few years the modern industrial works in which the power has to be transmitted quite a distance and subdivided among a large number of different sorts of tools. This, of course, was first attempted by shafting and belting or by rope drives. But it is evident that the loss by transmission in all these various transitions and distances of transmission are very great. Consequently we have seen other schemes tried. First came the subdivision of the steam engine itself into a large number of units, and we have only to look about us in our large factories to see steam-driven plants where the power is furnished from the central boiler plant to anywhere from ten or a dozen to seventy different engines scattered all over the works—sometimes twenty or more in one room. Sometimes the losses in steam transmission are under average conditions less than for shafting and belting. Of course no cast iron rule can be given for all conditions. But the subdivided steam plant has come in to stay. Of later years, superseding the subdivided steam plant, came in first compressed air and then electrical transmission and subdivision of power.

I have given this resumé of the changes of the power question to show that the problem of the present is economical transmission of power, not economical development of power. Of course economical development at the original point of production is of great importance, but it is vastly more important to transmit it economically, because the losses in transmission can easily exceed the largest losses possible in production.

Now, those of you who have spent any time on the problem of the subdivision of power or its transmission have seen that none of the systems heretofore provided satisfy the question. They all involve tremendous losses in transmission. They all involve heavy first cost, heavy expenditure for generating plant, transmission plant and redeveloping plant at the other end. For instance, in electrical transmission, if your total works need a thousand horse-power, besides your thousand horse-power of boilers you must follow with a thousand horse-power of steam engine, a thousand horse-power generator, your mains for carrying the electric power, and then on top of that a thousand horse power of motors. That is, of course, losing sight of all small factors and percentages of loss. Now the present status of gas power in this country or any other, and also of its immediate promise for the future, depends upon this statement of the problem in this part—that gas power offers the ideal solution for the subdivision and transmission of power, the mechanical difficulties for the time being lost sight of. In other words, let us suppose that a large industrial plant, requiring say 1,000 H. P., subdivided into say 50 different units, which are utilized at various points in different buildings on different floors at different speeds for different hours during the day, under different conditions of varying and steady load—suppose that in such a plant as that we install a 1,000 H. P. gas generator or its equivalent, and then lead from it or from the holder to a large number of gas engines large central gas mains—it is evident that the first cost is away below that of any system with the possible exception of the subdivided steam plant, where our boiler plant corresponds to our generating plant, our steam mains to our gas pipes, and our steam engines to our gas engines. But there is one big advantage which a gas plant has over a steam subdivided plant in point of operation, and that is that in the steam subdivided plant, no matter how large a proportion of the load be off, the central generating plant must be run, and the fixed charges of running cannot be altered. Steam must be kept up, the boilers must be kept hot, the stack, if there be one, must be kept hot, and the labor must be there to take care of the whole matter. I have myself tested one factory in which for a large proportion of each day the efficiency for the transmission of the power between the boiler plant and the work was 5 per cent., simply because they had to keep the whole plant going in order to move one small department. With the gas plant that entirely disappears. Your gas generator works for a certain number of hours a day on whatever load or capacity is best suited to produce maximum economy, and as we all know there is only one point in capacity in which any apparatus can work at minimum economy. During those certain number of hours a day the generator makes gas and stores it in the holder. The generating plant is entirely unconscious of the consumption of power provided it be large enough to fulfil all demands. The consumers of power, the foremen of different departments, are as unconscious as is the generating plant of the consumption of power. They simply know that all they have to do is to turn on their gas and start their engine. They may run twenty-four hours in a day while the gas generator runs eight, provided the total maximum production of the gas generator is large enough to cover the whole output of power. The comparison between such a gas plant and any plant relying upon transmission and subdivision of power, by compressed air or by electricity, or by any scheme wherein the power is first developed by the steam engine and then converted into another form and then converted back again—a comparison between the gas power plant and any such plant as that is really hardly possible from the economical standpoint. The operation of any such gas plant would be incomparably more economical than that of the compressed air or the electrical or the hydraulic system of transmission of power.

You will notice that I have entirely left out of the question the mechanical side of it, which I purposely wished to do. But for the merely commercial side there is an absolutely unlimited field for the development of power and its transmission and subdivision in industrial works by means of the gas generator and the gas engine.

The next big argument for any plant of that sort for division of power is that in every industrial works—the supply of power or steam—the supply of power is made to correlate with the other portions of the work. To be more plain, perhaps, in nearly all of our large textile mills in New England, and in a great many other forms of industry, the steam is used as much, and sometimes more, for heating purposes and boiling and dyeing than it is for power. In fact the big promoter of steam power in New England, where it has proved an indispensable auxiliary of water power, is the fact that the steam had to be had anyhow. That is true also of compressed air plants. There are a great many forms of factory where compressed air is indispensable for blowing, furnishing draft, cleaning and innumerable purposes to which it can be applied, and in a great many plants compressed air is used to transmit and subdivide power where no other system would be tolerated, simply because the compressed air has to be there any way, and the compressed air mains have got to be there, and they might a great deal better use it for power. The same thing applies to electricity. Those factories relying on the electric current entirely for light may often bring the power question into an entirely secondary importance compared with light. If they have got to have their central engines and generators and mains for the production and distribution of light, and if they need light more than power, then of course the electrical transmission of power is the thing, without any regard to the general arguments against. But this same factor of the correlation of the system of transmission of power and the system of transmission of other forms of energy needed in the works applies also to gas. In fact the gas producer has reached its present state of perfection largely owing to the fact that gas is the most economical form of fuel for a large number of industrial devices—metallurgical, for glass works, and for a large number of sorts of cooking and heating and baking, where exact temperatures and exact control of temperatures have to be had. In all these plants the power may again become secondary to other purposes in the factory; and in those plants where generators have already been installed for the purpose of supplying fuel gas, the gas engine follows as a natural sequence.

The reply to this side of the discussion—and you will remember that I am merely stating the discussion—the reply to this side of the discussion is that the mechanical difficulties have not yet been overcome; that the gas engine to-day, after having had spent on it the best energy, or of the best energy, in the line of mechanical engineering which the world has been able to produce for some thirty years, is still more crude in a great many mechanical features than was the steam engine of a century ago. It is still very heavy. In nearly all of the devices only one impulse is received by the fly-wheels for every two revolutions; in the case of the single acting engines only one is received; so that the fly-wheels are heavy. The regulation, as a rule, is accomplished by simply dropping out a certain proportion of the impulses instead of varying their strength; and the necessity for the ignition of the charge in a minute fraction of a second has led until very recently to extreme uncertainty in the matter of ignition and also on the question of perfection of combustion. That last is not so marked a feature, because even with poor combustion the gas engine is an exceedingly economical prime mover. But the mechanical difficulties still stand in the way of the accession of the gas engine to the proper field in which it belongs—that is, the universal factor for the production and transmission and subdivision of power in industrial works.

At the risk of being considered rather superficial in skimming over this subject, I will take one step into the future and say that while gas engines have hitherto been almost entirely run with illuminating gas, yet already there has been considerable done in the way of supplying gas engines with special producer gas from special producers built just for that purpose. There has also come upon the field—I will just mention it—the incandescent gas burner, that has just begun to attract wide attention as being an established fact. These two coupled together—first that the gas engine can be run much more economically upon producer gas, not illuminating gas, than it can upon illuminating gas, and second that there is a means attained of producing illumination by a non-luminous gas—lead us to the surmise—perhaps I should not state it as a surmise, I will state it as a hypothesis, which I hope to hear discussed—that the near future will see the distribution of energy—all energy—which is derived from coal in the form of a non-luminous cheaply-produced fuel gas—that this gas will be relied on entirely for power, for lighting where gas lighting at all is permissible, and where it is not, where the electric light is needed, that electric light will be produced through the medium of gas engines, and that this same gas will be used for all sorts of fuel and heating purposes—heating, domestic heating and cooking, and industrial heating of all sorts.

I have tried to make as brief a statement as I could of the gas engine problem as it appears to me to-day, not on the basis of the condition of the gas engine itself, but as a statement of its possibilities, the demands which are going to be made upon it in the near future, and what the near future may bring forth in the way of a powerful auxiliary to aid in the adoption of the gas engine as the universal prime mover.

THE UTILIZATION OF ELECTRICAL ENERGY FOR COOKING AND HEATING PURPOSES.—II.*

BY R. E. B. CROMPTON,
President of the Institution of Electrical Engineers.

By means of the platinum thermometer already described we have been able to measure with a high degree of accuracy the amount of electrical energy that is required for various forms of heating and cooking apparatus, and the following four tables give a fair idea of the cost of heating surfaces required—first for roasting or baking or frying. The second table gives the cost of heating surfaces to a lower temperature such as is required for warming the air of a room or for airing linen or similar purposes. Tables III and IV give the cost of the energy required for boiling water in small quantities, and are interesting as they show that in case we are using electricity in the manner in which it compares least favorably with solid fuel, i. e., for the boiling of water, we can, with an ordinary electrical kettle, switch on the current and obtain a cup of tea at a cost of less than a farthing for a single cup, or half a farthing per cup if several are required.

TABLE I.—*Showing energy required to raise a heater plate from 50° F. to 400° F. in half an hour.*

Time.	Energy in B. O. T. units. 1,000 watt hours.	Cost at 4d. per unit.	Temperature, Fah. scale.
0	0	0	50 deg.
10 min.	0.116	0.46d.	257 deg.
14 min.	0.164	0.67d.	322 deg.
21 min.	0.248	1.0d.	357 deg.
30 min.	0.404	1 61d.	400 deg.

TABLE II.—*Shows the energy required for a radiator plate, such as we use for heating the air of a room.*

Time.	Energy in B. O. T. units.	Cost at 4d. per unit.	Temperature, Fah. scale.
0	0	0	50 deg.
10 min.	0.091	0.364d.	171 deg.
30 min.	0.277	1.1d.	240 deg.
40 min.	0.350	1.4d.	257 deg.
50 min.	0.430	1.72d.	261 deg.
60 min.	0.500	2.0d.	264 deg.

TABLE III.—*Shows the energy required for boiling one pound of water in a tea-table kettle.*

Time.	Energy in B. O. T. units.	Cost at 4d. per unit.	Temperature, Fah. scale.
0	0	0	50 deg.
10 min.	0.075	0.32d.	212 deg.

TABLE IV.—*Shows energy required by a smaller kettle containing three-quarter pound of water, i. e., sufficient for two cups of tea.*

Time.	Energy in B. O. T. units.	Cost at 4d. per unit.	Temperature, Fah. scale.
0	0	0	50 deg.
12 min.	0.051	0.2d	212 deg.

Although these tables show the amount and cost of electrical energy required to raise various kinds of heating surfaces to a certain temperature, something more than this is necessary to enable you to form an opinion of the value of heating and cooking by electricity from the point of view of economy.

When the subject is first mentioned even to a skilled engineer, his first idea is that in almost every case electric heating must be too expensive to become general; he knows the wastefulness of steam generating plants is such that not more than six per cent. of the heat energy in the fuel can be distributed to the consumer in the form of electrical energy, and he is not to be blamed if he concludes from this that there is no chance of using the re-converted heat from this energy in competition with the heat which the consumer can obtain direct from burning the fuel itself. But the fact is that all these opinions are based on an insufficient knowledge of the economy—or rather extraordinary want of economy—of cooking as carried on at present by the ordinary kitchen grate. Now that we can actually measure the heat that is required to carry on cooking operations, we are astonished at the smallness of the results obtained by present methods. The percentage of the heat units of the coal burnt in our kitchens which is actually utilized in cooking the food is in all private houses and in most hotels and clubs so ridiculously small that I should hardly be believed if I quoted you the figures which we have obtained; it is not too much to say that in many cases not more than two per cent. is utilized. This enormous waste is due to the fact that, with the sole exception of boiling and stewing, all the remaining operations of cookery depend on the radiation of heat to the substance to be cooked. Take, for instance, the process of grilling a chop—consider how much coke has to be burnt before a bed of glowing coke fit for the purpose is obtained, and after the clear grilling fire is in order consider that seventy per cent. goes up the chimney, sixteen per cent. is radiated into the room or employed in roasting the cook—male or female as the case may be—it is not difficult to understand that the chop itself does not receive more than two per cent. of the total heat units. On the other hand, with a properly arranged griller heated by electrical means fully sixty-five per cent. of the heat energy in the electricity is utilized in the meat Take again the case of the ordinary oven attached to the kitchen of a small private house—the oven may be used on an average three hours a day, but if solid fuel is used the oven must be heated continuously from the time that the kitchen fire is alight in the morning until late at night, so that in this case the total heat usefully radiated from the sides of the oven to bake and roast or brown the food within it generally amounts to a very trifling percentage of the fuel used.

The comparison with gas cooking, although not so striking as when solid fuel is used, is still very favorable to electricity, for although in the case of the gas oven considerable economy results from the gas being used only at the time that the oven is required for cooking, yet in this case the heat is communicated to the food by radiation from gas flames so that it is necessary that a current of air must continuously pass through the oven in order to ventilate it and carry away the products of combustion. This ventilating current also carries away with it at least eighty per cent. of the heat units obtained by burning the gas.

The electrical oven consists, as you see, of a rectangular box having double sides at bottom, top, back and front; the inner surfaces of the inner plates are the electric radiators, and the space between them and the outer plates is filled with a non-conducting material; the door closes practically air-tight, no ventilating current of air is necessary; thus all waste of heat being prevented in this case, when the oven is filled with food more than ninety per cent. of the heat energy can be utilized, and thus although possibly five to six per cent. only of the heat energy of the fuel is present in the electrical energy, ninety per cent. of this, or four and one-half per cent. of the whole energy, actually goes into the food, and thus the electrical oven is practically twice as economical as any other oven whether heated by solid fuel or by gas.

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*Lecture delivered before the Society of Arts, London, Eng., on Wednesday evening, April 24th, 1895.

Thus far I have dwelt at some length on the economical question : it is time to say something on the questions of the convenience and of the superior results which can be obtained by electrical means.

I have already spoken of the large loss by radiation which occurs when solid fuel is used, or to a less extent when gas fuel is used. This has the great inconvenience of injuring the quality of food that is being prepared in the kitchen, of keeping the cooks in a heated and unpleasant perspiring condition, and I might enlarge considerably on this point. An electrically-worked kitchen may be kept as cool as a dairy if it be desired, and the effects on the quality of the cooking, and on the health and tempers of the staff, must be experienced before it can be fully appreciated. I have also mentioned in the case of the gas oven the necessity for allowing ventilating currents of air to pass over the surfaces which are cooking. These currents of air dry up and harden and take away the flavor of the outer portions of the meat. Any connoisseur can detect this in the case of joints cooked in a gas oven. With the electrical cooking, the absence of such ventilating currents and the stillness of the air prevent the above-described drying and hardening action, the meat is found to be tender and juicy right up to the extreme outer surface, it is browned only to a sufficient extent to please the eye and the palate. Again, the facility for regulating the temperature to any degree of nicety, which we can give with any of the electrical cookers or ovens, is very highly appreciated in the higher walks of the culinary art. Most skilled cooks will tell you that it takes much experience to satisfactorily manage an ordinary oven so as to bake or brown pastry or sweetmeats, and always give a uniform result. When these skilled cooks use electrical apparatus for the first time, they almost invariably say : A child could learn the ways of this oven in a few hours, and produce as good results with it with absolute certainty as I could with an ordinary oven after I had known it and learnt its ways for years.

All users of electric light are interested in the development of electric heating and cooking; you all of you have been told that the cost of electrical supply may be greatly reduced if it can be utilized during the daytime for other purposes in addition to lighting. Although the day may come, and I feel certain will come, that electricity will be used for power purposes within our homes to an extent undreamt of at the present time, yet such a development must be necessarily of slow growth, we must be educated to the point of using power for many occupations and pursuits which have yet to be invented; but the day of electric cooking is not far distant. There is no reason why in a few years to come quite a majority of the users of electric light will do all cooking operations of the nature of roasting, baking, stewing, frying, by electrical means, perhaps still employing solid fuel for boiling purposes only, and this in connection with a suitable furnace for supplying the whole of the hot water required for a household.

Time does not allow us to go into very many interesting matters connected with electric welding, brazing, soldering, roasting of ores, drying of paints, and many other industrial operations in which electrical heating can be advantageously employed. I am also unable to do more than state the bare fact that the managers of several theaters, notably the Vaudeville, have found that electric radiators form a most convenient, safe and economical method of heating the auditorium of a theater. During the late severe frost these radiators were found to be a great convenience in large shop fronts to prevent the lowering of the temperature and hence the freezing of the moisture on the plate glass which otherwise obscured the contents of the windows.

London Notes.

(From our London Correspondent.)

ELECTRIC TRACTION.

Some time ago I reported to you that the difficulties at present impeding the progress, or indeed the introduction, of electrically-propelled conveyances for street and road traffic were being considered by the London Chamber of Commerce (Electrical Section) who were bringing the matter before the Board of Trade. In the House of Commons recently a member asked the president of the Board of Trade whether he intended to take any steps to allow vehicles propelled by stored electricity or petroleum, if unobjectionable to the public, to be freely used in this country. In reply, Mr. Shaw Lefevre said he was about to introduce a bill upon the subject. This information was received with cries of "Oh !" and laughter, but why is more than I can conceive, for this is a question far more important than some which have been discussed lately.

The year 1894 saw very little done in this country in the way of electric railways or tramways. The year 1895 will, however, see several lines completed and opened. Among these may be mentioned the Bristol and Kingswood electric tramways, which will be finished in a month or two, the Brighton and Rottingdean Electric Seashore Railway, to adjoin Volk's Electric Tramway on the south coast. There are several others which will probably be ready in 1896 or 1897, among them being two important underground electric railways in London. After considering the matter for two years and more, the Coventry folk have ordered plant for equipping with electric power their old horse tramway lines, which have been lying idle for nearly two years. There is a tramway scheme in progress for Dublin, one suggested between Dublin and Dundrum, one proposed for Halifax, a railway scheme on hand for Llandudro (in Wales). So with all these it seems we are now waking from our long sleep, and things will doubtless go ahead, though we are a long way behind the States in this matter.

ENGINES FOR ELECTRIC LIGHTING WORK.

During the last few years the question of what is the most suitable engine for use in central stations has been discussed over and over again in the London engineering and electrical journals. It seems, however, that a more general and concentrated discussion will take place before the Institution of Electrical Engineers as the outcome of a paper which will be read on May 9 by Mr. Mark Robinson (of Willans & Robinson). In his paper, which is very lengthy, Mr. Robinson deals exhaustively with many moot and debatable points, and judging from the interest the matter has recently excited over here and from rumors that are about, it seems that the discussion will have to claim several evenings to itself. Mr. Robinson's paper is entitled "On the Recent Development of the Single-Acting High-Speed Engine for Central Station Work."

THE UNDERWRITERS' NEW RULING.

In the subjoined interviews ELECTRICITY has sought to show, in the most impartial manner, how the action of the Fire Board is regarded by those interests which are most directly affected by the recent promulgation of the Board that a double-braided insulated wire—Attix wire—is a tube :

Mr. J. E. Ham, manager of W. R. Brixey's Kerite products, said: "I regard the action of the Board, in specifying that Attix wire shall be used for interior work without conduit, to be an unjust discrimination against all other wire manufacturers. They could, with as much propriety and as great a sense of justice, declare that kerite wire or any other insulated wire could be used to the exclusion of all others. Any wire manufacturer, with proper equipment, can make as good a wire as the Attix—in fact we make such a grade now for underground service or use in damp places. I shall make formal request of the Board to know why our wire shall not be permitted to be used under the same conditions as the Attix.

"The wire manufacturers for years past have exerted every possible effort, employed all available science and skill, and expended vast sums of money to produce grades of insulated wire that would be so safe to use that the Underwriters themselves would be satisfied and convinced that their requirements had not only been fully met but even exceeded. That such results have been accomplished every one knows. To begin now a retrograde movement not only invites disastrous consequences, but threatens most seriously to retard the higher advancement of the art as well as to restrict the applications of electricity. It behooves every interest connected with the electrical industry to employ all possible safeguards; otherwise the public will lose that confidence it has taken so long to gain. The consequences in that event can not fail to disastrously affect the trade."

Another gentleman, manager of one of the leading wire manufacturing companies, but who does not desire to become officially or personally identified with the discussion, said: "I cannot conceive by what stretch of imagination, or of language, a braided wire can be called a tube or conduit, nor can I understand what should impel the Board of Underwriters at this day, when all effort and all skill are being directed towards securing the very highest standard of excellence in electrical work, to take such a step backward as the recommendation not only implies but expressly states. Everybody who has had experience in handling cotton yarn knows that it contains 15 per cent. moisture even when supposed to be dry. When placed in proximity to damp places it absorbs moisture to an alarming degree. To put two, or even three or four braids of it on a wire, even if the braids be treated with water-proofing and fire-proofing compounds to the point of complete saturation, the moisture in the cotton is not wholly expelled. Every one knows, too, that it is an immutable law of nature that material substances deteriorate, and fire and water proofing compounds are no exceptions. In due course of time, and a comparatively short period at that, these outer coverings of the wire have lost practically all of the qualities claimed for them when new. The result follows that your fire-proof and water-proof wire has become both highly inflammable and capable of absorbing moisture in a steadily increasing degree. To bury such a wire in plaster is the height of folly, to say the least.

"These observations are not made because the product of a competing company has been specified as the grade to be used for interior work, but are applicable to any wire similarly made by any company.

"Presuming that as a result of the adoption of this rule by the Board a fire should at any time or from any mysterious or unknown cause occur in an electrically lighted building, the insurance companies and public generally would lay the blame to the use of electric current. The insurance companies would be the first to become frightened and they in turn would frighten the people who own the buildings. What would follow? That feeling of confidence in the safety of electric service which it has taken long years to create would be so shaken that it would take years to restore it. The capital that is now being invested in electrical installations would be diverted to other channels and the trade suffer a most serious blow.

"The Attix wire, or a similar grade, can be made by any wire manufacturer, and if the new rule remains in force the market will be flooded with wire that may be denominated in all truthfulness worthless stuff."

The resolution of the Board is not interpreted alike by wire manufacturers. A high official connected with one of the leading companies is of the opinion that any wire manufacturer who can make the Attix "tube," or covering, or one as good, can thereby produce a wire that will in every condition fulfill the requirements of the Board. This same gentleman has long contended, and remains of the same opinion yet, that a wire covered with a proper insulation can safely be buried in plaster. "The difficulty here," he said, "lies in the inability of most wire manufacturers to make an insulation that will withstand the deteriorating influence of time as well as the destructive effects of damp plaster. In buildings where the maximum current consumed under any condition of service is below the carrying capacity of the wires, they can properly and safely be buried in plaster, provided, of course, that they are sufficiently well insulated. But in large office buildings, where the demand for current often exceeds the capacity of wires installed, some method that will permit the easy and quick removal and renewing of wires is not only desirable but almost absolutely necessary. The conduit method is thus far the only solution of that problem. It is plain that the Attix wire, with its tube of braid, cannot be considered a substitute for the conduit."

By defining a braided wire to be a tube or conduit, the new rule of the Board virtually substitutes the wire for the conduit and renders superfluous the use of the latter. This is the interpretation of the rule by the manufacturers of conduit, to whom the adoption and enforcement of the rule means a more serious blow even than to the wire manufacturers. Of this class of interests the Interior Conduit and Insulation Company is the most representative. In a late issue of the *Architects' Electrical Bulletin*, published by this company, is an editorial statement, in which Mr. Edward H. Johnson, president of the company, clearly states his views. He says: "We will readily admit that the Attix wire is of high grade, but that is not the point. Putting an extra coat of braid on a wire, no matter how it is applied, does not constitute a tube or conduit, and the rules demand conduits. The Attix wire is one thing, not two, and its outermost insulation is integral with and inseparable from its other insulation almost as much before it is put up as afterwards. Once slapped into the plaster, no power in the world could remove the copper inside without bringing away all the insulation; and to get at the wire all that covers it would have to be broken, chopped and ruined.

"If there is one fact demonstrated in the advance of electricity it is that the method of wiring edifices by means of the system of interior conduiting has done more than any other element to insure the success of electric lighting, and to make it at once convenient, safe and scientific. . . It is impossible to believe that electricians, architects, insurance men and others are about to relapse into the barbaric conditions of the days when a wire was buried haphazard in the walls and at once began a process of degeneration that ended in a disastrous fire or in its removal by chisel and pick."

Supplementing the above, Mr. Johnson said, in a conversation with a representative of ELECTRICITY:

"The action of the Board is not only unjust, but its attempt to force people to believe that a wire is a tube is both absurd and ridiculous. Why the Board should, or how it can, afford to form an alliance with a commercial enterprise, in discrimination against and to the detriment of other enterprises in the electrical field, needs some explanation on the part of the Board before its action can be comprehended or fully understood. Suppose, for instance, that a layman, having no practical knowledge of electrical work, but knowing enough to distinguish a tube from a rod, and who contemplated erecting a building, should inquire of the Board what he should use for interior wiring. Being told that Attix wire is a tube, he would accept the statement as correct, assuming, of course, that the Board had adopted the very latest and most improved appliances, and he would instruct his architect to specify Attix tube. During the gentleman's absence in Europe, we will suppose the house to have been built. Upon his return he finds that some of the circuits in the building will not work. He directs that the wires be withdrawn. But to do so he learns that a tube isn't always a tube. A workman with hammer and chisel digs out the wire and mutilates the building from attic to cellar. In that case I contend that the owner of that house has good and sufficient grounds for action against the Board. By its official promulgation it had declared a wire to be a tube. Upon that recommendation the owner had used what he presumed to be tube or conduit, but which was instead a braided wire tightly and immovably imbedded in the plaster."

The electrical construction and equipment companies who do the interior electrical work in New York will not be inconvenienced by the action of the Board. Mr. James F. Hughes, general agent of the Metropolitan Electrical Equipment Company, as a representative of this interest said:

"I have the highest personal regard for the inventor of Attix wire, and am glad to know that after years of persistent effort Mr. Attix has succeeded in making a wire that has received the approval of the Underwriters. In so far as this company is concerned, the policy heretofore existing will be continued. In wiring buildings already erected we shall continue to do our work in a first-class manner, using such grades of the best material, be it wire, molding, brass or iron-armored conduit, as the purchasers may desire. In new buildings we shall be governed solely by the architect's specifications. If Attix wire is specified we shall use it in accordance with the Underwriters' rules; if molding or conduit is specified we shall do likewise."

Work for Contractors.

The United States Treasury Department is inviting sealed proposals until 2 P. M. May 27, for wiring the United States building at Monroe, La., the court house and post office at Erie, Pa., the custom house at Philadelphia, Pa., and the United States public building at Paducah, Ky., for a system of electric lighting. Prospective bidders can obtain specifications and blank forms of proposals by addressing the custodians of the above named buildings. Proposals should be addressed to W. E. Curtis, Acting Secretary of the Treasury, Washington, D. C.

The Brooklyn Electrical Society.

This enterprising association of young electricians held its regular weekly meeting on Tuesday evening, May 14, in the lecture room of the Brooklyn Edison Electric Light Station. Mr. Nelson W. Perry had been announced to lecture on the subject of Induction, and this opportunity was embraced of returning the compliment to the electrical section of the Brooklyn Institute which had invited the society some months since to attend one of its lectures in a body. Invitations were therefore extended to the Institute, and many of its members availed themselves of the opportunity.

After discussing the ether and illustrating by means of a water analogy how waves were set up in this medium and by their means energy was radiated into space, the lecturer showed how these ethereal waves set electricity in motion in all parallel conductors with which they came in contact just as floating particles on the surface of the water were set in motion by water waves. This, he said, was the method by which currents were set up by induction. He then illustrated a number of very useful and novel applications of the principle of the Hughes induction balance. One of these was the location of bullets in the human body. Referring to the attempt to locate Guiteau's bullet in Garfield's body, the lecturer explained how to the ignorance and bungling of Garfield's physicians was due its failure. It seems that Garfield lay upon a metallic spring mattress on a brass bedstead and the electric probe located these rather than the bullet. An infallible instrument for detecting counterfeit coins was illustrated and explained and another, which should prove of great use to aurists, by which the acuteness of hearing could be most accurately determined. Another use suggested for this instrument was to determine the relative or absolute efficiencies of telephone instruments.

Finally the lecturer showed the operation of Dr. Lodge's coherer by which etheric waves set up by an induction coil spark some twenty feet away caused the closing of an electric circuit and the ringing of a bell. This was perhaps the first public exhibition in this country of Dr. Lodge's wonderfully sensitive instrument. The lecturer paid the society a compliment that all of the apparatus used was made by one of their members, Mr. M. R. Rodrigues.

At the close of the lecture Mr. Durant showed a number of beautiful Geissler tube effects which were much appreciated by those who were fortunate enough to be present.

The Bryant Switch Company Enjoined.

Judge Shipman, in the United States Circuit Court at Hartford, has granted a temporary injunction in the suit of the Edison Electric Light Company against the Bryant Electric Company of Bridgeport. C. E. Mitchell and Richard M. Dyer, of New York, appeared for the complainant, and Howson & Howson for the defendant.

Starting of the Niagara Plant Postponed.

Secretary Rankine of the Cataract Construction Company states that no power will be delivered until the second dynamo is set up and ready for operation. This seems to mean that notwithstanding the fact that the first dynamo is now ready no power will be delivered, even to local consumers, until perhaps August 1.

Toledo Combine Perfected.

All the electric light and railway companies of Toledo, with one exception, have finally been gathered into a consolidation scheme, of which Messrs. Ream and Hale, of Chicago, are the heads. The Robinson railway system is still out. New building and bonding will begin at once.

General News.

What is Going on in the Electrical World.

Coney Island, N. Y.—At the fire on the 16th the electric light plant was totally destroyed.

Earlville, Ill.—Waterworks and an electric light plant are to be introduced here at a cost of $18,000 or $20,000.

Little Valley, N. Y.—A committee has been appointed to look into the question of electric lights for this village.

West Burlington, Iowa.—The Burlington Improvement Society proposes to establish an electric lighting and street railway plant here.

Los Angeles, Cal.—Herman de Laguna has applied to council for a franchise to build and operate an electric railway in certain streets of this city.

Marietta, Ga.—The property and rights of the Marietta Electric Light Company have been transferred by foreclosure sale to James T. Anderson, for $4,500.

Dodgeville, Wis.—The city council has decided to advertise for bids for lighting the streets by electricity, and a committee has been appointed to prepare specifications.

Kansas City, Mo.—The solicitor for the Kansas City and Independence Air Line Railroad states that the Air Line will soon change its motive power from steam to electricity.

Ansonia, Conn.—Upon an order of the court the receiver of the Ansonia Electric Company will shortly pay a second dividend of 10 per cent. to the creditors and stockholders.

Oneida, N. Y.—As the summer approaches, interest in the proposed electric railway from this city to Oneida Lake is revived, and there is now a probability that the line will be built.

Alexander City, Ala.—At a mass meeting held here recently a committee was appointed to canvass the town and ascertain if sufficient money could be raised to put in electric lights.

Flagstaff, Cal.—J. D. Moore, of the Prescott Light and Power Company, has been canvassing the town with a view to putting in an electric plant. He will apply to the council for a franchise.

Brookfield, Mass.—A franchise has been granted to the Springfield, Warren and Spencer Electric Company, giving them the right of way for their road through the principal streets of this town.

Derry, N. H.—A considerable amount of the stock of the proposed Derry and Chester electric road has been subscribed for, and it is believed that the balance will be forthcoming at an early day.

Kutztown, Pa.—At a meeting of the Allentown-Kutztown Electric Railway Company here, on the 14th, it was determined to begin work on the line as soon as possible, rights of way having been secured.

Minneapolis, Minn.—An electric railway line to Lake Minnetonka is promised by Sir Charles Gibson, of St. Louis, the owner of considerable property at the lake, if he can arrange matters to his satisfaction.

Brattleboro, Vt.—The Electric Railroad Company will begin work at once on the construction of their trolley road in this town, the company having accepted the rules and restrictions of the selectmen.

Manchester, Conn.—Charles M. Jarvis, of East Berlin, Conn., temporary receiver of the Mather Electric Company, is to be made permanent receiver by the Superior Court. The works will continue to run.

Long Branch, N. J.—The Long Branch common council has refused to grant the petition of the West End and Long Branch Railroad to change its motive power to a trolley system. Long Branch is getting slow.

Pittsburg, Pa.—Consolidation of the several traction lines in this city is considered certain within a few months, the legal difficulties in the way of such a combination having been removed by recent legislation at Harrisburg.

Boston, Mass.—The bill to authorize persons or corporations, except a railway, engaged in the business of transmiting electricity for lighting or power to sell electricity for heating and cooking purposes has passed the House.

Charlottesville, Va.—The Piedmont Improvement and Construction Company have secured right of way for their electric car line through the grounds of the University of Virginia. It is expected that the line will be in operation by the middle of June.

Greensboro, N. C.—An ordinance has been prepared at the instance of the board of aldermen in regard to holding an election to ascertain the will of the citizens on the question of issuing bonds for the erection of an electric light plant by this city.

Monroe, La.—A number of business men of this city have applied to council for a franchise to build an electric railway to connect Monroe with the site of a new town laid out by the Pasqoud Land Improvement Company, about six miles distant.

Glen Cove, N. Y.—The Franklin Illuminating Company is erecting a 100 horse-power engine, to be used in furnishing light and power to Glen Cove. The monocyclic system will be used and a dynamo large enough to light 1 000 lights will be placed in the building.

Meridian, Miss.—S. H. Gehlman, of Springfield, Ill., and L. B. Bradley, of Peoria, Ill., have been awarded the contract for erecting an electric plant and to furnish the city with seventy-five arc lights at $800 per month, and also the contract for an electric railway.

Portland, Conn.—It is reported here that the Portland Electric Railway Company will begin shortly the construction of a road from the Portland dock to Glastonbury to connect there with the Hartford electric road. The road will be completed by the 1st of October and will be six miles in length.

Mitchell, S. D.—The plant and franchises of the Mitchell Electric Light Company have been sold by the owners to M. B. Cleminger of this city, the price paid being $15,000. The company held a twenty years' franchise and also a contract for lighting the city at $140 per month for the same length of time.

Elk Point, S. D.—C. A. Potter, of the firm of M. B. Potter & Company of New York, has proposed to this city that if it will grant a 50-year franchise and will agree to pay for a certain number of arc lights, they will put in an electric and waterworks plant to cost $30,000. The proposition will probably be accepted.

Baltimore, Md.—The Maryland Electric Company have under consideration the erection of new electric light plants in this city and are in consultation with the Fort Wayne Corporation about the equipment. The Fort Wayne Company has since its incorporation erected sixteen such stations as is contemplated in Baltimore.

Commerce, Tex.—Imboden & Canto, of Fort Worth, have made a proposition to the citizens of Commerce to put in a $30,000 cotton seed oil mill and electric light plant, they to take one-half of the stock and the citizens one-half, the same to be in operation for the fall crop. A committee was appointed to secure the required stock.

New Haven, Conn.—The Fair Haven and Westville Railroad Company has completed the purchase of the charter of the New Haven and North Haven Electric Street Railroad Company. A large tract of wooded land at the terminus of the proposed road in Montowese has been purchased by the company and it will be fitted up as a picnic ground.

Orlando, Fla.—A party under A. L. Hunt, have made a preliminary survey of the proposed route for an electric railway between Sanford and Orlando. There is said to be sufficient financial backing to the enterprise to insure the prompt construction of the road. G. W. Henck, of Longwood, Fla., is the general agent for the non-resident capitalists.

Elyria, O.—Ex-Congressman Tom L. Johnson is the authority given for the statement that an electric railway, to be the fastest in the world, will be built from his steel plant near this city to Cleveland, twenty five miles. The road is to be constructed with a view to obtaining the greatest possible speed, and it is expected that the distance will be covered in thirty-five minutes.

Hempstead, N. Y.—A New York electrical engineer has been visiting this place with a view of purchasing the plant of the Ball Electric Light Company for some New Jersey capitalists who propose to establish an electric railway in the county and utilize the plant in furnishing power for the railway as well as light for the village.

Vicksburg, Miss.—The city council has reconsidered its previous action awarding the contract for lighting the city to the Vicksburg Electric Light Company, and rescinded it. It is likely that an amicable arrangement will be effected, and that the company will get the contract on a moonlight instead of an all-night schedule.

Salt Lake City, Utah.—A new electric light plant is to be put in here by Messrs. Boettcher and Hunter, to utilize the rights and franchises of the Citizens' Electric Light Company. A site for the necessary buildings has been purchased, and a contract has been entered into with Henry A. Roemisch for the construction of the power house, etc.

Alton, Ill.—It is understood that the Alton and Upper Alton Street Railroad and Carrying Company and the Middletown Street Railroad Company are to be consolidated as one company under the former name, Wm. Eliot Smith to be the principal stockholder. The Middletown street and Second street car lines, now operated by motor and horse power, are to be changed to electric lines.

Clinton, N. Y.—Prof A. G. Benedict, of Houghton Seminary, was chairman of a meeting held here a few evenings since for the purpose of getting an expression of opinion relating to the building of an electric road from Clinton to Utica. The meeting was unanimous in favor of the project and committees were appointed to procure information, subscriptions and rights of way.

Niagara Falls, N. Y.—The Cataract Construction Company has men at work beautifying the grounds around the great power-house, while inside the building the second big dynamo is being set up, and the switchboard and other electrical apparatus put in place. It is thought that the company will be able to furnish power to outsiders by the last of July.

Montclair, N. J.—The newly incorporated Electric Light and Power Company of Montclair does not intend to ask for a franchise to light the streets this year, but the main object is to supply light and power to residences and stores. It will, however, put in a plant to supply arc as well as incandescent light, so as to be able to light the streets at some future time.

Cleveland, O.—The Walker Manufacturing Company is building two electric generators of 1,000 H. P. each and two of 500 H. P. each for H. A. Everett's street railroad in Detroit. The company has about thirty generators under construction aggregating 15,000 H. P., and is turning out six motors daily for the Chicago City Railway Company. The works are in operation night and day.

Waco, Tex.—Judge Goodrich has approved the sale of the Waco Electric Railway and Light Company's property to President Henry C. Scott of the Citizens' Street Railway, and the entire street-car system of Waco will now be conducted under his management. The light plant of the sold-out company has been purchased from Mr. Scott by the Waco Gas Company.

Hagerstown, Md.—Mr. Powell Evans, representing a Philadelphia syndicate, has been granted permission to erect poles and string wires along the roads of the county and the streets of Hagerstown for the purpose of conducting and supplying electrical power for all purposes, the power to be obtained from dam No. 4. or dam No. 5 on the Potomac river. Mr. Evans says the power at dam No. 5, where there is a heavy fall, is equal to 3,000 H. P.

Richmond, Va.—The council committee on streets have decided to recommend the Jenkins underground electric system for the Broad street car line, and suggest that the line be extended from its present terminus to the Exposition Grounds and to Chimborazo Park.—A resolution has passed the council appropriating $500 for the purpose of having plans and specifications drawn for an electric light plant of 600 arc-light capacity.

Reading, Pa.—A resolution of councils passed a few days ago requires the appointment of a committee "to inquire into the light question and communicate with electrical construction and other light companies with a view of ascertaining what the cost of construction and outfit of a plant would be and as to the feasibility of the city constructing its own light plant, and such other and necessary information as the facts of the case may warrant and require."

Wabash, Ind.—Capitalists in the Indiana oil belt are after a franchise to build an electric line from Bluffton to Camden, using the right of way of the Cincinnati, Union and Chicago Railroad which was abandoned last winter. The length of the proposed road is eighteen miles, and it is the intention of the projectors to lay out a park, construct a large lake and make an attractive pleasure resort six miles from Bluffton.

Kokomo, Ind.—Capitalists of this place have secured a franchise and right of way for an electric line from Kokomo to Greentown, to be constructed this summer. It is the purpose of the company to extend the system to Sycamore, West Liberty and other towns, and to connect with the projected electric lines in Grant, Delaware and Madison Counties. When these are completed the Indiana gas belt will be a network of electric railways.

Camden, N. J.—At the annual meeting of the directors of the Camden, Gloucester and Woodbury Electric Railway, held recently, the following officers were elected for the year: President, J. Willard Morgan; secretary, Thomas P. Curley; treasurer, William J. Thompson. Directors: Henry J. West, George H. Barker, Abram Townsend, David Baird, Gustavus S. Muller, Thomas P. Curley, J. W. Morgan, Henry M. Harley and W. J. Thompson.

Atlanta, Ga.—The Electrical Building is the first of the Exposition Buildings to be completed. It is considered a very pretty building and spacious enough to contain all the exhibits that are likely to be sent.—The South is evidently endeavoring to "keep up with the procession," and Atlanta never drops far from the music. The Atlanta Consolidated Street Railway Company has lately added to its rolling stock several elegantly constructed cars for the accommodation of "trolley parties" and picnickers.

Chicago.—The Western Electric Company has been granted a permit to erect an eight-story and a two-story brick building at 242 to 258 Jefferson street. They are to be used as a factory, offices and blacksmith shop and will cover an area of 180 by 49 feet and 50 by 50 feet, the latter being the two story building used as the blacksmith shop. The total cost will be $140,000. The same company also secured a permit to build two additional stories on their factory at 37 and 39 West Congress street.

Norfolk, Va.—Electrical equipment is to displace steam power on the Norfolk and Ocean View Railroad. The road connects Norfolk with Ocean View, a seaside resort twelve miles distant, and it has been operated by steam for over fifteen years, making connections with the Seaboard Air Line, Norfolk and Western and other roads touching at Norfolk. Forty-foot cars with 100 horse power motors are to be employed, with three or four trailers, practically making a trolley train. The road handles considerable freight.

Vancouver, B. C.—F. S. Barnard, M. P., manager of the Consolidated Railway and Light Company, has made a proposition to the New Westminster city council to the effect that if a bonus be given to him by the city he will put up a new generating plant on Seymour Creek where water power is obtainable, and supply electric light to the city at 25 per cent. less than it is at present paying and also furnish power for the Vancouver and Westminster electric railway lines.

New Brunswick, N. J.—The new owners of the City Railway, the Kreuger-Radel syndicate, have organized by electing the following officers: President, Judge Gottfried Kreuger; vice-president, John Radel; secretary and treasurer, Edward Radel. The company will change the horse car line into an electric railway, and intends after a franchise is granted to run its tracks from New Brunswick to Milltown, South River and South Amboy.

New York.—The Edison Electric Illuminating Company of New York reports for April: Gross earnings, $129,277; increase, $13,066. Operating expenses, $60,876; increase, $10.915. Net earnings, $68,401; increase, $2,152. Other income, $3,802. Total, $72.203; increase, $5,954. January 1 to April 30: Gross earnings, $570,225; increase, $82,167. Operating expenses, $267,954; increase, $56,271. Net earnings, $302,271; increase, $25,996. Other income, $22,044. Total, $324,315; increase, $48,040.

Portland, Ore.—The General Electric Company has begun a suit here against the receiver of the O. R. and N. Company, to recover $63,016.43 for the loss of nine carloads of electrical machinery destroyed by fire at Albina. Judgment is asked for the value of the damaged goods at the factory at Lynn, Mass., for freight paid on the damaged goods from Lynn, Mass., to Portland, for freight paid on reshipment of certain of the machinery to the factory in order to have the destroyed parts rebuilt, and for damages for six months' delay in completing the electric-power plant.

Harrisburg, Pa.—The East Harrisburg Passenger Railway Company and the Citizens' Company are to be consolidated under the title of the Harrisburg Traction Company, and will be operated after June 1 under one management. The new company will have a capital of $1,500,000, of which $1,240,000 is divided among the East Harrisburg stockholders and the remaining $260,000 among the Citizens' stockholders. The company will control all of the tracks that are at present in use here, and will make extensive improvements.

Shelbyville, Ind.—B. S. Sutton, of this city, A. A. Hackman, of Oldenburg, and John Hildebrand, of Batesville, have organized the Batesville and Oldenburg Steam and Electric Railway Company, which starts with a capital stock of $100,000. The projectors have obtained the right of way from the Batesville and Oldenburg Turnpike Company, and will build an electric line between the two towns. The company expects to extend the line during the summer to Osgood and then to Versailles, and later from Oldenburg to Brookville. A power house will be built at Batesville, and later one at Osgood.

Cincinnati, O.—The annual union meeting of the Brush Electric Company, the First Cincinnati Electric Illuminating Company, and the Heuss Electric Company, was held here on the 8th inst. The following officers were elected to serve for the three companies; A. Hickenlooper, president; C. F. Hesser, vice president; Charles J. Foust, treasurer and assistant secretary; Harold Ryland secretary and assistant treasurer.—The Cincinnati, Middletown and Dayton Street Railroad Company is busily engaged in getting consents for the proposed line through to Dayton. The line as surveyed will go by way of Paddock Road to Carthage, O.

Rochester, N. Y.—Proposals will be received at the office of J. Foster Warner, architect, 1,036 Granite Building, Rochester, for all the work and materials required for interior finishing of a fireproof court house for the county of Monroe, in the city of Rochester, N. Y. Each bid must be in gross for the whole work, which includes plastering, papier mache, marble work, carpenter work, plumbing, elevator enclosures, stairs, skylights, electric lighting, wires, etc. Each bid must be accompanied by a certified check for $10,000. The right is reserved to reject any or all bids.

Wiscasset, Me.—The Maine Water and Electric Power Company have a scheme in hand which, if carried out, will have an important bearing on the prosperity of this locality. The plan is to acquire the water power on the Sheepscot River between Cooper's Mills and Wiscasset. These powers the company proposes to improve by the erection of dams and the construction of canals, etc. Then they hope to induce manufacturers to locate along the river and use the power. Several manufacturing concerns in other States are understood to be examining the location of the company's proposed works with a view to erecting mills. The prime movers in this enterprise are Pennsylvania men, and associated with them are Henry Ingalls of Wiscasset and Dr. Card of Alma.

Santa Fe, N. M.—The Santa Fe and Cochiti Railway Company and the Rio Grande Electric Power and Irrigation Company have filed articles of incorporation here. The two companies are practically one corporation. One feature of the plan of the promoters is the construction of a railway and telegraph or telephone line from Santa Fe westward by the most feasible route to a point on the eastern bank of the Rio Grande nearly opposite to the mouth of the Canon de Cochiti, and thence, crossing the river and continuing in a westerly direction, to Allerton and up Pino Canon to Bland, which is located at the very heart of the Cochiti mining district. The distance from Santa Fe to the river is about twenty miles and from the river to Bland is about fifteen miles. Another feature is the building of dams on the river at White Rock Canon and the utilization of the great water power obtainable in the generation of electricity. Among the incorporators are Alexander H. Handlan, jr., and Thomas W. Murray, of St. Louis; Levi Ellis, of New York; James H. Purdy, a well known local attorney, and Herman Claussen, proprietor of the Palace Hotel, Santa Fe.

Telephone and Telegraph.

Wires are being put up for a new telephone system in Demopolis, Ala.

Most of the $5,000 capital stock of the Wayne County Telephone Company, of Clyde, N. Y., has been subscribed.

The Electric Railway Company at Leavenworth, Kan., is stringing wires for a telephone system in connection with its street car line.

The attempt in the Select Council at Philadelphia to repeal the ordinance granting a franchise to the Mutual Automatic Telephone Company failed—for repeal, 7; against, 21.

The International Bell Telephone Company (limited) has filed with the Secretary of State at Albany a certificate of reduction of capital stock from $1,700,000 to $1,000,000.

A local telephone company has been organized at Sacramento, Cal., to compete with the Sunset Company, a Bell concern. The new company has asked the council for a franchise.

The Westchester Telephone Company, Yonkers, N. Y., has reduced its rates and adopted a graded system by which charges are based upon the amount of use or number of calls made.

Moved to action by the fact that a rival company has obtained a franchise to build a line in Rahway, N. J., the New York and New Jersey Telephone Company is entirely renewing its system in that town and substituting cables instead of the ordinary wire.

The Trinity Church corporation has extended the lease granted to John W. Mackay for the ground on which the Postal Telegraph Building, cor. Broadway and Murray street, New York, was provisionally erected, twenty years at an annual rental of $52,500.

The Northwestern Telephone and Construction Company have begun work in Osage, Iowa, erecting poles and wiring the place for a system of telephones. Connection will be made with Charles City and Mason City and with nearly every town in the county.

The Chester Mutual Telephone Exchange of Chester, Ill., has been organized with Dr. William A. James as president; E. W. Abrams, vice-president; Louis Heltman, secretary and treasurer. Contracts have been let for the erection of the system, to be completed by July 15.

The Co-operative Telephone Association of Shreveport, La., has contracted with the Brown Electric and Machinery Company of Little Rock, Ark., for a plant and central office, with equipments for 359 telephones, including the erection of the line and its connections at all points in the city.

A telephone system is being put in in the Temple at Boston to enable those in the lower temple and Temple College, at the overflow meetings, to hear the pastor's voice simultaneously with the delivery of the sermon in the Temple proper. Tests already made indicate that the system will be a success.

The Crookstown Telephone Company of Crookstown, Minn., has arranged to extend its line to Fisher, Mallory and Grand Forks. It is the intention of the company to ultimately extend its system to the towns upon the Fosston extension and connect with those along the Thief River Falls and at St. Vincent.

The Detroit Telephone Company, incorporated at Detroit, Minn., has elected officers as follows: President, T. A. Nottage; secretary, J. K. West; treasurer, J. E. Furber; trustees, W. E. Reed, E. McNeil and C. K. Day. The company will put in and operate a telephone system between Detroit and Lake Melissa and probably extend the line to Fargo, N. D.

The Wizard Telephone Company has asked the city council of Council Bluffs, Iowa, for the right to establish a telephone system in that city, but the ordinance prepared by the council is so restrictive that the company is not likely to accept it. The ordinance stipulates that the company "put its wires in alleys wherever practical" and "underground whenever ordered by the council," and limits the term of the franchise to ten years.

The telephone system to Morgantown, W. Va., has been completed, putting in communication with one another the towns of Morgantown, Fairmont, Grafton, Clarksburg, Parkersburg, W. Va., and Uniontown, Pa. It is the intention of the company to extend the system to Pittsburg, and include all the towns along the Fairmont, Morgantown and Pittsburg Railroad. It will also reach the remaining towns in Central and Western West Virginia.

The Harrison Telephone Company of Owensboro', Ky., has filed articles of incorporation. Its capital stock is $20,000. Capital is furnished by the following local people: R. Monarch, J. R. Lancaster, J. H. Parrish, Z. T. Robinson, Lawson Reno, J. W. Carter, J. D. Powers, E.H. Luckett and Wilfred Carico. The new company will have a rate of $30 per year for business houses and $18 for residences. The cut will be met by the Bell Company.

At the annual meeting of the stockholders of the Rochester District Telegraph Company at Rochester, N. Y., directors and officers were elected as follows: President, S. B. Gifford; vice-president. C. A. Tinker; secretary and treasurer, G. D. Butler. The remaining directors are: A. Erickson Perkins, J. C. Kalbfleisch, T. Barnard and G. V. B. Frost. It was reported that the messengers of the company are being equipped with bicycles for the purpose of expediting the service.

The Drawbaugh Telephone Company, which is asking permission to construct a telephone system in Philadelphia, was incorporated in 1893, with a capital of $2,000,000. The management is composed of J. F. Stokes, president; Charles A. Gladding, secretary; John D. Ford, treasurer; Brinton N. Newcomb, general manager; Samuel L. Kent and William O. Hempstead. The ordinance granting the company the right to establish its system has just been ordered by councils' electrical committee to be reported to councils with a favorable recommendation.

The Mutual Automatic Telephone Company is getting a large number of subscribers in Buffalo, N. Y. Its contract with applicants gives a rate of $36 a year for business places and $30 for residences, and one of the principal conditions is that the contract "shall not be binding upon the subscriber until 2,000 subscribers shall have been obtained, nor until the right to erect and maintain the company's wires in the city of Buffalo shall have been granted by the municipal authorities and accepted by the company, nor shall this contract be binding unless said company or its assigns commence to lay its wires and make substantial progress within six months after said grant."

The stockholders of the Baxter Overland Telephone and Telegraph Company held their annual meeting at Utica, N. Y., last week and elected officers as follows: President, C. W. Mather; vice-president, J. B. Turnbull; secretary, A. W. Mills; treasurer, T. J. Griffiths. Executive Committee: Louis Friede, S. Mansbach and Counteil Munson. Directors: C. W. Mather, J. B. Turnbull, Benjamin D. Gilbert, Clayville; Palmer M. Wood, Herkimer; T. Jay Griffiths, A. W. Mills, M. O. Terry, Louis Friede, Countcil Munson, S. Mansbach and Chas. L. Sharp. A committee was appointed to confer with an electrical expert and procure estimates as to the probable cost of placing the plant of the company in operating order.

The company recently incorporated at Madison, Wis., to be known as the Standard Telephone and Electric Company, will use the "Milde" long-distance microphone, which has been adopted by the French houses of Parliament, the Admiralty and War Offices, Post-office and Telegraph department, the Paris telephone exchange, railway companies, public institutions, etc., also by the British, Italian, Spanish and South American Governments, the Norwich Telephone Company, the telephone companies of Italy and Egypt, and generally by the railroads, corporations, collieries, etc., throughout France and England. One of the features of the "Milde" telephone is that it is both long and short distance, needing no regulation. The new company has absorbed the Standard Telephone and Electric Company of Minneapolis, Minn., which has been making the French telephones in this country for about five months, and will remove the plant to Madison. The officers of the new company are: President. P. L. Spooner, Madison; vice-president, B. B. Clarke, Madison; secretary, E. W. Batchelder, Minneapolis; treasurer, R. M. Lamp, Madison; electrician, H. C. Dodge, Minneapolis.

COMMERCIAL PARAGRAPHS.

It is always well to have a rule to go by. Warren & Lozier, the electrical repairmen of 465 Greenwich street, New York, think so and have been supplying their friends in the trade with a useful one. It is 12 inches long and bears legends that call to mind what the donors are here for.

The Manhattan Electrical Supply Company, 32 Cortlandt street, New York, have issued an elaborate and handsomely illustrated catalogue descriptive of the complete lines of electrical supplies handled by them.

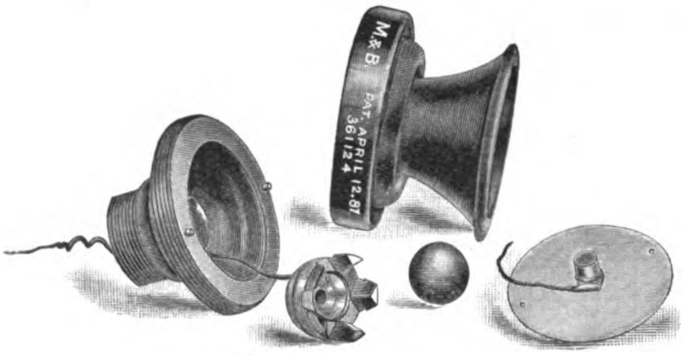
Eugene Munsell & Co., 218 Water street, New York, miners, importers and wholesale dealers in electrical Mica, are issuing, from time to time, descriptive and up-to-date lists of their products. This company procures all its supplies direct from the mines and in dealing with buyers reaches first hands, and not middlemen.

The C. W. Hunt Company, 45 Broadway, New York, the leading manufacturers of industrial railways, have issued an illustrated catalogue that should be in the hands of every power station manager in the country.

The Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, are advising their customers and the trade generally that while they are willing to meet competitive prices on high-grade rubber wire, the National India Rubber Company, manufacturers of N. I. R. Wire, will not enter competition upon the low grade of cheaper wires that have been foisted on the market. They prefer to keep up the high standard of this wire, feeling that in the long run it will be to the advantage of the business at large and the wire trade in particular.

The M. & B. Transmitters.

The M. & B. Transmitter is not a Blake, not a Hunning, not a granular carbon (solid back), and in fact, not like any other ordinary type; but it is claimed to be the most simple, perfect and reliable transmitter possible to construct. The accompanying cut shows the transmitter dismantled. The diaphragm is of India mica, a highly resonant material which gives great efficiency. Attached to the center of this diaphragm is a small aluminum cup holding a carbon or other suitable point. In front of the black rubber shell is shown the basket or runway of aluminum or metal. The sphere shown in the cut may be of carbon or other material, which normally lays in the basket or runway, which is so constructed that no matter which side of the transmitter is up the sphere rests on a plane that is always inclined towards the diaphragm. When these parts are assembled the point on the diaphragm comes about on a level with the center of the sphere, which, owing to the angle of the side of the basket or runway, is kept against this point by gravity. With every oscillation of the diaphragm a movement of this sphere takes place which breaks the battery current, hence the name "Make and Break" and the well-known sign "M. & B."



M. & B. TRANSMITTER.

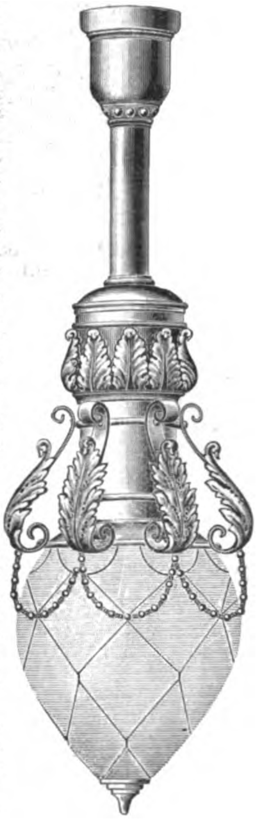
It will be readily seen that the M. & B. Transmitter is indeed novel in every detail, that the electrodes are not in constant contact, and that by it an intermittent or pulsatory current is produced instead of the undulating or vibratory as is used by the ordinary form of transmitter. The M. & B. principle is set forth in the first claim of the broad method patent No. 361,124 under which these transmitters are constructed. The claim reads:

"The art or method of transmitting vocal or other sounds telephonically by causing intermittent or pulsatory currents of a uniform volume or intensity, and of durations corresponding to the phases of the oscillation of the diaphragm."

The practical results obtained by this form of transmitter, which shows its superiority over other kinds, are: 1st, Articulation, which is claimed to be better and more perfect. Every syllable, whether a shout or a whisper, is transmitted clearly and distinctly. There is no running together of words nor confusion of sounds; 2d, Volume. While the volume of sound is great, yet there is no sputtering, snapping or "frying" sound, which is so annoying in some well-known transmitters; 3d, Long Distance Transmission. Every M. & B. Transmitter is a long-distance instrument; 4th, Simplicity of Construction. There is nothing to get out of order; no adjustments to be made; no springs to give out; no "packing," and no plastic material to change in density. In fact, it is claimed the M. & B. can never get out of order or wear out. This means a great saving to exchange managers, and to private users it means still more, as they often have no one who could adjust or patch up their telephone when they get in "trouble."

The United States Telephone Construction Company of Philadelphia, who control the M. & B. Transmitter, invite competitive tests as to all their points of superiority. These transmitters are covered by over ten construction patents, with others pending, besides the broad method patent mentioned before and issued April 12, 1895, so that users of these instruments are perfectly safe from any fear of suits on patent questions.

Arc Lamps and Fixtures.



The accompanying illustration shows but one of the great variety of styles of Arc Lamps for constant potential circuits made by the General Incandescent Arc Light Co. R. B. Corey, general sales agent of this company, has compiled an elaborate and attractive catalogue, embracing illustrated descriptions of lamps, ornamental brackets, pole fixtures and other accessories.

The accompanying illustration shows an ornamental type of rack rod lamp for 100 to 220 volt direct current circuits. It is similar in style and finish to the lamps made for alternating current circuits. These lamps are made in either short, regular or long lengths, and pass 6, 8 and 10 amperes and burn 7, 11 and 14 hours respectively.

Interior arc lighting has assumed such proportions that the necessity for lamp brackets of ornamental design has long been apparent. The catalogue in question devotes considerable space to the illustration of a variety of brackets of both plain and ornamental designs.

These brackets are made of wrought iron and are as well adapted for outdoor service as interior lighting.

The street lamp pole fixtures are made of wrought iron pipe with cast cross-pieces, strength and durability being the chief points sought in their construction.

Manhattan General Construction Company.

The Manhattan General Construction Company have moved their offices from 50 Broadway to the Edison Building, 44 Broad street, New York.

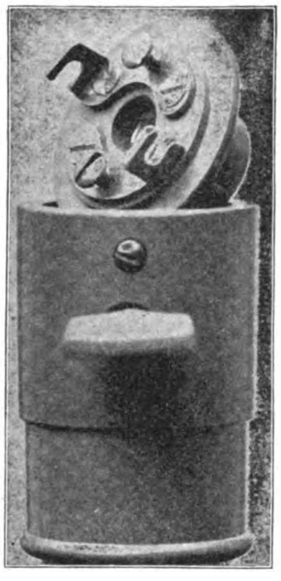
A Non-Conducting Socket.

In interior wiring electricians have long felt the need of a lamp socket made of non-conducting material. Several such sockets have been designed, but in their manufacture no effort has seemingly been made to produce an article that will harmonize in dimensions or finish with the elaborate and artistic electric lighting fixtures now so largely used.

In the Non-conducting Socket, shown in the accompanying engraving, tastefulness of design has not been made subordinate to the other and marked advantages the socket possesses. The socket shell is made wholly of hard rubber, highly polished. It consists of two parts. The base has attached to it two brass ears to which the terminals of the conductors are fastened by binding screws.

The ears have projections which, when the cap is in place, engage with lugs in the body of the socket. None of the conducting parts are exposed to contact with external objects. The shell being of non-conducting material, it is impossible for a short circuit from one conductor to the shell to take place, as is a common occurrence with brass shell sockets.

The simplicity of wiring the socket will certainly commend it to wiremen. By removing the base the process of wiring is reduced to the simple operation of placing the conductors under the binding screws and fastening them down with a screwdriver.



NON-CONDUCTING SOCKET.

The socket is suitable for use in all classes of interior or exposed work. It is made in all finishes such as brass, silver, oxidized, etc., to harmonize with fixtures, to which it is attached in the same manner as brass sockets. The socket is the invention of Charles H. Balsley, of Connellsville, Pa., and is made and sold by Balsley & Bryner of that place.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

MAY, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	......	1	......
2	12.40 A. M.	2	4.00 A. M.
3	1.10 "	3	4.00 "
4	1.30 "	4	4.00 "
5	2.00 "	5	4.00 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	7.30 P. M.	9	9.30 P. M.
10	7.30 "	10	10.30 "
11	7.30 "	11	11.30 "
12	7.30 "	13	1.00 A. M.
13	7.40 "	14	1.10 "
14	7.40 "	15	1.40 "
15	7.40 "	16	2.00 "
16	7.40 "	17	2.20 "
17	7.40 "	18	2.40 "
18	7.40 "	19	3.00 "
19	7.40 "	20	3.20 "
20	7.40 "	21	3.40 "
21	7.40 "	22	3.40 "
22	7.50 "	23	3.40 "
23	7.50 "	24	3.40 "
24	7.50 "	25	3.40 "
25	7.50 "	26	3.30 "
26	9.00 "	27	3.30 "
27	10.00 "	28	3.30 "
28	10.40 "	29	3.30 "
29	11.00 "	30	3.30 "
30	11.10 "	31	3.30 "
31	11.40 "	Jne 1	3.30 "

INCORPORATIONS.

The Wood County Telephone Company, at Grand Rapids, Wis. Capital stock, $5,000. Incorporators: John A. Gaynor, H. H. Voss and George L. Williams.

The Bissell, Dodge and Erner Company, Toledo, Ohio—to manufacture, repair and deal in all kinds of electrical and other machinery, tools, equipments, etc., also build, contract and construct all kinds of electrical and other mechanical plants, etc. Capital stock, $25,000. Promoters: Fred'k Bissell, Fred'k H. Dodge, Jno. A. Erner, A. W. Scott, G. G. Kelp.

The Cable Insulator Company, Saco, Maine—to manufacture and deal in insulators and electric appliances of all kinds. Capital stock, $10,000. Promoters: Samuel Oakman, Wingate P. Sargent, Melrose, Mass.; Jas. R. Powers, Boston Mass.

The William's Bridge Gas and Electric Light Company—to manufacture and use electricity for producing light, heat or power in the village of William's Bridge, Westchester County, N. Y. Capital stock, $30,000. Directors: Charles H. Royce, William L. Johnson, James Thatcher, Franklin Paddock, of New York City; and J. F. Tracy, of Larchmont, N. J.

The Citizens' Telephone Company—to operate telephone lines in Marion, Bartholomew, Jackson and Johnson Counties, Indiana. Capital stock, $15,000. Directors: Andrew E. Reynolds and Carl L. Rost, of Crawfordsville, and George W. Caldwell, of Columbus, Ind.

The Tacoma, Burnt Mills and Sandy Springs Railway Company, of Montgomery County, Md.—to construct and operate an electric railway from near the District line in Montgomery County to Ellicott City by way of Sandy Springs. Capital stock, $100,000. Incorporators: J. B. Colegrove, M. F. Sliney, Allen Freas, F. Ray Keys and B. H. Colegrove.

The Topeka Electric Railway Company, Topeka, Kan.—to construct and maintain railway from Topeka to Rossville, street railways, etc. Capital stock, $75,000. Promoters: A. J. Arnold, T. M. James, Louis Stair, Francis C. Downey, Topeka.

The La Salle Construction Company, Chicago, Ill.—to construct railroads or tramways to be operated by steam, electricity or other motive power, etc. Capital stock, $100,000. Promoters: W. E. McClurg, C. H. Bumstead F. S. Donnell.

The Greenville Electric Light, Heat and Power Company, Greenville, Ill.—to erect, construct and maintain an electric plant for the generation, transmission and sale of electricity for light, heat, power, telephone and all other purposes. Capital stock, $25,000. Promoters: Ernest C. Bruckman, Samuel E. Bruckman, Alice H. Bruckman.

The People's Telephone Company, Haverhill, Mass.—to transmit intelligence by electricity and deal in telephone instruments, etc. Capital stock, $1,000. Promoters: Edw. H. Hoyt, Philip C. Sweet, Franklin Woodman.

The Montclair Light and Power Company, Montclair, N. J.—to construct, maintain and operate an electric light and power plant in Montclair, N. J. Capital stock, $50,000. Promoters: Geo. F. Baker, Chas. C. Coe, New York, N. Y.; W. G. Snow, Chas. D. Backus, Montclair, N. J.

The Inter-Urban Rapid Transit Company Tiffin, Ohio—to construct, acquire and operate street railway or railways in and between the cities of Tiffin and Fostoria, Ohio, electric, steam, cable, horse, or other motive power to be used in operating. Capital stock, $250,000. Promoters: Meshech Frost, Amandus Betts, Norman McCarty, Lewis Selle, W. F. Noble.

The City and Prospect Heights Street Railway Company, Peoria, Ill.—to construct, maintain and operate a street railway by horse, dummy, or electricit . Capital stock, $150,000. Promoters: Wm. S. Turner, Chas. Edwards-Woodbridge, Jno. C. White

The McKeesport and West Newton Passenger Railway Company, McKeesport, Pa.—to build a passenger railway operated by electricity in Westmoreland County, Pa. Capital stock, $60,000. Promoters: Homer H. Swaney, Jos. R. Henderson, F. W. Patterson, McKeesport.

The Citizens' Railway Company, Denver, Col.—to build and operate electric railway lines connecting Denver with other towns in Jefferson and Boulder Counties, Col. Capital stock, $500,000. Promoters: Milo A. Smith, Chas. E. Hawver, E. S. Smith, Clarence M. Cobb, Thos. W. Porter, all of Denver.

The La Crosse, Black River Falls and Millsville Electric Railway Company, La Crosse, Wis.—to build an electric road from La Crosse to Millsville. Capital stock, $300,000. Promoters: N. Clark, P. McHugh, Wm. H. Polleys, T. J. McHugh, Wm. Burns, La Crosse.

The American Union Telephone Company (incorporated in W. Va.), New York, N. Y.—to lease and dispose of telephones, telephone switches, electrical appliances, etc. Capital stock, $5,000,000. Promoters: Michael P. O'Connor and John A. Wallace, New York City; Franklin Noble, Brooklyn, N. Y.

The National Electrotype Company, Chicago. Capital stock, $5,000. Incorporators: C. J. W. Harders, Albert E. Flig, Rudolph Morstadt.

The Automatic Long-Distance Telephone Company, Chicago. Capital stock, $5,000,000. Incorporators; Cleveland F. Dunderdale, John F. Pershing and Stephen W. Groesbeck.

The Delany Heater and Rheostat Company of New York City—to manufacture and deal in all kinds of machinery. Capital stock, $100,000. Directors: J. R. Steers, J. M. Delany and E. T. Birdsall, of New York City.

The Naugatuck (Conn.) Electric Light Company has increased its capital from $30,000 to $50,000.

The Shelby Electric Railway Company, Shelby, Ohio—to construct and operate a line of railway, electric, steam or other motive power, in and between Shelby, Annapolis and Olivesburg, in Richland and Crawford Counties, Ohio. Capital stock, $10,000. Promoters: S. S. Bloom, Albert Moore, C. S. Holbrook.

The Ticonderoga Telephone Company—to maintain and operate a line of telephone from Addison Junction to Rogers Rock Hotel, Strent Road, Crown Point, Port Henry, Chilson, Schroon Lake, Whitehall, Hague, Bolton, Caldwell and Olena Falls. Capital stock, $5,000. Directors: W. W. D. Jeffers, W. I. Higgins, C. B. Bascom, R. C. Bascom, E. J. Owen, F. L. Brust, A. H. Weed, C. H. Delano and F. W. Hyde, all of Ticonderoga, Essex County, New York.

The Stromberg-Carlson Telephone Manufacturing Company, Chicago, Ill.—to manufacture and sell electrical and mechanical apparatus and appliances, and to construct telephone exchanges. Capital stock, $50,000. Promoters; Alfred Stromberg, Androv Carlson, Arthur B. Cotton.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MAY 14, 1895

ELECTRIC RAILROADS AND APPLIANCES.

539,184. Closed-Conduit Electric Railway. Paul Lucas, Berlin, Germany. Filed June 23, 1894.

539,242. Car-Wheel for Electric Cars, etc. Charles Thompson, Oswego Falls, assignor of one-half to George J. Emeny, Fulton, N. Y. Filed Nov. 22, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

539,150. Electric Lamp. William H. Sheppard, New York, N. Y. Filed Nov. 20, 1894.

539,365. Electric-Arc-Lamp Clutch. William B. Luce, Brookline, Mass., assignor to E. S. Ritchie & Sons, same place. Filed March 15, 1894.

539,392. Arc Lamp. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed April 5, 1894.

539,393. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed July 2, 1894.

DYNAMO ELECTRIC MACHINERY.

539,022. Method of and Means for Assembling Commutator-Segments. Asa F. Batchelder, Schenectady, N. Y. Filed Feb. 28, 1895.

539,032. Carbon-Brush Holder for Dynamos. Winfield S. Bosley, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Sept. 8, 1894.

539,277. Electric Motor. John C. Lincoln, Rochester, N. Y., assignor to L. S. Graves & Son, same place. Filed Jan. 16, 1892.

539,293. Controller for Electric Motors. Horace F. Parshall and John W. Darley, Jr., Lynn, Mass., assignors to the General Electric Company, of New York. Filed Feb. 11, 1893.

539,369. Means for Effecting Synchronism. James H. Rogers, Washington, D. C., assignor to the Visual Synchronism Company of West Virginia. Filed Dec. 29, 1888.

539,376. Starting-Box for Electric Motors. Donald M. Bliss, Boston, Mass., assignor to the Holtzer-Cabot Electric Company, same place. Filed Feb. 20, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

539,068. Telephone. Morris Martin, Malden, Mass. Filed Nov. 10, 1886.

539,086. Telephone-Transmitter. Robert F. Rice, Hartford, Conn., assignor to Francis H. Richards, same place. Filed May 18, 1893.

539,142. Telephone Circuit and Apparatus. Charles W McDaniel, Kansas City, Mo. Filed March 16, 1895.

539,163. Telephone-Transmitter. Alfred C. Brown, London, England, assignor of one-half to George Richard Neilson, same place. Filed Sept. 27, 1894.

539,170. Magneto-Call Apparatus. Frank B. Cook, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed Dec. 26, 1894.

539,274. Mounting for Telephones. Thomas Kelly, Philadelphia, Pa. Filed Sept. 8, 1894.

SIGNALS AND SIGNALING APPARATUS.

539,154. Railway Signal System. George L. Thomas, Brooklyn, assignor to the Hasell Perfected Railway Signal Company, New York, N. Y. Filed Jan. 26, 1895.

539,298. Communicating, Signaling, etc., to or from Movable Objects. Joseph Y. Porter, Cleveland, Ohio, assignor to J. W. Morrison, Detroit, Mich. Filed Feb. 14, 1894.

539,354. Signaling System. John P. Coleman, Swissvale, Pa., assignor to the Union Switch and Signal Company, same place. Filed Aug. 26, 1893.

539,381. Apparatus for Indicating and Signaling Speed of Vehicles. John W. Darley, Jr., Baltimore, Md., assignor of one-half to Michael Holzman, Philip Hamburger and Leon Hamburger, same place. Filed March 29, 1894.

539,396. Railway-Signal. John Stringham, Jersey City, N. J. Filed Feb. 6, 1895.

MISCELLANEOUS.

539,024. Electrical Connector. Frank N. Bell, Milford, Mass. Filed July 28, 1894.

539,040. Insulator. Leonard H. Desisles, Boston, Mass., assignor of one-third to Frederick S. Palmer, same place. Filed Sept. 10, 1894.

539,079. Electric Push-Button. August J. Oehring, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 2, 1893.

539,099. Annunciator Connection for Multiple Switchboards. Giles Taintor, Keene, N. H., assignor, by mesne assignments, to the Western Electric Company, of Illinois. Filed April 11, 1892. Renewed March 13, 1893

539,105. Variable Rheostat. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Sept. 18, 1894.

539,123. Cross Arm for Carrying Electrical Wires. Thomas T. Eckert, New York, N. Y. Filed March 20, 1895.

539,192. Electric-Light Head-Gear for Personal Wear. Alfred M. Rodriguez, Brooklyn, N. Y., and Edward D. Rockwell, Bristol, Conn. Filed Feb. 25, 1895.

539,216. Rheostat. Augustus C. Carey, Lake Pleasant, Mass. Filed Feb. 26, 1895.

539,222. Electric Conductor. John R. Hare, Baltimore, Md. Filed Nov. 23, 1894.

539,234. Electric Fire and Water Alarm. Gustave S. Neu, New York, N. Y. Filed Jan. 25, 1895.

539,299. Electric Track-Switch. Joseph Y. Porter, Cleveland, Ohio, assignor to J. W. Morrison, Detroit, Mich. Filed Feb. 14, 1894.

539,302. Electric Glass-Cutting. Israel L. G. Rice, Weston, Mass. Filed Jan. 2, 1895.

539,358. Electric Stop-Motion for Warping-Machines. Clayton Denn, John Cocker, and Charles Denn, Philadelphia, Pa. Filed Jan. 11, 1895.

ELECTRICITY.

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EDITORIAL NOTES.

The Great Trolley Litigation. Elsewhere in this issue we give a somewhat extended report of the arguments in the equity suit of the Thomson-Houston Electric Company vs. the Winchester Avenue (New Haven) Railroad Company and the Westinghouse Electric and Manufacturing Company, which will be read with interest by every electric street railway man in the country, whether his interests be those of the officer or operator of the road or merely those of the stock or bond holder. No apology is offered for the space devoted to this subject, since its importance ranks fairly with that of anything that has heretofore come before the courts of an electrical nature.

The meaning of this suit is simply this—that if the plaintiffs win every trolley car in this country built or operated by others than the plaintiffs, who are the General Electric Company, and whose building or operation has not been authorized by the plaintiffs, is an infringement upon their patents. If they win, every electric railway in this country not built or authorized by the plaintiffs will have to pay tribute to the G. E. Company or abandon the use of the modern trolley. On the other hand, if the defendants win, the modern trolley in its broad sense is open to the public.

The Winchester Avenue Railroad of New Haven, Conn., was partly equipped by the Westinghouse Company with the trolley devices used by that company. The General Electric Company, owners of the Van Depoele trolley patents, sue the two companies for infringing two of the Van Depoele patents, which they claim broadly cover all of the travelling contact devices or trolleys used in this country to-day. The defendants deny the patentability of the devices claimed, owing to the previous state of the art, and also owing to the alleged fact that the patents in suit were anticipated by previous patents granted to the same inventor.

If the complainants' position is valid, the Van Depoele trolley patents are nearly as broad as the original Bell telephone or the Berliner microphone patents. It seems exceedingly doubtful, however, if in view of the previous state of the art their position can be maintained. Should it be maintained, however, it would, we are happy to say, not place in the hands of the G. E. Company a monopoly of the trolley business. There are many other efficient methods of maintaining a travelling contact not contemplated in the patents in suit, one of the best of which is used abroad in many cases in preference.

Reference is here made to the flexible sliding contacts usually mounted in the form of a parallelogram on the top of the car. One great advantage that this form of contact has is that it does not lose contact with the wire and that upon reversing the direction of the car it is not necessary to pull down the trolley, reverse its position and then adjust it to the conductor. In fact, we have often wondered that this device, so well and favorably known abroad, has not been adopted here to the exclusion of the devices with which we are familiar.

Judge Townsend, before whom the arguments were made, is regarded as a very strong and able judge, and those interested congratulate themselves that the decision is in such competent hands. It is thought that several months will elapse before the decision is handed down.

* * *

The Status of the Microphone. Just what effect the rehabilitation of the Berliner patent will have upon the telephone business is a question upon which those most closely interested seem to differ somewhat. It was supposed by many, and we ourselves were for the time under the impression, that the decision in the Bate Refrigerator case settled the Berliner patent for all time irrespective of any decision that might be given on appeal in regard to the validity of the methods employed to keep it in the Patent Office or the expiry of the Lake patent of 1880 in Great Britain.

The Bate decision settled once for all the question as to the limitation of an American patent by the expiry of the *same* foreign patent granted to the *same* inventor before the American patent, but the question as to the effect of a foreign patent granted to another person, or of a foreign *species* patent granted to the same or another person before an American *genus* patent, has never yet been decided in the courts unless the United States Circuit Court of Appeals in the recent decision in the Berliner suit passed judgment on this point.

Among our most profound students of patent law it is generally thought that unless the foreign patent previously granted is for the same thing substantially, and issued to or by the consent of or authorization of the American inventor, the American patent is *not* limited by the foreign patent. In other words, if the American patent, as in the case of the Brush storage battery, is a generic patent, and some one gets out a foreign patent which is not generic but simply an improvement upon the American patent, or some one not authorized by the American inventor takes out a foreign patent for *substan-*

tially the same thing, the American patent is not limited by the life of the foreign patent.

Our best attorneys, however, admit that this point is yet unsettled, and unless the recent decision at Boston throws some light on the question it is still moot.

True, in the suit of the Commercial Canning Company vs. Fairbanks Canning Company, where this question was brought up, the Court seemed to lean to the view that a foreign species patent did limit an American genus patent, but the opinion was not decisive.

In the Berliner case, the British Lake patent, granted in 1880 and expiring in 1894, was a species patent and by Judge Carpenter held to limit the Berliner patent. In this case the limiting patent, although simply for an improvement on the original Berliner patent, was taken out in England by Berliner's agent by his consent and authorization. The question still remains open, what would have been the effect of the expiry of this patent had it been taken out by some one else than Berliner or his agent? A similar case was the Edison carbon microphone patent This also may be considered to be but an improvement on the Berliner, but having been taken out independent of Berliner is believed not to have had a limiting effect on the latter's patent.

As to the effect of the recent decision upon the general telephone business, we find that it is less than would generally have been predicted. We have taken pains to feel the pulse of those who would naturally be expected to be most seriously affected, and find that they look upon the future with entire equanimity. The feeling is very well expressed in the following reply to one of our letters of inquiry to an officer of the Western Telephone Construction Company. It reads as follows:

> The recent Appellate Court decision will seem to prove of more value to the legitimate telephone business than harm. It will weed out the unstable and define the scope of operations. The Bell people will find themselves further away from their coveted monopoly by reason of this decision than before. The people want improvements, extensions and advantages in this art denied by the Bell monopoly, and where there is need there will be genius to offer the means. The best devices in telephone apparatus are already outside of the Bell domain, and it is reasonably sure that the public will be supplied with the highest class of modern improvements in this line without paying much tribute for patent rights or monopoly privilege.
>
> The Western is still forging ahead.
>
> J. E. KEELYN.

Another effect which the decision will have will be to make more generally known the fact that other transmitters than those based on the Berliner patent are equally as good, if not better. As stated in our last issue, the Bell Company have so industriously given currency to the idea that the microphone was essential to the art of telephony that the public has been led to believe that it was true. Nothing in fact is further from the truth, and ELECTRICITY hopes to demonstrate that fact in a manner to leave no shadow of a doubt in the minds of the public.

* * *

IF THE *Electrical World* deserved credit for its reports of the lamp litigation in 1893, and we think it did—it certainly claimed it—does not ELECTRICITY deserve credit for reporting the most important railway patent case up to date—the trolley case at New Haven? We think we do, but by comparison only. It is no great enterprise to go to New Haven at the proper time to hear and report a case that interests the whole American electrical public, but it is a great *want* of enterprise *not* to have done so. If the *Electrical World* is *fair*, and if its Digest is what it *claims* to be, the readers of that paper will see a report of this case in the Digest a *week after this* credited to ELECTRICITY. Will it be fair? We'll see.

* * *

The Gas Engine Business. The discussion of the status of the gas engine, the first part of which we published last week, brings up a subject upon which we have long been intending to make some remarks ourselves. It is a subject in which we are interested professionally and to which we have given considerable study. The result of this study has been two fold. First, we have been convinced of the economy of the gas engine and its adaptability to small (and large) isolated electric lighting plants, and second, we have been more than convinced of the utter incompetency of the average gas engine manufacturer of this country to properly handle this business. There is no field more promising for the gas engine to-day than the electric lighting field if properly cultivated, and the electrical press in general, and ELECTRICITY in particular, have done what could be done to educate the public up to an appreciation of this fact. We have done this not for the benefit of the gas engine manufacturer, for we are under no obligations to him, but for the benefit of the public. The manufacturer, instead of appreciating this fact and taking advantage of it as a man in any other business would, seems to have shut his door to this avenue of trade as effectually as he would against the smallpox if he knew it was seeking admission. His attitude to the trade is inexplicable upon any business hypothesis. To illustrate one part of our meaning, it is almost impossible for an inquirer to obtain prices or other information from any of the leading manufacturers or their agents without having first satisfied such manufacturer or agent that he is a "proper party." For example, an electrical engineer of our acquaintance some time since had occasion to use some figures and applied to the New York agent of a large Philadelphia firm manufacturing gas engines for his list price. Note that he did not want net prices, but merely list prices. The agent wanted to know first who he was, next what he wanted them for, and then what size he wanted the price on. The engineer stated that he wanted prices on all sizes from 1 H. P. "What do you want with a 1 H. P. engine?" was asked. "For a small electric lighting plant," was the reply. "You can't do anything with a 1 H. P. engine, and besides nobody in this country but us can go into the lighting business with gas engines," said the polite agent. "I suppose that settles the matter," said the engineer, putting on his hat and walking out. This gentleman took pains to inquire whether this was the customary treatment accorded inquirers by this particular agent, and finding that it was, and thinking that the firm he represented should know how they were being represented, wrote them, stating at the same time that he declined to have any further dealings whatever with their New York representative. To his surprise he received a somewhat curt reply upholding the New York man in every particular.

This treatment of would-be customers by gas engine manufacturers and their agents has become so notorious as to deter many from making inquiries which they would otherwise like to make, and this particular experience has cost the firm referred to several orders of considerable size. How different would be the experience of an inquirer after steam engines, dynamos, motors or any other commodity under the sun. He need only let it be known that he is in want of the goods to be overrun with gentlemanly agents only too willing and too anxious to give him all the information they possess.

Now, as to the truth of the statement attributed to this particular agent, that no one could go into the gas engine electric lighting business but the firm he represents. We know of quite a number of electric lighting plants installed during the past few years by this same firm and not one of them gave satisfaction until they had been repeatedly overhauled and changed about in accordance with good engineering practice, and not a few installed upon guarantee of satisfactory performance have been bodily thrown out after repeated failure to have the guarantee made good.

To such an extent have the business methods of leading gas engine manufacturers disgusted the investing public that capitalists and business men who would like to go into the business of equipping small lighting plants driven by gas engines have in a number of cases within our knowledge given up the idea. In another case within our personal knowledge a Philadelphia company of large capital intending to go into this very business have given up all idea of dealing with American manufacturers and are preparing to send or have already sent a representative abroad in the hope that there at least they will be able to deal with business men who will give guarantees that are worth something.

Another result of the policy of the American manufacturers is that English, German and French manufacturers are establishing agencies in this country for their gas engines, and in the discussion which we conclude in this issue one of them, apparently a business man, and one who represents one of the most widely known firms in England, takes a prominent part. He came here with the expressed intention of introducing the oil engine of his firm. He came here not only with information in regard to what he has to sell but a willingness to impart that information that must have astonished the manufacturers of this country. Do the latter think they can compete under their present policy with competitors, even from abroad, who not only know what they have but are willing and anxious that the world should also know it?

Mr. Richmond, of the De La Vergne Company, who has had a wide experience with the men who are following the inane and suicidal policy which we are condemning, spoke right out in meeting. As soon as the gas engine men suspected that the De La Vergne Company might manufacture their own engines instead of buying from them, they fell all over themselves to effect a sale. Mr. Richmond says: "I got as much as 40 per cent. discount quoted at the first slap—I don't know how much I could get by negotiation," and then they proposed that the De La Vergne Company, if they did manufacture, should add 200 or 300 per cent. profit, and then divide up with them, half and half. Mr. Richmond further says: "As a matter of fact the prices are all broken up in the gas engine business at the present moment."

Yes, the gas engine business was broken all up by the simple announcement that a single business competitor might enter the field.

The prices were, however, only cut for that competitor, but to the average purchaser they remained the same.

We prophesy that before long some competitor with a good gas, gasoline or oil engine behind him and common business tact in his head will come to the front and reap the harvest which the manufacturers are doing their best to destroy.

If, as implied by Mr. Richmond, the present prices include 200 or 300 per cent. profit, this new competitor will be satisfied with 25 or 50 per cent. Whether or not the present manufacturers continue to require your pedigree and certificate of character before they will impart any information, the new competitor will require no other credentials than other business men require and facts will be freely and fully given. Whether or not the present manufacturers will continue to try to monopolize the use of their own engines for electric lighting (a business which they have generally shown themselves totally incompetent to handle), and give guarantees that are not worth the paper they are printed on, the new competitor will be glad to sell to every one who can pay a fair price for his engine, and he will sell to them low, and give a guarantee that can be relied upon in every particular. The American public and Electricity will welcome this competitor with open arms. We all hope he will be an American, but we will welcome him anyway if he changes, as he must, the present order of things.

* * *

Keely and His Motor and a Challenge. In the April number of the *New Science Review* is an article by John W. Keely himself describing (?) not only his motor but the philosophy of it. If we cannot quite grasp his meaning at all times it is of course our fault, for he has expressed himself in language which certainly cannot mean anything else but that which he intended it to mean. What he intended it to mean, Heaven and Mrs. Bloomfield Moore, himself, and possibly Mr. J. M. Stoddart, the editor of the *Review*, only know, but it *can't* mean anything else. It is, therefore, perspicuous in a high degree. It means something on the same ground that the dog was a good coon dog—it had been tried for everything else under the sun and found worthless, but God made everything for a purpose, and since the dog had been tried and failed on everything else it was concluded that the Almighty intended him for hunting coons.

So with Keely's language. We have gotten out our Greek and Sanskrit lexicons; we have rummaged the shelves of old papyri dating back of the time of Rameses I; we have studied the hieroglyphics on the backs of all the mummy scarabs we could find in the cases of the Museum of Archæology; we have compared it with the inscriptions on the Rosetta stone and the hieroglyphs of the Mayas on the ancient temples of Chichen Itza; but all to no purpose. None of these throw any light upon the subject, and we have concluded that Mr. Keely's description describes nothing in the sea or under the sea or on the land or under the land or in the air above the land. But it *must* describe *something*. Else why should Keely have written it? Else why should Mrs. Bloomfield Moore "withdraw the veil?" Else why should J. M. Stoddart print it? There is but one recourse left, as with the dog—to believe that it describes Keely's motor.

Let us consider that matter settled, then.

At the end of the article Mr. Keely enumerates a number of tests which he is willing to put his motor to in the presence of scientists. We do not doubt for a moment that his motor, or whatever he calls it, will successfully perform every one of the things there enumerated. And supposing it does? What has it accomplished? Will it do no more than this? Is this the discovery about which Mrs. Bloomfield Moore has been prating so long and so loudly?

Oh, what a-groaning of the mountain! and oh, what a birth!—*ridiculus mus.*

These tests, if all accomplished successfully, would have the same value to the world as have the usual spirit communications—no more, no less. They would indicate an accession to our knowledge quite on a par with that which is brought to us from the dead through the agency of professional spiritual mediums and other like impostors.

We do not pretend to be versed in occult things, but we hereby issue a challenge:

We will undertake to repeat, without recourse to other than well known physical agencies, every phenomenon which Mr. Keely will produce by his so-called newly discovered force or agencies. To enable us to do this we ask no especial privileges within the arcana of Keely's workshop. We ask only to be permitted to see the experiments performed as he will show them to other experts, in order that we may know the task which is before us.

If Mr. Keely will give us this opportunity we will agree to repeat everything which he does before the same committee of experts, provided they are men of recognized standing in the scientific world, within sixty days. If Mr. Keely and his friends have confidence in themselves they will not let this challenge go unnoticed.

Under the Searchlight.

Views and Opinions on Timely Topics.

BRUSH COMPANY'S ELECTION.

Coffin, Lawrence and Miles Step Out.

At the annual meeting of the Brush Electric Company in Cleveland last week, Mr. Robert Treat Paine was chosen president in place of W. H. Lawrence, J. P. Ord vice-president in place of C. A. Coffin, C. G. Smedberg treasurer in place of B. F. Miles, and Mr. S. M. Hammill general manager. The meeting was interesting, lasting the greater part of two days. Full details will appear later in Electricity. Mr. Smedberg was formerly assistant treasurer of the Edison General Electric Company.

* * *

"Electricity's" Advantages.

(From the Industrial World.)

The advantages of Electricity for heating are gradually becoming more appreciated.

Quite true. We can produce more heat in one issue than all of our contemporaries combined.

* * *

The Chicago-St. Louis Air Line.

Dr. Wellington Adams stated ten days ago that $9,000,000 of the bonds of his great enterprise had been placed in New York and Chicago. Careful investigation has failed to reveal any bank or financial institution which has bought any. We think the story must be—incorrect.

* * *

It may interest other lamp makers to know that the Harrison Lamp Works bill their lamps to the Schenectady office at 8½ cents apiece.

* * *

The conviction of Henri Bier at New Orleans for perjury shows that even in that cosmopolitan city, where reform has been looked upon as hopeless, there is a sharp awakening. Mr. Bier is a wealthy man and has always stood well in his city. He got mixed up in the procurement of franchises for a branch of the Traction Company, and in a previous case shielded his friends by making false statements on the witness stand. For this crime he has just been convicted. The incident shows that even in corporation matters bribery and perjury are *sometimes* held to be criminal by the courts.

* * *

The Brooklyn Heights Railroad.

The committee of three experts who have been examining into the physical condition of the above-named property have practically agreed on their report, which is that from three to four millions of money needs to be expended in track renewals and repairs to equipment.

* * *

He Has Watched Us Grow.

(Hon. John R. Murphy in a recent lecture.)

The growth of Electricity is without a parallel in the world's history.

Sleepy Eye Rudely Awakened.

(From the St. Paul Call.)

Sleepy Eye, Minn., May 18.—At 12:20 o'clock a tremendous explosion was heard and ten minutes later the school building here was in flames. The electric plant in the basement is an entire loss.

* * *

A Warning to G. E. Employees.

(From the San Francisco Examiner.)

Ward Gets Ten Years for Bribery.

There was a tearful scene in Judge Smith's court room, Stockton, this afternoon immediately after the passing of sentence on Charles W. Ward, convicted of bribery in connection with the adoption of plans for the new County Hospital.

The defendant stood up and the Judge in passing sentence said that bribery was considered one of the most serious of offences, and the Legislature had so said in fixing the punishment at from one to fourteen years, and in disqualifying the offender from ever holding any office of trust. The term of imprisonment was then fixed at ten years in San Quentin. As the sentence was fixed by the Judge the defendant gasped and sank back in his chair, burying his head on the breast of his wife, who was seated by his side. His little six-year old child added her tears to those shed by husband and wife, and altogether the scene was an impressive one.

* * *

He Sees the Mistakes of Another.

(From a letter to the Editor of the Brooklyn Eagle.)

Gentlemen—Dear Sir—I was ther man that cought this Pick pocker an seen him take 2 one doller bill from ther boy pocket and I ran after him and brought him back to ther car and later I had him arested. Kindly correct ther mistake and oblige H. Butler, Electrician.

[We take it that Mr. Butler is the chief electrician for the Electropoise or Earth Magneto promoters.—Ed.]

* * *

Hunt and Taltavall Will Lash the Ether.

Meantime Let's All be Happy.

When the sun's rays weaken, when the decay of a colossal planet is heralded to us, how shall we prepare for the inevitable darkness or drive away the iciness of interplanetary space? The glow-worm has taught us its lesson; the will-o'-the-wisp is no longer a delusion. With a whip that science alone can control we will lash the ether until it gives to us the quivering light of dawn—the effulgence of the rising sun.—*Electric Age.*

* * *

Lighting Deal in Brooklyn.

It is announced that the Brooklyn Edison Company has purchased nine-tenths of the stock of the Citizens' Electric Light Company of that city. This trade means an entirely new situation in Brooklyn lighting matters.

When the Edison Company came into the field in Brooklyn they found the political machinery in the hands of the men who owned the two other companies which did all the city lighting at a good fat rate, and a small amount of commercial incandescent work. It took the Edison Company, made up from the solid element of the city's business men, over two years to get a franchise. They refused to pay a dollar to the Board of Aldermen, and finally compelled the granting of a franchise in the courts. They did not have any chance at city lighting contracts until last year when a reform administration came in. This year they found that even under a "reform" Board of Aldermen specifications were drawn in a way to practically prohibit their bidding on the city contract.

The present deal does not mean that the Brooklyn Edison Company have ceased to believe that honesty is the only policy to pursue in business, but that they have at last been forced to pay the ring what they want. The money has been paid in an honorable way—$170 per share for the stock of the Citizens' Company—but it is none the less the payment of just about the original price demanded by the ring for allowing the Edison Company to do business.

It may be that this Brooklyn ring will be broken up some time. It is certain that it is still just about as powerful as ever, and equally certain that the members will retire, if they ever do retire, with bank accounts large enough to enable them to live in peace and contentment. Their consciences will not disturb them.

* * *

Its Reason for Existence.

(From the U. S. Investor.)

It has been stated this week that General Electric stock was booked for a handsome advance. But one opinion, however, exists regarding the company—it is kept alive merely to furnish certain speculative bankers a football out of which to kick stock market profits.

* * *

A SPECIMEN GENERAL ELECTRIC ASSET.

In the report of the Gas and Electric Light Commissioners of Massachusetts for 1891, the Lee Electric Company appears for the first time and returns the following assets:

Gas plant, mains and meters	$8,185.85
Real estate (electric)	4,485.27
Steam plant and water power	2,952.62
Electric plant	4,899.60
Lines, meters, lamps, etc	12,777.96
Supply account	2,874.11
Material on hand and accounts receivable	9,465.20
Total	$37,454.76

The liabilities were returned as follows:

Capital stock	$20,000.00
Bonds issued	15,000.00
Unpaid bills	1,982.49
Total	$36,982.42

The returns show that the electric plant was as follows:

One 650-light T.-H. alternator.
Two 160 H. P. boilers.
Two 165 H. P. engines.
One 60 H. P. waterwheel.
91,000 feet wire (in lines).
649 16-C. P. incandescent lamps.

The liabilities therefore footed up, to begin with, about $43 per lamp installed. In the report of "securities" held by the G.E. Company, on page 81 of ELECTRICITY, current volume, it appears that among them are $11,000 of these bonds, and that the "Securities" Company has $19,400 of the stock; presumably some local citizen or citizens have the other $600.

According to the returns of subsequent years the floating debt, consisting of notes and unpaid bills—presumably due largely to the G. E.—has accumulated as follows:

1891 (as above)	$1,982.42	1894	$40,150.56
1892	7,864.49	1895	45,203,44
1893	20,792.08		

So that the gross liabilities have now reached the tidy sum of $80,203.44. The number of 16 C. P. lights returned in 1895 was 1,500. The results of operations for the year ending June 30, 1894, were as follows:

Income from sale of electric light and power	$5,480.84
Operating expenses	5,541.93
Deficit	$61.09

In order that the brilliancy of the future prospects of this enterprise may be appreciated, the following statement, showing the rate of increase of population in the town of Lee is given, as taken from the census reports:

1860	4,420	1880	3,939
1865	4,035	1885	4,274
1870	3,866	1890	3,785
1875	3,900		

A *decrease* of 635 in population in the last 30 years.

The prospects of this plant ever paying a dividend may be easily ciphered out from the above statistics. How many other "securities" of equal value are contained in the schedules of the General Electric?

* * *

THE ELECTRIC CONSTRUCTION AND SUPPLY COMPANY.

If the failure of the Electric Construction and Supply Company of this city, and incidents attending it, constituted an isolated case of dishonesty, it might with propriety have passed unnoticed. But it is not, unfortunately, an isolated case. No failure reported in this trade in the past three years has left those connected with it free from deserved criticism. In nearly every case, as the facts were revealed, it was shown that the failure should have come earlier, before the debts were out of all proportion to assets. And in nearly every case the *insiders* engaged in a disreputable scramble to protect themselves at the expense of the legitimate commercial creditors.

Of the latter feature the collapse of the E. C. and S. Co. was a conspicuous example.

The electrical trade will never be upon a solid basis—will never be worthy of financial credit or the respect of the public—until the ideas of business revealed by such failures as the one under discussion and the men holding them are driven out and replaced by men and ideas more in harmony with the established laws of commercial integrity.

The *causes* of this failure may be passed over briefly, yet they are important in considering the actions of the management when the crash came.

The E. C. and S. Co. was simply a selling company. It was capitalized at $225,000, about $85,000 of which stock had been sold to the public. In the days of prosperity its gross sales were about $300,000, and the profits were large.

Its product was manufactured by the Standard Thermometer Company of Peabody, Mass., of which Mr. F. R. Upton, Mr. Rice and others of Mr. Upton's relatives were the chief owners. The product was never manufactured with any degree of skill, and was unsalable when delivered to the E. C. and S. Co., necessitating the maintenance in New York of shops in which every lamp had to be overhauled before shipment. Notwithstanding that the work of the manufacturing company was inferior, the prices charged to the selling company were 25 to 33⅓ per cent. higher than the work could have been done for on contract elsewhere.

When the great falling off in sales occurred in 1893, the E. C. and S. Co. was still *compelled to take the product from the factory*, at one time having as many as 8,000 lamps in stock, for which they were unable to pay, giving notes therefor endorsed by Mr. Upton.

Counting the extra cost of lamps made at the family factory over what it would have been under other circumstances with the cost of the repair shop in New York, the total cost of each lamp was nearly double what it should have been. So much for the causes.

The condition of the company naturally became worse and worse. When failure was inevitable, a Mr. Rocap was elected treasurer, and empowered by the Board to make transfers, etc. He was in office ten weeks before the collapse. When the receivers were appointed it was revealed that he had given to Mr. Upton a bill of sale of about $35,000 worth of stock, and had assigned to him accounts of about $30,000, leaving say $10,000 of stock for the receivers to sell for the benefit of the outside creditors. The total debts were about $105,000, and if the assets were equitably divided, it will be seen that the creditors would come out fairly well, getting perhaps 70 cents on the dollar.

In addition to the grab of Mr. Upton, Mr. Rice got out attachments for salary as an officer of the selling company, although he had performed no services for that company.

The stock of the E. C. and S. Co. seized by Mr. Upton is now offered for sale by a Mr. Waterman. Whoever he is, we are not surprised that Mr. Upton or Mr. W. J. Hammer, his assignee, did not offer this stock over their own names. It shows that they had some appreciation of their position at least.

One fact we wish to call particular attention to: This stock of goods, according to the rules of common honesty, should have been in the hands of the receivers and the proceeds divided pro rata among all the creditors. It is indeed an open question whether the assignments to Upton were valid in law.

Every man paying Mr. Upton any money either for stock or on account of bills due the E. C. and S. Co. does so at his own risk. The purchaser may still be sued by the receiver for the recovery of the property, or may be compelled to pay his bill twice over.

The episode, we think, marks the close of Mr. Upton's career in the electrical business. He will have to find another field.

As for Mr. Hammer, we suppose there will always be a demand for the servicces of such as he. Whenever there is particularly dirty work to be done he will be called on, and will always be found ready, for a consideration, to do anything required of him.

It is not a pleasant duty for a trade paper thus to point out the rottenness in its own trade. It is, however, a duty which must be performed. When dishonest and corrupt methods have been reduced to a minimum, as they are in other industries, then and not till then will this trade be upon a proper basis, worthy of the respect of the world and inviting the investment of capital.

We take special pleasure in pointing out that in the total wreck of the E. C. and S. Co.'s business, and amid all the crookedness revealed thereby, two men stand out clearly, unashamed of their relations, unstained by any dishonest acts—Herbert Torrey and Robert B. Corey. These gentlemen refrained from taking any steps to protect themselves at the expense of the other creditors when they might have done so with perfect propriety for salary due and earned. They erred on the side of fairness.

And we think time will show that in this case *it paid* to do right, and that those who did wrong will pay the penalty.

Personal.

Mr. John C. Dolph, 126 Liberty street, New York, has been appointed manager of the Eastern district for the Forest City Electric Company of Cleveland, Ohio, manufacturers of the well-known "Roll Drop" commutator bars.

Mr. J. H. Rhotehamel, president of the Columbia Lamp Company, has been in New York the past week. He reports the Columbia Company's business in flourishing condition, and that they are ready now to sell 220 volt lamps in any quantity.

Mr. C. I. Hills, who has represented the Columbia Lamp Company in this city for about a year, has made arrangements to go with the Perkins Switch Company of Hartford, beginning June 1. Mr. Hills began his electrical business career with the Perkins Lamp Company in 1889, continuing with them and with the Waring Company until the latter was finally closed by the courts. He has the reputation of being the best lamp salesman in the business, and has made many friends. For the Perkins Company he will handle their full line of switches, sockets, cut-outs, Waterhouse arc lamps and incandescent lamps.

Railroad Patent Litigation.

THE UNDER-RUNNING TROLLEY.

Final Hearing of a Case Involving the Basic Patents of the Modern Trolley—The General Electric and Westinghouse Companies Lock Horns.

The suit of the T.-H. Company vs. the Winchester Avenue Railroad Company and the Westinghouse Electric and Manufacturing Company came up for final hearing in the United States Circuit Court at New Haven, Conn., on Wednesday morning, May 22, and continued through the rest of the week. This suit is one of unusual importance and interest in that it involves the validity of the Van Depoele patents, which are claimed to broadly cover all of the under-running trolleys in use to-day on the electric railroad systems throughout the United States. These patents were acquired by the Thomson-Houston Electric Company—now merged into the General Electric Company—and all unauthorized users of the modern trolley are claimed by the plaintiffs to be infringers, and they have sued the present defendants to establish their claim and also for an accounting.

This suit is for infringement of two letters patent based on the invention of Charles J. Van Depoele (deceased).

The first of these patents (in order of date of application) is that dated April 11, 1893, No. 495,443, based on the application signed and sworn to on January 17, 1887, and filed in the Patent Office March 12, 1887.

The Patent Office file of this application shows that the application was long delayed in the Patent Office owing to interferences with rival applications of R. M. Hunter and others, the final decision in favor of Van Depoele having been rendered on February 4, 1893, and the patent issued a few days thereafter. The inventor had in the meantime died and the patent was issued to his executors and by them was assigned to the complainants.

The second patent is dated April 11, 1893, No. 495,383, and is based on the application sworn to November 15, 1887, and filed June 18, 1888. This patent also was long delayed owing to interference with F. J. Sprague, but was finally awarded to Van Depoele on December 15, 1892.

On the first patent the claims at issue are the following, which are the 6th, 7th, 8th, 12th and 16th, of which the 6th is the most general and the 16th the most specific. They read as follows:

"6. In an electric railway, the combination with a suitable track and a supply conductor suspended above the track, of a car provided with a swinging arm carrying a contact device in its outer extremity and means for imparting upward pressure to the outer portion of the arm and contact, to hold the latter in continuous working relation with the under side of the supply conductor, substantially as described."

"16. In an electric railway, the combination of a car, a conductor suspended above the line of travel of the car, an arm pivotally supported on the top of the car and provided at its outer end with a grooved contact wheel engaging the under side of the suspended conductor and a tension spring for maintaining an upward-pressure contact with the conductor, substantially as described."

The specification describes the drawings in detail, in which Fig. 1 illustrates the combinations claimed as a whole; Fig. 7 shows a modification of the contact wheel (with its arm support and spring), and Fig. 9 shows, on an enlarged scale, the vertical and transverse axis upon which the contact carrying arm is sustained.

Of the second patent (No. 495,383), which is for an improvement upon the system broadly claimed in patent No. 495,443, the claims involved in this suit are the 11th, 12th and 13th, which read as follows:

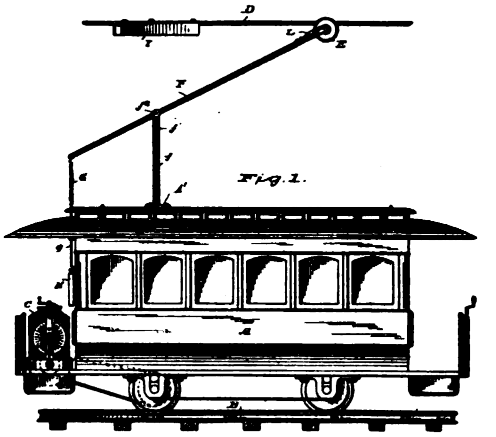


Fig. 1.

Fig. 7.

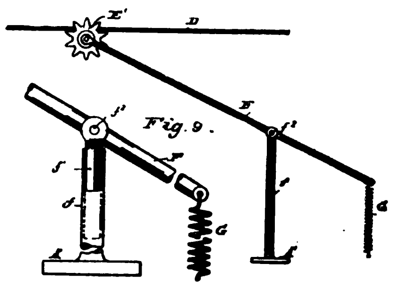


Fig. 9.

"11. In an electric railway, the combination of a car, an overhead conductor, a standard on the car, a rotating support thereon, an inclined contact carrying an arm hinged upon said support and a tension spring secured so as to rotate with the support and acting upon the said arm for holding the contact device in position."

"12. In an electric railway, the combination with a car of a standard on a car, a rotating support thereon, an arm hinged upon said support and provided with a grooved or flanged contact device for engaging with a suspended conductor, and a tension spring secured so as to rotate with the support and acting upon the said arm to hold the contact device in position."

"13. A reversible contact device for an electric railway vehicle, consisting of a standard, a rotating support thereon, a contact carrying arm hinged upon said support, and a tension spring secured so as to rotate with the support and acting upon the contact-carrying arm for holding the contact device in position."

The specification states that the novel features of this application comprise an improved apparatus whereby the upward pressing contact is maintained against the conductor and means are provided "for reversing the position of the contact arm upon the car, together with various details of construction and arrangement," and Fig. 5 is given as an elevation showing the embodiment of his invention.

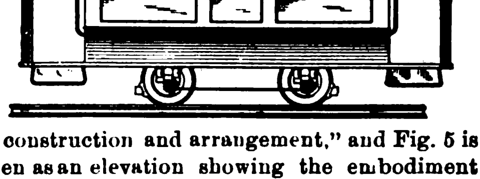


Fig. 5.

The defendants claim in defence respecting No. 495,443:

1. That the invention was anticipated by several prior American and British patents in the same art.

2. That the invention was anticipated by the prior public use of Daft at Baltimore.

3. That the invention was made not by Van Depoele, but by one Verstræte, an employee of the Van Depoele Company.

4. That the invention was made by Sprague before Van Depoele made it.

5. That in view of the state of the art there was no invention involved in making the combination of the claims.

6. That the same invention had, before the issue of said patent, been patented to Van DePoele by several prior patents.

7. That the same invention was inseparably involved in inventions previously patented by the same inventor.

Respecting No. 495,383:

1. That the alleged invention was anticipated by several prior American and British patents.

2. That in view of the state of the art there was no invention involved in making the combinations of the claims in suit.

3. That there is no evidence that Van Depoele made the invention prior to June 18, 1888, the date of his application for the patent, and that the alleged invention was therefore anticipated by the prior public use of Sprague at Richmond.

4. That, if the alleged invention was embodied in the New Orleans road, it was in public use and on sale more than two years before Van Depoele's application for the patent.

5 That the same invention had, before the issue of said patent, been patented to Van Depoele by several prior patents.

In regard to anticipation the defendants hold that the following preceded the Van Depoele inventions:

(1) Wesson's Patent. Granted Feb. 17, 1857, for improvements in electric telegraphs.

The object of this is stated to be "to transmit telegraphic communications between railroad trains, canal boats and other vehicles, etc." It consists briefly of a telegraphic line suspended from posts at the side of the track which are supplied with current from a stationary source. This line is divided into sections at the posts, and on each post is a circuit breaker which is operated by an arm, mounted on the middle of the car, so that as the car passes the post the line circuit is broken and the current is deflected through the car where it operates a telegraph apparatus.

They claim that this patent discloses an overhead conductor suspended at the side of the track and supplied with current from a stationary source, a railway car provided with a contact device carried by the car, attached to a projecting arm moving freely so as to compensate for "the swaying motion of the vehicle from whatever cause," the said arm carrying at its outer end a grooved contact device which is pressed upward by a suitable spring (tension device) into engagement with the under side of the conductor.

The current transmitted to the car is used to operate a telegraph instrument instead of a motor for propelling the car, but it is claimed that this substitution was not new with Van Depoele as it had been done prior to his invention by Siemens, Finney, Cowles and others. It was at the side of the track instead of over the car, but this difference was not new because it had been previously so placed by Goodwin, Finney, Cowles and others.

(2) Fitzgerald Patent. This was for an arrangement of devices whereby signals could be transmitted between a train of cars to the station or to another train. It describes a method of underrunning brushes making contact with transverse wires overhead connecting with longitudinal wires. Date of patent June 22, 1869.

(3) Smith Patent. Aug. 5, 1873. This relates "to the construction of a system of railway telegraph mechanism by which upon lines of railway all of the trains of a line may be kept in communication with the various stations of the line and with each other if desirable."

In the words of the inventor, "For this purpose I construct a line of wires so arranged that either a constant or an intermittent current

(*Continued on Page* 270.)

THE STATUS OF THE GAS ENGINE.

A Statement and Discussion of the Subject Before the American Society of Mechanical Engineers at Their Monthly Meeting April 10, 1895.

DISCUSSION—(*Concluded.*)

Mr. Reeve was followed by Mr. Anson W. Burchard, who read a paper on the gas engine installation at the works of the Danbury and Bethel Gas and Electric Company at Danbury, Conn.

In 1893 it became necessary for the Danbury and Bethel Gas and Electric Light Company to erect a new electric station, their business having outgrown the capacity of their former station, and advantage was taken of the opportunity to place the new station on a site adjoining that of the gas works, in anticipation of being able to effect some economy in administration thereby.

This company manufactures gas by the Edgerton process, in which the retorts used for fixing the oil gas are heated by a producer gas flame, and the apparatus for making this gas is regularly employed in this work.

The economical performance of the gas engine plants operated by producer gas in Europe led to the belief that a moderate amount of power could be generated by this means at a lower cost than by steam, particularly where water for condensation is not available, as in the case under consideration.

After some investigation of this subject, it was decided to install a gas engine plant, the company being favorably situated in respect to its having the necessary apparatus for making the producer gas. A number of gas engines of large size in operation were inspected and an analysis made of the difficulties experienced in their use; and in planning the installation arrangements were made to overcome these difficulties so far as this could be accomplished.

It was found that none of the builders in this country were at that time prepared to furnish engines of larger units that 100 H. P., nominal, and three of that size were ordered. They were of the Otto type, two cylinder, single acting, the cylinders being placed one over the other, with connecting rods engaging a single crank. On account of the low quality of producer gas and the difficulty of igniting it, it was decided to use electric sparks from an induction coil for this purpose. This plan enables the ignition to be effected at exactly the desired time.

The engines are provided with gas, air and exhaust valves of the poppet type, affording facilities for regrinding to maintain tightness.

The engines were placed side by side with crank shafts in line, and to extensions of these shafts there were fitted clutches, so that the engines could be coupled together with the cranks 180 or 120 degrees apart.

Another arrangement was made for coupling the governors, so that by connecting them and the shafts the engine could be run as—

(1) A four cylinder engine with two cranks, 180 degrees apart.

(2) A six cylinder engine with three cranks, 120 degrees apart.

The cylinders being arranged to take gas alternately with two engines running coupled, there were two impulses or two opportunities to govern per revolution, and with three engines running there were three impulses or three opportunities to govern per revolution.

A further provision against irregularity of speed was made in a balance wheel on the counter shaft, weighing about 6,600 pounds and speeded at 483 revolutions per minute.

At this time the engines were arranged to regulate the power by either admitting a full charge of gas or cutting it off altogether as the load increased or diminished.

Experiment showed, however, that with the producer gas it was possible by regulating the the quantity of gas admitted to the cylinder per impulse to obtain impulses varying considerably in power, and it was possible to ignite a very weak mixture of gas and air, and that the loss of economy due to the use of a reduced charge of gas was not serious; and the engines were subsequently fitted with conical governor cams by which means the supply of gas per impulse is varied according to the power required, within certain limits, below which the supply of gas is cut off altogether.

ANALYSIS OF GAS USED BY ENGINES DURING BRAKE TEST OF GAS ENGINES AT ELECTRIC STATION OF DANBURY AND BETHEL GAS & ELECTRIC LIGHT CO., DANBURY, CONN.

Gas used.	CO_2	O	Illuminants.	H	CO	CH_4	N	Combustibles per cent.	B. T. U. per cu. ft. at zero C & 760 mm.	Lbs. Carbon per 100 cu. ft. at zero C & 760 mm. due to				
										CO_2	Illuminants.	CO	CH_4	Total Carbon.
Mch. 10..........	4.69	.05	.56	14.34	28.63	.94	50.79	44.47	168.3	.1500	.0856	.9098	.0802	1.1256
Mch. 13..........	....	....	....	......	......	....	......	......	......	......	......	......	......	......
1st Analysis.......	6.85	.21	.37	15.48	26.27	1.19	50.15	48.31	162.9	......	......	......	......	......
2d Analysis.......	6.41	.09	.206	15.56	26.59	1.18	49.96	43.53	161.1	.2041	.0182	.8405	.0861	1.1019
Mch. 15..........	4.63	.55	.541	14.500	23.40	1.33	50.54	44.77	164.2	.1432	.0849	.9081	.0419	1.1881
Mch. 18..........	4.12	.11	.000	13.63	27.80	1.11	53.24	42.54	153.5	.1818	.0000	.8840	.0849	1.0507
Mch. 23..........	...	....	...	......	......	....	......	......	......	......	......	......	......	......
1st Analysis.......	4.12	.11	.000	13.63	27.80	1.11	53.24	42.54	153.5	......	......	......	......	......
2d Analysis.......	4.12	.11	.000	13.98	27.53	1.15	53.12	42.66	154.2	.1318	.0000	.8936	.0856	1.0610
Mch. 28..........	5.26	3.15	.008	13.63	28.41	.661	51.72	42.05	151.3	.1683	.0005	.9084	.0908	1.0989
Mch. 29..........	....	...	....	......	......	....	......	......	......	......	......	......	......	......
1st Analysis.......	4.52	.12	.02	12.95	26.97	1.11	54.30	41.05	149.1	......	......	......	......	......
2d Analysis.......	4.58	.02	.06	12.86	26.96	1.20	54.31	41.09	149.5	.1456	.0006	.8576	.0369	1.0409

This was found to improve the regulation very much as compared with a single engine, or with two or three engines running uncoupled, and as satisfactory regulations could be obtained without coupling the engines, the use of the couplings was abandoned, since they required to be handled with some care, particularly in coupling two engines when in motion. In ordinary service the variation on the alternating current E. M. F. is not over two per cent.

OUTPUT AND FUEL CONSUMPTION, ELECTRIC STATION, DANBURY & BETHEL GAS & ELECTRIC LIGHT CO., DANBURY, CONN.

Date.	Output of Station in Kilo-watt hours.				Fuel Used by Engines.				Watt hours per lb. of Coal.	Watt hours per lb. Coal, allowing 25 per cent. for fuel used in steam boiler.
	Incandescent by Station Meter.	Commercial Arc—825 watts per lamp.	Street Arc—400 watts per lamp.	Total Kilo-watt hours.	Coal used in Producer.	Illuminating Gas used. Gas 1,000 B. T. U. per cu. ft.	Equivalent in Coal. Lbs.	Total Coal.		
1894.										
October.....	5188.4	744.3	7646.4	13579.1	64000	29800	4470	68470	198.3	165.3
November...	4724.8	677.3	8163.6	13565.7	62100	50000	7500	69600	194.9	145.7
December..	5149.4	740.3	9511.2	15400.9	65900	4500	675	66575	231.3	192.7
1895.										
January.....	4088.8	678.9	425 watts per lamp. 9764.2	14471.9	73300	11400	1710	75010	193.0	160.9
February....	2983.8	562.5	450 watts per lamp. 7626.6	11172.9	76400	2800	420	76820	145.5	121.3
March......	3097.6	621.4	9003.6	12722.6	66500	12300	1845	68345	186.2	155.2
Averages....				13485.5					191.5	159.6

182 days. Average Output per day, 435,000 Watt Hours.

Special arrangements were made for belting the engines to the countershaft, the high speed of which required the use of small pulleys, 26 inches in diameter. The clutches were considered impracticable because of the irregular driving effect of the engines, besides which the small diameter of the pulleys would have necessitated placing the clutches outside them, involving the use of quill arrangements with separate bearings, which would have taken up a great deal of room on the shaft.

A frame carrying a series of rollers was placed at each side of the driven pulleys, and by running the rollers between the belt and the pulleys the belt can be lifted off the pulley, the tension of the belt being regulated by an idler pulley carried on upright frames and moving conjointly with the roller carrying frame. Thus, when the rollers were in a position lifting the belt off the pulley, the idlers would be raised and the belt nearly straight. When it is desired to connect an engine with the shaft, the rollers are run around to a position between the upper and the lower parts of the belt, allowing it to come in contact with the driven pulley, and the necessary tension given the belt by lowering the idler pulley, which also increases the arc of contact between the belt and the pulley.

The advantages of this arrangement are that none of the parts of the shafting device are in motion except while the belt is being shifted, that little room is taken up on the shaft, only four inches on each side of the driven pulley, and that the power is transmitted to a pulley keyed rigidly to the shaft. The idler pulley moves simultaneously with and in proper relation to the rollers, and has an independent adjustment for maintaining a proper tension on the belt.

This device is made use of to start the engines also, the practice being to get the shaft under motion by means of a small steam engine, and then to start a gas engine from the shaft by the belt.

Oil is supplied to the engine bearings and journals through a system of pipes, is collected, filtered, and pumped into a tank, from which it is drawn for use again.

The tests described were undertaken for the purpose of determining whether the engines were capable of developing the amount of power which they had been represented as being able to perform.

As the power is in a large measure dependent upon the quality of gas furnished, a standard had to be determined for this. As a large number of analyses made by Mr. H. H. Edgerton, gas engineer of the D. & B. G. & E. L. Co., had shown that producer gas of about 150 B. T. U. per cubic foot, at zero C., and 760 mm. pressure was the highest which could be made in ordinary producer practice under the most favorable conditions, this was adopted as the standard for the test, and it was intended that they should be made with gas of this composition. A leak from a pipe containing illuminating gas into the producer gas holder raised the power of the gas somewhat above this figure during the first tests, but they are interesting as showing the effect of the richer gas.

BRAKE TEST OF GAS ENGINES AT ELECTRIC STATION, DANBURY & BETHEL GAS & ELECTRIC LIGHT CO., DANBURY, CONN.

Engine.	Date.	Hour.	Counter.	Total Revolutions.	Revolutions per min.	Load on Brake.	M. E. P.		Correction.	Average M. E. P.	I. H. P.	B. H. P.	Mechanical Efficiency.	Gas used.		Gas used reduced to am't at zero degrees C.		Thermal Units per cu. ft. Gas.	British Thermal Units per		Thermal Efficiency Per Cent.		Lbs. Carbon per 100 cu. ft. Gas at zero C & 760 mm.	Lbs. Carbon used per	
							Upper Cylinder.	Lower Cylinder.					Per Ct.	Cubic Feet.	Temp.	I. H. P. Hour.	B. H. P. Hour.		I. H. P. Hour.	B. H. P. Hour.	I. H. P.	B. H. P.		I. H. P.	B. H. P.
	1894.																								
No. 1.	Mch. 10	12.25	18742	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
		1.45	26563	12821	160.26	581.5	53.76	59.47	2.90	58.71	92.106	80.305	87.2	11340	14.4° C	87.2	99.6	166.5	14510	16570	17.70	15.5	1.1256	.982	1.121
No. 1.	Mch. 13	10.20	5120	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
		10.50	9891	4771	159.03	598.5	56.17	67.32	2.28	59.89	95.24	82.24	86.12	3950	8.8° C	82.6	95.8	161.6	13348	15481	19.20	16.06	1.1019	.9103	1.056
No. 3.	Mch. 15	10.30	37384	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
		11.45	50312	12938	161.7	615.75	58.42	58.75	3.19	55.39	95.83	85.801	89.06	11080	5.5° C	85.2	95.2	171.7	14590	16300	17.60	15.74	1.1281	.9611	1.1038
No. 3.	Mch. 18	11.10	71214	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
		12.30	84226	13012	162.51	613.75	58.35	59.37	3.19	55.57	95.72	85.95	89.6	11704	16.6° C	87.4	97.3	164.2	14520	16160	17.68	15.91	1.0507	.9183	1.0223
No. 3.	Mch. 23	4.00	95242	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
		4.40	101667	6425	160.6	575	54.86	60.3	3.19	54.39	93.46	79.58	85.18	5540	12.2° C	84.5	99.1	153.8	12990	15210	19.77	16.87	1.0610	.8965	1.0524
No. 3.	Mch. 23	4.45	102466	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
		5.05	105668	3222	160.1	600	57.21	62.53	3.19	56.68	97.09	82.78	85.26	2900	16.5° C	86.2	101.1	153.8	13250	15550	19.35	16.49	1.0610	.9146	1.078
No. 3.	Mch. 28	3.50	25590	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
		4.20	30570	4980	166	590	56.82	56.41	3.19	53.42	94.89	84.40	88.9	4226	5.5° C	87	97.8	151.6	13180	14820	19.50	17.81	1.0930	.951	1.069
No. 3.	Mch. 29	3.50	45912	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
		4.10	49212	3300	165	600	58.33	60.21	3.19	56.08	98.01	85.32	87.2	3040	1.1° C	91.7	106.3	149.1	13670	15900	18.09	16.14	1.0400	.9587	1.105
Averages...					161.9	596.81				55.65	95.29	83.3	87.81			86.47	99.02	159.03	13757	15748	18.61	16.25		.9319	1.0753

This leak was discovered and stopped between March 15 and 18.

The gas was analyzed by Mr. Edgerton in a modified Franklyn apparatus over mercury, and the results give evidence of great care and accuracy. The samples from which the analyses were made were collected over mercury from the main gas pipe near the engine at a uniform rate during the test, and represent the average quality of the gas used. The gas was measured in a holder of a capacity of about 30,000 cubic feet, and in all cases this was allowed to stand several hours after filling before starting a test, to allow the gas to diffuse uniformly.

Observations of the height of the holder and its temperature were made at intervals of ten minutes and the results were reduced to zero C. and 760 mm. pressure, a correction being also applied for moisture.

The gas is made in plain generators, there being two in use, each five feet inside diameter and ten feet high. In practice the ashes are removed from them on alternate days.

The power of the engines was measured by a prony brake of the ordinary pattern, applied to a rim which was bolted to the spokes of the fly wheels.

A counter was connected with the governor shaft to record the number of revolutions of the engines.

Observations of the counters, brake load, holders, etc., were made by two observers and the results checked.

The indicator cards were taken at intervals of about fifteen minutes by Crosby indicators, made specially for gas engine use, one for each cylinder, connected directly with the ignition chambers. Most of the cards were taken with 180 pound springs, although a few were taken with 120 pound springs.

The engine cylinders were fourteen and one-half inches in diameter and the stroke was twenty-five inches, the engine constant being .0107, the clearance about twenty-five per cent. of piston displacement. The compression was from sixty-four to sixty-eight pounds and the initial pressure from 180 to 200 pounds.

The table appended shows the composition of the gas and the performance of the engines with gas of different degrees of calorific value.

A table is also appended showing the results of the operation of the station from October, 1894, to March, 1895. The figures given in this table were about as follows:

The current for incandescent lighting is measured by a Thomson wattmeter in the station, through which the entire current passes.

The current for lighting is taken from the number of lamp hours, which is carefully recorded, and an estimate of the amount of energy consumed by each lamp, based on a number of careful measurements.

The engines are fitted with an attachment by means of which illuminating gas can be substituted for the producer gas without stopping or even reducing the speed. As the illuminating gas is very much more powerful than the producer gas, at times when two engines will not carry the load during the daily period of maximum consumption, the illuminating gas is turned on for an hour or two. A record of this gas is kept, and as a correction has been applied for the quantity used. The boiler supplying steam to the producer is used to supply steam for other purposes so that no exact record can be given for the steam used in this manner, but an allowance of twenty-five per cent. has been made for this in the final footings.

The method of estimating the current sent out from the station in watts is open to criticism and these figures are given for what they are worth, and not as an exact representation of what can be accomplished by such a motive power equipment as has been described.

The experience with this station may be said to have shown that it is practicable to operate an electric station for which the motive power is furnished by gas engines operated by producer gas, that the liability to interruption of the service will be not much, if any, greater than with steam engines, and that by means of gas engines the fuel consumption in a station requiring a small amount of power can be reduced to a point considerably below that which can be obtained by the use of steam engines.

The other items of cost of gas engine power, repairs, depreciation, etc., can be determined only after a longer experience.

The Chairman—I understand Mr. Richmond has been making some experiments in gas engines. We should be glad to hear from him.

Mr. Richmond—Mr. Chairman, you are not correct in announcing the fact that we have been making experiments in gas engines. We had need of a motive power for small refrigerating machines in connection with the De La Vergne refrigerating machinery, and we started out to find a suitable motor for running these machines and the first thing that suggested itself was a gas engine, naturally. Well, we thought it would be a good thing to build those gas engines so that we might get all the benefit, and after a little while we were assailed by a number of inventors of gas engines, who came to us with propositions something like this: We build the gas engine and put about 300 per cent. upon the cost, and we divide the proceeds between us. (Laughter.) It seems to me that the gas engine business is in a rather unhealthy condition in this country at the present moment. Undoubtedly the owners or the licensees of the Otto patents had a very good thing while it lasted, and that rather excited the cupidity of the outsiders, and they were prepared as soon as the Otto patents ran out to build gas engines at any price they could be sold at, and realize an immense fortune for everybody concerned in the matter. I have catalogues I think from something like thirty different builders of gas and gasoline engines in this country. It would be hardly fair to quote their prices, but I will tell you that I got as much as 40 per cent. discount quoted at the first slap—I don't know how much I could get by negotiation. (Laughter.) So it seemed to us there was very little prospect of dividing up any 200 or 300 per cent. profit. As a matter of fact the prices are all broken up in the gas engine at the present moment. The subject this evening, of course, has turned on the larger sized engines used in producer gas, and really my experience is not relevant to that.

Now, instead of occupying your time talking about the oil engine, I would like to introduce, Mr. Chairman, a gentleman who came with me, Mr. Wildy, who is a member of the English Institute of Mechanical Engineers and also of the German Society, and who represents Hornsby & Sons, of Grantham, and they claim to have the best oil engine. He has something to say about oil engines and he can speak with much better authority than I can with the little experience I have had.

Mr. W. Lawrence Wildy then stepped to the platform and spoke as follows:

Mr. Chairman and gentlemen: When I came in here to-night I had no idea that I was going to do anything except listen to the paper of our friend, and I have listened to it with a great deal of interest. I have had a very considerable experience with producer gas, water gas and the ordinary gas in use in engines, that is, in England, and the figures which he has given tonight I can pretty fully substantiate, only I wish he had gone a little further into the question of the actual method of producing the gas in the producer. Most of you know, doubtless, that the producer is an ordinary cylindrical vessel lined with fire-brick, and more or less intricate in shape according to the inventor's idea of what his patent is (laughter), and with certain cooling surfaces, or heating surfaces, or conducting surfaces, or something; but you will find 150,000 patents in the patent journal, doubtless, and they have all got something about them. But the simplest producer I have ever used was a column of fuel about 10 feet high. The fuel we used in England was coke—the coke which after the distillation of the gaseous product was a residue which went to make the cost of the production of gas a mere cipher to the corporation running that gas concern. In Leeds, where I had my experience principally, the gas which was distributed through the houses cost nothing in the holder—it was all profit. (Laughter.) I have seen the figures and have gone into it with the gas chairman of the Gas Committee of the Leeds Corporation, and it is a fact that it was a decimal short of nothing in the holder. (Laughter and applause.) You laugh, but I am telling you the facts. The by-products from making the bituminous gas were so valuable at that time that they paid all the expense, interest and depreciation of plant, and the gas in the holder cost nothing but distribution and collection of accounts. Meters, of course, are charged by rent there. In proportion to the size of our meter, they charge us 18 pence or half a crown or 2 shillings, so that does enter into consideration, and inside our premises our pipes are all our own, so that the distribution costs from a shilling to 14 pence per day according to the district, and we get good gas—16 candle power gas. But at the same time we were using enormous quantities of gas for a process which we carried on in our works. I got hold of this water gas process as it was made in Germany at the time, and I saw that it seemed a very good heating medium, very cheaply produced, and we went in for a plant there. The plant was a magnificent success so far as we were concerned. It reduces our gas bill from between £6,000 and £7,000 to just over £1,000 a year—fuel, interest, depreciation, labor, distribution, everything concerned, came over just £1,000 a year, or something under one sixth of what we paid before. That gas cost us on an average about three pence halfpenny per 1,000 cubic feet. We made only water gas, but we got no by-products. In the water gas business there are no by products. You simply consume your fuel right away there in the blowing up process, or in the cooling down process, wherein you inject steam and produce carbonic acid first. That carbonic acid in going down to a lower temperature parts with its atom of oxygen and absorbs an atom of carbon, and becomes carbonic oxide, and that passes to the scrubber, where it is cleaned, and then to the holder. That was the gas with which we reduced our expenses from £6,000 to £1,000 a year. With that producer we got a gas which gave us 30 per cent. of carbonic oxide, and 5, 6 or 7 per cent. of hydrogen, and a very small percentage of the olefiant gases which were hardly valuable. After that we went in for other experimental business, and came on to the oil engine, which was the subject that Mr. Richmond has kindly fastened on me to night. In the oil engine we have a machine which works with the ordinary petroleum of commerce, that is, any of the lighting oils which are in the market. It will also work with the heavier oils up to the specific gravity of .9, and it will work with an oil having a flash point of anything that the ordinary oils have and up to 320° Fahrenheit. The continual combustion of the oil in the vaporizer restores to the vaporizer the heat which has been extracted by the vaporization of the oil and the heating of the air necessary to produce the subsequent explosion. These engines have been running continuously for two months day and night without stopping, without any hitch whatever, and the higher the work that is taken out of the engine, up to full power, the better the engine works. At very low powers the engine will want a little nursing perhaps, but at full power she will work right along. We start our engine at 5:30 in the morning and the men come in at 6 o'clock, and she is never looked at again except when the man goes in at dinner time and oils her, and at half past five when he goes to stop her, and there is no outside flame, no exposed red heat or dangerous flame of any sort about the engine.

A Member—What do you mean by nursing?

Mr. Wildy—I mean this, that if the engine has to run light for five or six hours, which I suppose no sane man would do under ordinary circumstances, it is possible that he may want to put a little brake onto the engine, or something of that sort to put a little work on her.

Mr. Holloway—Is there any residuum in the cylinder?

Mr. Wildy—None whatever. We have run her for two months and there is not as much as you could wipe off with your hand.

Mr. Oberlin Smith—What was the efficiency of the various sizes in fuel per horse power, rating the oil at the same price as coal?

Mr. Wildy—I can hardly give you that here. The consumption runs about ⅞ of a pint of American Daylight or Water White per horse power on all sizes of engines. It runs a little lower, but only a little lower, on the larger engines than on the smaller ones. The very small ones will run to a pint. There is a greater loss owing to the friction of the engine itself. I am giving you per brake horse power in that case, not indicated horse power. We sell the engine on the power which the purchaser is going to get off the fly-wheel. He doesn't care what the power is in the cylinder. He wants what he will get off the fly-wheel. A 16 H. P. engine uses just .8 of a pint.

The Chairman—Mr. Burchard, yours uses about a pound of carbon?

Mr. Burchard—Yes, sir; about a pound of carbon in the gas.

The Chairman—A pint weighs about a pound. Your ⅞ Imperial would weigh about a pound?

Mr. Wildy—Yes, that is so, sir. In Russia they are adopting these engines, and we cannot keep pace with them. With us in England it is a matter of consideration, because the oil which I understand you give about 7 cents a gallon for, costs us about 6 pence half penny a gallon. They are doing wonderfully well with the engines over there. Every class of power user is adopting them to the rejection of all steam engines up to 50 or 60 H. P. They are in the hands of stablemen, gardeners, coachmen, all sorts of people, who after they are once instructed know what to do.

Mr. Perry—How about the noise from the explosion? Is it less than from the gas engine?

Mr. Wildy—The pressures in the oil engine are rather lower. In the Scotch gas I have had as much as 210 pounds initial pressure in the gas engine. The consequence is that the terminal pressure is so high that the exhaust end becomes noisy. What is your engine pressure? (To Mr. Burchard.)

Mr. Burchard—About 180 pounds.

Mr. Oberlin Smith—About what is the price of this engine compared with the engines of like power after the 40 per cent. is taken off?

Mr. Wildy—I am afraid you have got on the wrong track. Mr. Richmond was not alluding to our engine. We do not do business that way in this country.

Mr. Oberlin Smith—We want to get the 300 per cent.

Mr. Wildy—300 per cent.—that is nearer the mark. I am much obliged to you, gentlemen.

Mr. Jesse Smith—What maintains the temperature of the generator?

Mr. Wildy—The continual combustion of the oil.

Mr. Smith—Whereabouts?

Mr. Wildy—In the vaporizer. There is no generator. It is nothing but a vaporizer.

Mr. Smith—There is a fire inside?

Mr. Wildy—No, sir; there is no fire inside. It is such a black heat that it would only just melt tin.

Mr. Smith—What maintains that temperature?

Mr. Wildy—The combustion of the oil.

Mr. Smith—But the combustion takes place in the cylinder of the engine.

Mr. Wildy—No, sir; it takes place in this vaporizer and communicates by this little narrow neck.

In answer to a question by the chairman, Mr. Wildy said further:

With gas at 2 shillings per 1,000 feet we run rather cheaper with the oil even at six pence halfpenny. The gas engine makers will tell you that they use 14, 16, 18 cubic feet to the horse power. As a matter of fact they will use 25 to 30 in regular work. But with the producer gas you will use at the very least 90 to 100 cubic feet of gas, and then you have always to provide an attendant to the producer and the steam boiler, and you have got a great deal more plant to put down for that gas engine than the oil engine. When you come to take into consideration the depreciation on the first cost and labor, you get a cheaper engine with the oil engine than with the producing gas engine.

A Member—What causes the explosion in the vaporizer?

Mr. Wildy—The temperature of the vaporizer and the compression of the mixture. There is no electric spark, no flame, no ignition tube. There is nothing after you have once started the engine but the temperature of the vaporizer. If there is any gentleman who doubts at all what I am saying to-night, if he will visit the De La Vergne Company's Works, where they have got one of these engines, Mr. Richmond will be only too pleased to let him see that engine running and show him that there is nothing whatever but the temperature of the vaporizer and the compression to produce that. To prove to you that it is the compression, we use a different amount of compression for American oil from what we use for Russian oil, and the engines are all adapted so that you can make an engine here to day and use it on Daylight oil and send it to Russia to morrow, and by altering it in a little matter, which will take perhaps seven minutes, you can use it with Russian oil. The Russian oil requires 25 to 30 per cent. more compression than the American oil.

The Chairman—Have you determined the temperature of the ignition there with the power you are running at?

Mr. Wildy—It does not matter what the temperature is provided it is not below 400. We find that at 400 degrees, the melting point of tin, we could start any engine with any oil.

Mr. Holloway—As we understand it, the oil lies in the vaporizer until the compression raises the temperature.

Mr. Wildy—No, sir. The instant it is in the vaporizer it is vapor, because our vaporizer is at black red heat. The compression will increase the temperature a little, of course, but it will not be a very great matter. We put a block of tin on there; the moment that melts, that is the proper point to start the engine.

A Member—I would like to ask one question which seems to bear on the subject. I would like to ask the amount of cooling water that is required to cool the cylinders of the gas engine.

In some localities, with large powers, I should think that would cut quite a figure in running expenses.

Mr. Burchard—In this case we circulate the water through the cylinders—the water contained in the holder tank of the large gas holder—in winter. In summer we pump the water from the stream that flows near by, so we do not measure it. I have measured it, however, and I have some notes here and could look it up if you wish.

Dr. Emery—There is one question that I think ought to be brought out here—what was the actual cost of horse power in this particular case that is so ably presented by Mr. Burchard? I do not know but I made it up too hastily here; I would like to be corrected if I have, and it would interest others to know if I am right. There is 160 watts per pound of coal—159.6.

Mr. Burchard—Allowing for the 20 per cent. for the fuel used for making steam the average was 159.6.

Dr. Emery—Calling it 160 and 746 for a horse power, it makes 4.66 pounds per horse power per hour for the work delivered out of the line to the lamps. Now for efficiency of plant from the lamps back through the dynamo and the gas engine of 80 per cent., as we would usually allow, that would make the cost per indicated horse power $3.72. It does not seem to me a very remarkable result; it is about what we get for the high pressure engine, if the way this is figured is right.

The following written discussion was contributed by Mr. Paul Winand, Superintendent of the Otto Gas Engine Works, Philadelphia:

Philadelphia, April 11, 1895.

MR. F. R. HUTTON, Secretary A. S. M. E.

DEAR SIR: I had the pleasure of being present at the meeting of your Society last night, and would have asked for the privilege of making a few remarks on the subject as a representative of the Otto Gas Engine Works, had it not been for the lateness of the hour at the close of this very interesting discussion. May I be permitted to offer these remarks in writing as a supplement to the discussion?

It was a pleasure for me to add my share of applause after Mr. Reeves's very able exposition of the subject. I fully concur with the same except on a few minor points.

Concerning gas lighting by incandescent burners, I know by actual experiment that the temperature obtained from producer gas is not sufficient for the purpose. On account of the large percentage of inert gases which it necessarily contains it is not even economical to enrich it for lighting purposes. However, by reason of the cheapness of the power obtained from this gas, electric lighting is generally the best possible way of providing light in such an installation.

Pure water gas, though it can well be used in incandescent burners, is more expensive per heat unit, and on the whole can not compete with producer gas.

It is generally thought that by increasing the number of impulses the gas engine can be greatly improved as far as regularity of motion is concerned. This is only an argument of relative value, however, as the question resolves itself to this: Whatever the number of impulses may be, there must be fly wheels of sufficient momentum to produce the desired degree of regularity. Now is it cheaper, more economical and generally preferable to have a simple engine with a large amount of momentum, or a more complicated one with smaller fly wheels? The same regularity can be obtained in all cases, and it has not been proved that a simple engine of sufficiently high speed is not the more preferable solution. A considerable experience in this line has shown to me that it would be decidedly wrong to complicate the construction in order to get more than one impulse for each revolution. I should wish to emphasize the point made relative to the use of fuel gas for industrial heating purposes concurrently with its use for power. The advantages of gaseous fuel when applied not only on a large scale, as for metallurgical operations, but in smaller apparatus of various kinds, are being gradually recognized.

The engines at Danbury, so carefully tested by Mr. A. Burchard, were built by the Otto Gas Engine Works with the provision, as he has stated, that they could be operated indiscriminately by producer gas or by illuminating gas. The latter gas having about six times the heating value of the former, it will be easily understood that a compromise had to be resorted to in the construction, the result being that the engines do not give the best possible efficiency in either case. Engines built solely for producer gas would give better results. A test of a similar engine has been made by Prof. Spangler, and was published in the Journal of the Franklin Institute, May, 1893. These engines were designed in 1891, and naturally engines built to-day show a marked advance in construction as well as in economy.

Since steam is being used in the Danbury plant for various purposes it was quite natural to employ a small steam engine for starting the gas engines. The large engines built now by us are provided with a self-starting device which renders the use of auxiliary power unnecessary, and greatly enhances the convenience of operating the plant.

The efficiency of a plant depends on the choice of the units of power, and perhaps a better result could be obtained in this case if the units were differently selected.

It should also be borne in mind hat the producer used is large and would be capable of furnishing gas for a greater amount of power, especially if the load factor was more favorable, as it would be, for instance, in the operation of a mill or of a water works, and I might well state here that gas power is being used extensively in Europe for the last named purposes. The assumption made by Mr. Burchard that 25 per cent. of fuel should be allowed, that is, added for the production of steam, is rather too high. In numerous tests made abroad the coal used for steam was found to average about 12 per cent.

Up to this date it has been customary to use a steam boiler in connection with the producer. This is not necessary, however, and we operate in our works a producer plant without boiler. The necessary amount of water vapor which passes with the air through the producer is generated at atmospheric pressure by means of the waste heat of the gas as it leaves the producer. There is thus no additional fuel used for producing steam and besides the operation of the apparatus is rendered almost automatic.

Mr. Richmond has stated that oil engines were not made in this country, that they were in fact hardly known Such engines have, however, been manufactured here for several years, and considerable efforts have been made for their introduction. We ourselves are fully prepared to begin their manufacture if a sufficient demand should arise. But in view of the fact that gasoline engines are so much preferable in most every respect, it is not surprising that the demand for oil engines should be so small. Gasoline engines have all the advantages of gas engines, and in some of those built in this country to-day the provisions for safety are so absolute that the insurance companies have no objection to their use. Besides the objectionable smell which seems inseparable from the oil engine, there is the objection of its not being ready for starting at a moment's notice. Oil engines are naturally wasteful when running at partial and variable load. This is due to the fact that the proper degree of temperature is not maintained at the different loads which occur in practice. When a continuous external flame is used for maintaining this temperature, the fuel consumed in this flame decreases the efficiency at reduced loads.

The oil engine described by Mr. Wildy was exhibited at the World's Fair. In this engine, the ignition of the charge depends on the temperature of the chamber which is left uncooled at the rear. The temperature of this chamber, and consequently the time of ignition, varies with the load, and this circumstance produces an additional variation of the efficiency with the load.

Oil engines are naturally somewhat more complicated, more expensive and less convenient than gasoline engines, and unless there be a marked difference in the prices of the two fuels the latter would seem preferable in most cases.

As a conclusion, I would remark that all those actively engaged in the development of internal combustion engines cannot fail to feel gratified at the increasing interest which is manifested in this subject and of which yesterday's discussion was a remarkable instance. Very truly yours,

PAUL WINAND.

London Notes.

(From our London Correspondent.)

AMSTERDAM EXHIBITION.

At this exhibition, which was opened on the 10th inst., one of the principal features among the exhibits is an electric restaurant, where the services of waiters are dispensed with, the guests being served by means of electrical contrivances. Many of the latest electrical inventions are exhibited.

ELECTRIC TRACTION.

There is at present a decided move in favor of electric traction. Works are in hand for tramways at Coventry, Dublin and Bristol, while Leeds is thinking of important extensions of its system and many other towns are considering proposals to work electric tramways who would not have looked at the matter a little over twelve months ago. The Bristol line will be on the Thomson-Houston system, the British company having the contract, and in a few weeks everything is expected to be complete. There is a tendency among railway companies to let electricity supersede steam on their lines, notably the Mersey Company, who anticipate largely increased receipts through the proposed innovation. Our larger railway companies give no thought to the question, neither do they seem at all likely to do so.

TELEPHONE SERVICE.

For the past few weeks a Parliamentary Committee has been sitting to hear evidence from experts, electricians, local authorities and others as to the efficiency or otherwise of our present telephone service, and as to whether it is advisable for the Government to purchase the whole telephone system and rights of the National Telephone Company, which company owns nearly the entire system of telephonic communication in this country. We shall doubtless have the whole in the hands of the Government before a great while has passed, but a pretty penny will have to be paid, for the system has only reached its present dimensions through strict superintendence and enormous expenditure.

The Waddell-Entz Factory Sold.

The Waddell-Entz factory at Bridgeport has been sold by Judge J. H. Perry for $60,000 to Percival Knauth, a member of the firm which was the chief backer of the original enterprise.

RAILWAY PATENT LITIGATION.

(Continued from Page 265.)

may be kept up between the wire and a *projection* from a running train or car, and upon each train I have a car containing a battery, a receiving and transmitting telegraph instrument and *a swinging or projecting device* by which the circuit or connection may be formed with the main line."

(4) Guyard British Patent. This is also for "Improvement in railway telegraphs," and discloses a conductor suspended over the train and communicating with the apparatus carried thereby by means of a contact device or "communicator" mounted on top of the car. The date of this is 1855. The "communicator" is referred to in the provisional specifications as follows :

"On the tender or engine or one of the carriages of each train is *a projecting* arm carrying two metallic brushes. By this or other suitable means a connection is made between the wires and one pole of the galvanic battery or other source of electricity on the train, the other pole of which battery is connected with one of the axles and through it with the earth."

(5) Clark British Patent, date 1878, is for a railway telegraph and describes a stationary conductor arranged in any of three different ways—below, at the side, or over the top of the car. When below, the contact device is an overrunning shoe secured to the end of a trailing spring-pressed arm; when at the side, it is a flanged roller mounted in a fork on the end of a vertical arm which is pivoted to one end of a pivoted lever extending into the car, which lever is provided with a weight on the other end for causing the contact roller to bear upwards against the under side of the suspended conductor. Provision is made for the lateral movement of the conductor by making the conducting roller long enough. When placed above the car the latter construction is also used.

(6) Dalstrom's British Patent of 1880.

This patent is for a railway telegraph. It has a conductor suspended above the train, and a contact arm mounted on the train carrying a grooved contact roller making an underrunning contact with the conductor. The specification is :

"The conducting wire, supported (properly insulated) by arms from the telegraph poles, or in any other way, is freely suspended the whole way between the stations at as nearly as possible a uniform height above the rails, and equally distant throughout (or as nearly as may be) from the center of the line of the railroad track. . . . If there be several railway lines side by side, the wires may be supported on cross-pieces situated above and crossing the rails, said cross-pieces being supported by a sufficient number of poles. . . . . The wire may be arranged either in line with the central line of the track or at a greater or less distance therefrom."

(7) Swears's British Patent (1866) is for improvements in railroad telegraphs, and describes a conductor extending along the track in several different positions and several different forms of contact device. The conductor is described as a bar or rod of metal placed on or hung from insulated supports ; the height of the insulating supports of the conductor "can be from a few inches to any height, and can be supported over the train if necessary."

The contact arm is thus described :

"To form an electric communication between this supported rod, bar or wire and the train, there is fixed at the side or end of the carriage a socket in which an arm is adjusted, which arm projects from the carriage over the supported rod, or the arm may be fixed on or over the grease box of the axletree, *or any other suitable place.* This arm can be made adjustable so as to regulate the distance of its projection."

The contact device is thus described :

"At the end of the arm over the supported rod is an axle; on this axle are one or more rollers or wheels insulated on the arm, and a connecting wire brought from them into the carriage; *these rollers or wheels trail along the rod, either above, under, or at the side.*"

And again :

"These wheels can be simply mounted on the axle at the end of the arm (insulated), and a contact wire brought from them into the carriage, and rendered self adjustable by means of the arm and axle."

(8) Tatham's British Patent of 1882 is for a railway telegraph, and discloses a conductor mounted upon insulated supports between the rails of the track. Communication is made with the train by means of a trailing arm pivoted to the under side of the car and which is provided with a spring for pressing it down against the conductor and a grooved roller which makes contact with the upper side of the conductor.

(9) Traill's British Patent of 1883. This patent is for an electric railway in which there is the single independent conductor for supplying current to the car, the rails being used as the return conductors. The contact device consists of an arm projecting laterally from the side of the car and capable of being adjusted to any length of projection. The supply conductor is arranged on low posts at the side of the track, and the contact device consists of an elliptic spring which bears against the conductor, making contact therewith either on its under or its upper surface as may be desired. The inventor says (p. 2199, l. 22) :

"According to my invention, to enable the contact brushes to travel along such conductor with the least amount of friction while preserving metallic contact, and to adapt this to the varying loads in the cars, and to automatically adjust themselves for either direction of motion, and to rapidly slide off and again to mount on to an electric conductor where interruptions of the same occur with the least chances of breakage, I employ in lieu of and in preference to either wire brushes or roller wheels, 'a contact brush,' which, in its simplest form, is a double curved and elliptical or semi-elliptical steel spring, shaped like a carriage spring, formed of thin but broad spring steel in one or more leaves, and furnished with a shoe or contact wearing piece at the place of rubbing contact. The brush is attached to a metallic arm projecting from the side of the car and capable of sliding in or out, being held by a spring catch or screw when drawn out to the requisite distance or of folding up or back when not in use."

And at line 46 of page 2198 :

"The brush is capable of attachment to the projecting arm so as either to press down upon the top surface of a contact rail, as in Fig. 2, or so as to press upward against the under side of the conductor rail, as in Fig. 4, or it may be used for a side pressure."

(10) Lake's British Patent of 1884. This patent is for improvements in railroad signaling and stopping apparatus for preventing collisions on railways. It discloses a conductor arranged above the train and a contact device mounted on top of the train spring-pressed upwards against the conductor, whereby the current is conveyed into the train to operate the signaling device or a contact-closing device which will throw into circuit electrical devices for stopping a train. The patent also states that the conductor may be arranged at the side of the train or between the rails below the cars. The contact apparatus has four contact pieces, two of which are brushes and two rollers, the said contact pieces being mounted upon an arm sustained by a spring in the middle so that two of the contact pieces are back of the supporting point and therefore trail along the under side of the overhead conductor.

(11) Bolton's British Patent of 1885. This patent, dated May 21, 1885, is for lighting railway carriages in tunnels and underground railways. It discloses a line conductor suspended from the roof of the tunnel, and a trailing contact arm pivoted on top of the car and provided with a contact device making an upward spring-pressure contact with the under side of the conductor. The specification says (p. 2232, line 25):

"On the roof of the tunnel, and supported by brackets or hangers, I fixed metal conductors at such a height above the rails that the brushes or grooved wheels on the carriage roofs will either rub or roll along them when the train passes through the tunnel. . . . The conductors are connected to the hangers or brackets in such a manner as to be insulated from them and as to present a smooth under surface."

Several different forms of contact device are described in the specification, and two forms are illustrated. The first illustrated form is described as follows :

"The construction of the collectors is shown to an enlarged scale in under view and side view at Figs. 2 and 4. They consist of a copper strip *c*, held by metal clamps *d* on upright bars d^1, pivoted at *e* to metal plates *f*, screwed to insulating plates *g* of earthenware or other material, and fixed on the roof of the carriage, the collector being held in the upright position by helical conducting springs *h* connected thereto, and to insulating blocks *i*, also fixed on the carriage, the electrical connection being made between these ends of the springs and the conductor leading to the lamps in the carriage. By this arrangement it will be seen that *when the conductor* c *comes in contact with the conductor* a, *it can be depressed thereby in a more or less inclined position, the springs* h *maintaining the contact between the two, notwithstanding any vertical oscillation of the carriage.*"

This particular contact device is made wide so as to permit of lateral movement between the contact device and the conductor without breaking contact.

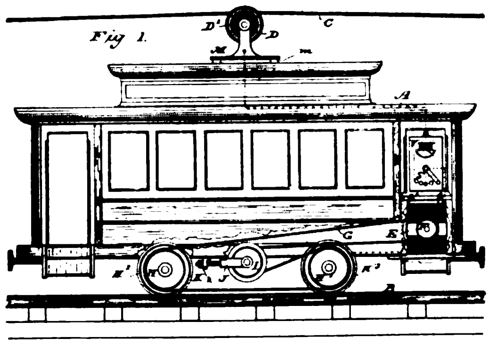
A second form of contact device consists of an arm pivoted so that it may assume an inclined position, as in the case with the first construction. It is, therefore, a trailing arm, and is surrounded with a helical spring which presses it upwards against the conductor, while the plate springs R R, one on each side, serve to hold it in a vertical position against its lateral movement. It has not only an upward spring pressure tending to maintain it in contact with the conductor, but also spring pressure from both sides tending to counteract its lateral movement. This device is a pivoted trailing upwardly spring-pressed arm, capable of both vertical and lateral movement, and it complies in every particular with the contact device described in Mr. Bentley's definition of Van Depoele's alleged primary invention with the exception that it is not used to convey current to propel the car.

In short, the defence claim the Bolton patent discloses a "railway having an overhead conducttor and a car for such railway provided with a contact device carried by the car so as to form a unitary structure therewith, and consisting of a trailing arm hinged and pivoted to the car so as to bridge the space between it and the conductor and move freely both laterally and vertically, the said arm carrying at its outer end a contact device capable of being pressed upward by a suitable tension device into engagement with the under side of the conductor," and is therefore a complete anticipation of Van Depoele's said alleged primary invention as defined by Bentley and set forth in the patent, 495,443, in suit.

Daft's prior use at Baltimore. The defendants introduced the testimony of Leo Daft to show that he used at Baltimore a contact device essentially the same as that described in the patents in suit; that Van Depoele's devices were essentially the same as those described in Siemens's 1880 patent. They also claim that Van Depoele was not at the time of his patents trying to solve the problem of efficient contact, but was trying to adapt the Van Depoele dynamo to use as a motor; that the contact problem had already been solved and cut only the most insignificant figure in the whole transaction.

They claim that there is no credible evidence that Van Depoele invented the upwardly spring-pressed swinging and pivoted underrunning trolley before March, 1887, the date of his application for No. 495,443.

Summing up, the defence claimed to have shown the ample art which preceded the commercial introduction of electric railroads from which inventors might select suitable means of taking the current from the conductors, and that Daft, Sprague and Hunter did select upwardly spring-pressed arms of the trailing form. They claim that Van Depoele, even as late as 1886, 1887 and 1889, used the overrunning trolley at Montgomery and elsewhere; that the underrunning trolley was due more to the substitution of the single overhead wire, which was less adapted to overrunning than the double wire and cheaper, than to any other one thing; that patent No. 495,443 is void because the same invention was patented in prior patents to the same inventor, by which the right to patent was exhausted.



The patents here referred to, Nos. 331,585 and 467,448, are illustrated in the above cut:

In this device the wheel D has a grooved metallic rim set upon a flexible rubber web which permitted slight lateral motion, and journaled upon bearings resting upon springs permitting of slight vertical motion.

The substance of the answer to this defence is that none of the patents prior to those at suit covered the essential features of the Van Depoele invention which permitted the extremely wide variations, both laterally and vertically, amounting to a complete reversal of the position of the trolley pole when desired. It is claimed by the complainants that there was nothing in the state of the art at the time of the Van Depoele patents that would suggest his invention, and they refer to the evidence of defendant's experts, Brevoort and Waterman, as admitting that Van Depoele's work was new.

In regard to the Wesson and Fitzgerald patents, they hold that they do not show a spring upon the *outer* end of the arm, but on the contrary that they show the spring between the pivotal device and the contact device. Smith's patent does not show the arm on the under side of the conductor but on the side of the conductor nearest the car. Brunnin's shows underneath contact with an overhead conductor, but his conductor is not continuous and no swinging arm is described. Guyard's shows arms, but the spring is at the contact end and not at the opposite end; there is no swinging arm and no substantial capacity for adaptation to *material* changes of level.

In the Wesson patent the wheels are not mounted on a swinging arm.

The Fitzgerald patent is vague and indefinite, and nothing is said in the specifications about any capacity for movement. The complainants interpret the specification very differently from that placed upon it by the defence.

As regards the Bolton patent, they hold that it is not early enough in point of date, viz., Feb. 20, 1886. (This was date of final specification; it is not known when the patent was sealed.)

Further, it is claimed that it does not cover Van Depoele's invention, as while there is a suggestion of the substitution of some grooved device and there is a possibility of slight capacity for lateral and vertical motion, it does not meet the requirements in the extent of these; and still further, it is not for *propulsion* purposes as claimed in the patent in suit. Bolton clearly had no swinging arm and nothing that would enable a car to take switches or crossings, or to maintain contact at curves.

Edison never got beyond the third rail.

Dr. Werner Siemens appreciated the overhead system and exhausted his ingenuity in the variety of devices which he adopted to secure efficient contact by overrunning, side-pressing or slotted-tube devices.

Daft approached the direction of Van Depoele's at road crossings but failed to embody the swinging arm feature, and then failing to see any possibility of further development in that direction, turned his attention to overrunning or towed trolleys.

Sprague, it is claimed, probably adopted his final ideas from Van Depoele.

The defence concluded as follows:

I. That the Van Depoele patent No. 495,443 was anticipated by the prior American and British patents before enumerated; by Parish & Munn's patent No. 297,438, dated April 22, 1884; by Parish & Munn's patent No. 320,495, dated June 23, 1885, and by Heald patent No. 385,928, dated July 10, 1888,—all of which specify contrivances claimed to be essentially the same as Van Depoele's.

II. That the patent was anticipated by the prior use by Sprague at Richmond.

III. That in view of the state of the art its claims did not involve invention.

IV. That the following prior patents of Van Depoele's embodied the same invention: Patents 394,087, 405,750, 408,638, 422,266, 424,381.

The court room looked like a veritable toy shop at Christmas time. Nearly, if not quite all of the devices mentioned in the above report were represented by models of cars with the devices attached showing their method of application to the stationary conductors. There was also a model of a portion of the Winchester Avenue Railroad, showing a double track, a cross-over, the overhead wires and feeders, and two cars, labeled "Short" and "Westinghouse," with their trolley poles.

Historical exhibits of the trolley actually used on the New Orleans road in 1885 (Van Depoele) and of the one used at Montgomery, and several more modern ones, were features of the exhibits for the plaintiffs.

Strange to say, this case seemed to have no interest for the public, as there were few present besides those who were actually engaged in the case. Stranger still, of all the electrical papers that claim to keep their constituents posted as to what goes on in the electrical world, *not one* was represented but ELECTRICITY.

Counsel in the case were Betts, Hyde & Betts for complainant and Jenner, Kerr & Terry for defendants.

For Mutual Protection.

Independent Telephone Companies Organized.

A meeting of the independent telephone manufacturing companies was held in Chicago this week for the purpose of organizing an association for the advancement and benefit of the legitimate telephone business. Mr. J. E. Keelyn, president of the Western Telephone Construction Company, was instrumental in bringing about the meeting, his call to arms being sounded in the following telegram:

Can your managing official meet here with others, to perfect national organization for mutual protection, next Saturday and Monday. Important immediate action. Answer quick. Confidential.

Confirming the telegram and urging still further the necessity for united action, Mr. Keelyn sent the following letter:

The probable effect that will obtain in the future respecting the form of order to be entered by the United States Court of Appeals in the Berliner case at Boston requires the earnest and urgent attention of all those expecting to be engaged in the manufacture or production of telephone apparatus.

The further necessity for preparing for the promised onslaught of the Bell people calls for immediate organization toward a peaceful conduct of legitimate telephone business, and the maintenance of the legal and business rights of those engaged in it.

This has suggested the prompt meeting of interested parties. If you desire to be identified with this organization it will give the writer pleasure to have your prompt advices to that effect.

It was deemed unwise at this time to make the convention open to the public, but it is expected and hoped that the result of the conference will be conducive to the enterprise of free ingenuity and the material advancement of legitimate telephone business.

The National Association of Telephone Manufacturers was officially formed on Monday, May 27. The officers elected were as follows: President, J. E. Keelyn, of Western Telephone Construction Company, Chicago; first vice-president, J. R. Johnson, Viaduct Manufacturing Company, Baltimore; secretary, Paul W. Bossart.

American Institute of Electrical Engineers.

The annual meeting of the Institute for the reception of the yearly reports and election of officers was held at 12 West 31st street, New York, May 21.

The Council reported a membership of 944, showing a net gain of 144 members for the year ending April 30, 1895.

The count of letter ballots, completed at midnight, gave the following result:

For President—Dr. Louis Duncan, Baltimore, Md.

For Vice-Presidents—Dr. Michael I. Pupin, New York City; W. F. C. Hasson, San Francisco; Angus S. Hibbard, Chicago.

For Managers—Carl Hering, Philadelphia; Bion J. Arnold, Chicago; Charles F. Scott, Pittsburg; Dr. Cary T. Hutchinson, New York City.

For Treasurer—George A. Hamilton, New York City.

The discussion of Prof. Anthony's paper on "Underwriters' Rules," read April 17, was resumed, and opened by Prof. W. L. Puffer, of Boston.

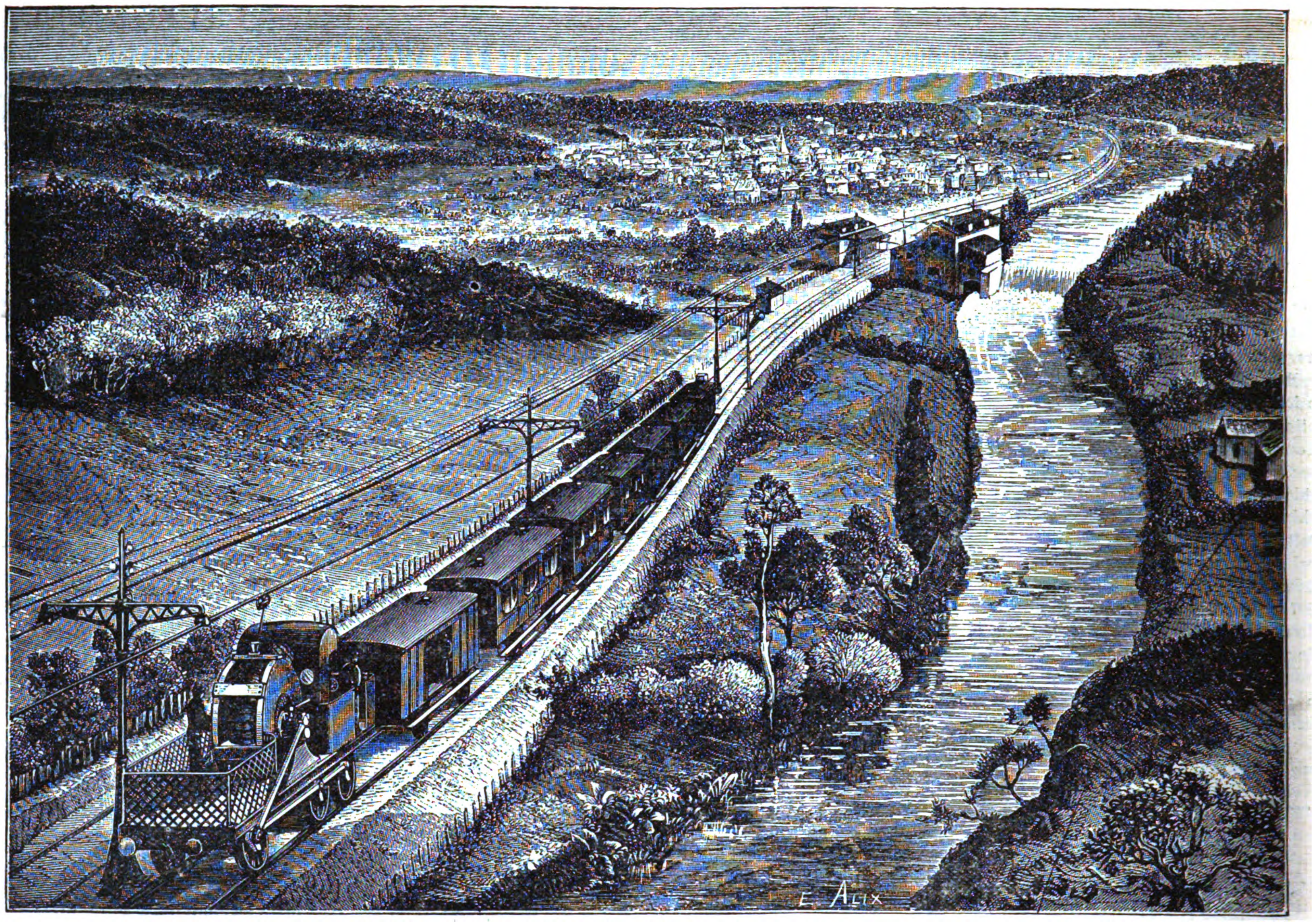
At the meeting of Council in the afternoon the following associate members were elected:

William C. Andrews, Alexander B. Simpson, Frank W. Roller, Brooklyn, N. Y.; Clare F. Beames, Myron E. Canfield, Sydney Hogentoren, New York City; John Thomas Dewar, Antwerp, Belgium; William David Gharky, Philadelphia; Henry Banks Henderson, Ithaca, N. Y.; Theodore K. Jackson, Chicago; Norman T. Wilcox, Seneca Falls, N. Y.

The following associate members were transferred to full membership:

Romaine Callender, J. Day Flack, F. R. Colvin, New York City; Russell Robb, V. M. Berthold, Boston; Herbert Lloyd, Philadelphia; Harry Hartwell Blades, Detroit, Mich.

The Council decided that the General Meeting at Niagara Falls should be held on June 25 to 28 inclusive.



AN UNDERRUNNING TROLLEY OF 1884.

The Siemens road between Frankfort and Offenbach. Contact running in slotted conductor.

THE GRAND CENTRAL PALACE.

Proposed Exhibit of the N. E. L. A.

Last week marked the close of the annual Food Show at the Grand Central Palace which had been attended by thousands daily for several weeks. The exhibitors were more than pleased with the success of the exhibit.

The dinner given by Mr. Mestaniz, the manager, to the Executive Committee of the N. E. L. A. attracted the attention of the entire electrical fraternity to the building, and it has been carefully inspected by all those interested in the movement to hold a grand electrical exhibition here in 1896. But one opinion has been expressed, and that is that the Grand Central Palace offers advantages for such an exhibition equalled by no other building in this country. We have no doubt that everything will be arranged properly, and that the N. E L. A. will make a thorough and substantial success of the 1896 meeting in New York.

If it is finally decided that the Association has no legal right to conduct an exhibit, it is proposed by a number of New York gentlemen to incorporate an exhibit company under the laws of this State, for $5,000 or $10,000, offering the stock to the trade generally; then to begin work on the grand exhibition early in September. Under this arrangement, the Association would incur no liability, but would have the use of the great hall in the building free of charge, and would receive a handsome percentage of the profits from the sale of space, the Association appointing one of its officers to co-operate in the work of placing the exhibition upon a proper basis.

TELEPHONES FOR TEXAS RANCHMEN.

Wire Fences for Pole Lines.

A paragraph has recently been going the rounds of the electrical and daily press purporting to give reliable information respecting the use of barbed wire fences in the Western States as telephone lines. There has recently been formed at Dallas, Tex., the Texas Telephone and Electric Supply Company, which will devote much of its attention to this work. In a communication to ELECTRICITY Mr. W. H. Thacker, general manager of the company, gives some very interesting information touching the methods by which wire fences are to be utilized for telephone purposes. He says:

"Few people not resident in the West have any conception of the extent of a large cattle pasture. For instance, it may be stated that by continuous running it takes a Fort Worth and Denver Railroad train from 4:30 to 10 A. M. to pass through the Goodnight ranch in Northwest Texas. This is not so large as other ranches, among which may be mentioned that of the Copital Syndicate, which is 300 miles in length.

"Poles being so high priced, and the distances to be covered so great, it would be utterly out of the question to establish an extensive telephone service among the ranchmen. We purpose using the wire fence already erected, thus obviating both the necessity and expense of constructing independent pole lines. For short lines, not exceeding a few miles in length, we simply connect the 'phones to two of the fence wires, one for the outgoing and the other for the return side of the circuit. On long lines the staples holding the wires to the posts are drawn out and the wires fastened to the posts by brackets and insulators. At every ranch or tenant house a loop is run in and connected to an instrument, the whole ranch being connected on one side of the circuit, a second wire being used for the return, thus forming a complete metallic circuit. Grounds are established at points where instruments are connected in circuit, but on only one side of the circuit.

"In addition to affording a means of quick communication with all parts of a large ranch, this form of telephone service will provide an excellent means for testing the condition of fences. An open circuit will cut off the telephone communication and at the same time indicate a break in the fence."

The company of which Mr. Thacker is manager will do a general electrical contracting business, but will devote special attention to telephone installations. The general plan will embrace the organization of companies owning all, or at least the controlling interest in, the local enterprises.

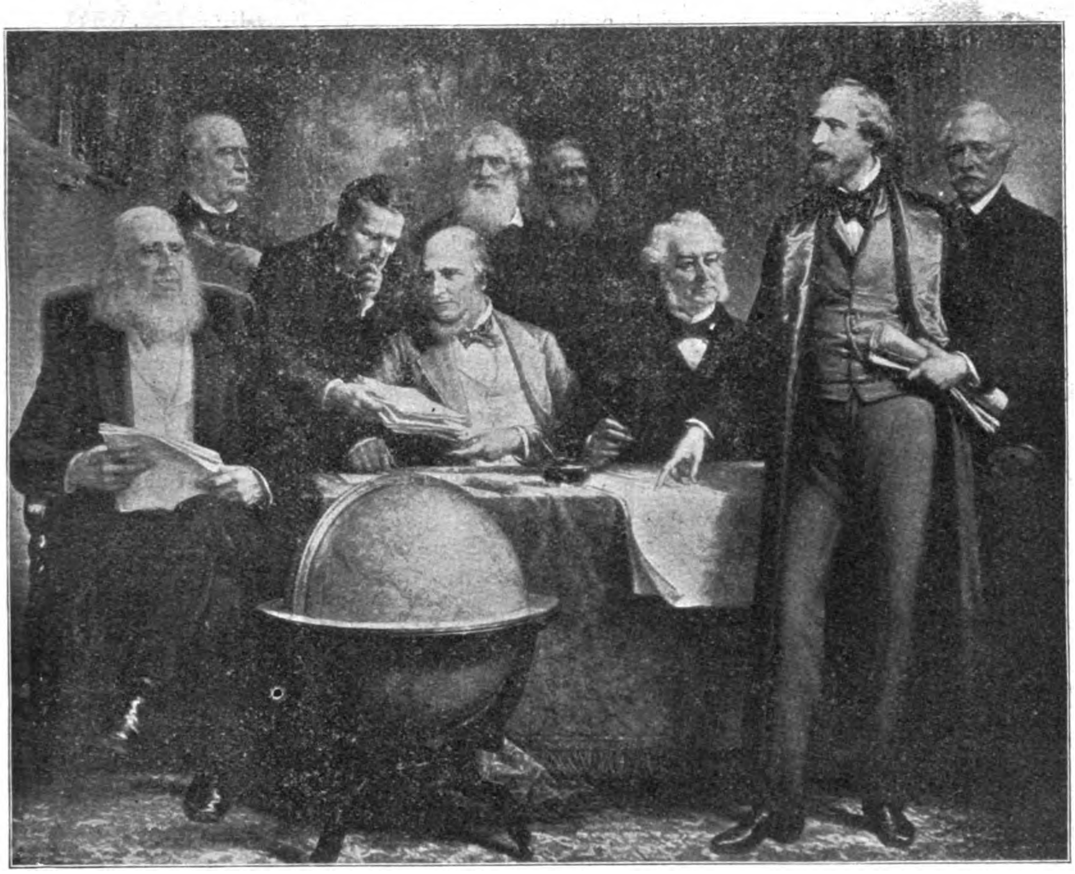
Electric Lighting Contracts.

One of the bills passed during the closing hours of the New York Legislature, and which has since received the signature of the Governor, provides:

That any incorporated village may contract for a term of one year or more with any electric light company organized under the laws of this State or with any person or persons for lighting the streets and public grounds of such village. The amount of such contract agreed to be paid shall be annually raised as a part of the expenses of such village and shall be levied, assessed and collected in the manner that other expenses of such village are raised, and shall be paid over to such electric light company, person or persons by such trustees according to the terms of any such contract. And any such contract entered into by the Board of Trustees of any village shall be valid and binding upon such village; providing, however, that no such contract shall be made for a longer period than five years, nor for a greater sum in the aggregate than $2.000 per annum in a village of less than 4.000 population, nor more than 1½ mills per annum for every dollar of the taxable property of such village, according to the last preceding assessment roll, nor for a greater sum in the aggregate than $4.000 per annum in a village of more than 4,000 population, nor more than 2½ mills per annum for every dollar of the taxable property of such village according to the last preceding assessment roll, unless the proposition for the same be submitted to a vote of the electors of such village, and approved by the majority of the voters entitled to vote and voting on such question at an annual election or at a special election duly called.

PROJECTORS OF THE ATLANTIC CABLE.

A special meeting of the New York Chamber of Commerce was held on Thursday last to formally receive the painting entitled "The Projectors of the Atlantic Cable," presented to it by fifty-two of the leading citizens of New York. Morris K. Jesup, chairman of the special committee having the matter in charge, presented the painting to the Chamber in an appropriate speech. Dr. Chauncey M. Depew delivered the oration, paying a glowing tribute to the memory and achievements of Cyrus W. Field, Moses Taylor, Marshall O. Roberts, Wilson G. Hunt, Prof. S. F. B. Morse, Chandler White and David Dudley Field.



The Projectors of the Atlantic Cable.

D. D. Field. S. F. B. Morse. Daniel Huntington. Wilson G. Hunt.
Peter Cooper. Chandler White. Moses Taylor. Marshall O. Roberts. Cyrus W. Field.

The painting represents a meeting of the projectors of the Atlantic cable at the residence of Cyrus W. Field in Gramercy Park. The venerable Peter Cooper is presiding. To the right stands Mr. Field, who is calling attention to a chart of Trinity Bay, pointing to Heart's Content as a safe harbor for landing the cable. David Dudley Field stands behind the president with a law book. Chandler White is handing estimates of expenses to Marshall O. Roberts, next to whom at the table is Moses Taylor. At the end of the table stands Wilson G. Hunt. Prof. Morse is standing behind Mr. Roberts, and by his side Daniel Huntington, the artist, sketching. The original idea of the picture was suggested by Mr. Field to Mr. Huntington shortly after the completion of the cable.

Milwaukee Street Railway Co.

The street railway system of Milwaukee is at last compelled to acknowledge bankruptcy and to go into the hands of a receiver. It is bonded for $12,800,000. The G. E. Company holds $325,000 and the Street Railway and Illuminating Properties $600,000. Interest has been defaulted four times.

The system is equipped chiefly with Sprague apparatus, and to put the road into good condition will require a large amount of fresh capital.

BOOK REVIEWS.

The Keely Motor Explained by Its Inventor, with Running Comments by the Editor.

Operation of the Vibratory Circuit (by Polar and Depolar Sympathetic Interchange as Associated with the Transmitter). By John W. Keely. ("New Science Review" for April.)

Keely, it will be remembered, is the irrepressible fraud that for twenty five years or more has been periodically coming before the public with new schemes of perpetual motion, or for drawing energy from sources where it does not exist. These schemes are never twice exactly alike, but all have gone under the generic term of the "Keely motor." The writer well remembers that in 1877 he saw at the Chester Steel Works several iron or steel spheres. One was about 3 feet in diameter, and two others about 1½ feet. These were very nearly solid, so he was told, but but had small cavities at their centers which communicated with the outside by a narrow channel, perhaps as large in diameter as a lead pencil. On inquiring for what purpose they were made, he was told that they were for the Keely motor. They had been tried, but Keely claimed that they were not strong enough to hold his "vapor" and had returned them. They had not been paid for.

At that time Keely claimed that he used a vapor, and the only bar to his successful accomplishment of the feat of running an engine from New York to San Francisco on a thimbleful of water was his inability to obtain a containing vessel for his "vapor" strong enough to hold it.

Evidently the Keely motor of to day is not the Keely motor of that day, for in the article under review he gives the following very lucid (?) description of the new apparatus, which evidently requires no containing vessel of unattainable strength, as did the older one, unless it be something very strong to hold the "ring of less diameter, situated inside of the larger ring and carrying on its face *eight* disks, with a triple grouping in each," which he states constitutes the "depolar field, or field of high polar interference."

Continuing his description of the apparatus, he says: "In the center is placed a resonating intensifier, through which the sympathetic currents pass. By a spiro-vibro phonic [sic] arrangement these currents are diverted toward the neutral center of the earth. This device is the sympathetic multiplying agent for the polar field, and the negatizing agent for the anti-polar field. When under action it is entirely subservient to the transmitter, both in regard to high intensification and thorough neutralization of polar and depolar interchange."

Here we have the whole thing in a nutshell, so concise, so clear that none but John W. Keely, Mrs. Bloomfield Moore, or J. M. Stoddart could equal it in style.

But the simple description of the apparatus in which eight disks are given a "triple grouping," is nothing compared with the philosophy of its action.

Here is part of it:

"The circles containing the sensitized disks—both polar and depolar—are in sympathetic relation to the polar negative circuits of the earth. . . . The sympathetic conditions of the polar and depolar fields of the circuits remain latent until the transmitter is associated and the introductory impulse given. . . . The introductory impulse represents the sympathetic chord of unity to polar attraction. When this is given the polar outreach [What t'ell's a polar outreach?] is immediately established in the polar circuit which seeks to assimilate itself to the anti-polar, or triple groupings; but as the alternation of the two circuits represents a condition of sympathetic antagonism [as 8 is to 9]. [*Sympathetic antagonism* is good.—Ed.] an intensified differentiated wave motion is induced between [Again in the classic language of Chimmy Fadden, "t'ell wid sympathetic philosophy."—Ed.] the two." . . . "In sympathetic philosophy the polar circuit represents the brain power of the instrument, or the medium of impregnation from celestial radiating outflow."

We are not much "up" in physiology, but isn't Mr. Keely a little "off" when he assigns to the brain the function of reproduction?

As an illustrative example of how his motor motes, he points out the analogous (?) action of gravity and centrifugal force. He says: "Our earth in its routine of revolution is governed by the same law (viz., the power of neutral attraction draws the molecules of any mass, no matter what the weight, toward the center of rotation, instead of toward its periphery, according to the intensity of the negative vibration that is induced upon that particular circle), in every particular, its mass tending toward its center of neutrality with a force that is equivalent to the character and velocity of its rotation. *If its rotation were increased, the tendency of everything associated with it would be increased towards its center of neutrality on the same ratio. That is, a pound in weight* would, under certain conditions of *increased velocity*, become *two pounds* in weight."

We quite agree with Mr. Keely that such would be the case were the "condition of increased velocity" the condition of *negatively* increased velocity.

"The laws governing the sympathetic rotation of vibratory machinery are the same laws that govern planetary suspension."

We are rather inclined to believe this too, for was it not by the observed wobbling of the other planets that the planet Uranus was discovered?

If Mr. Keely's mechanism will only wobble enough in its sympathetic outreach for fools' money, we firmly believe that it will increase its velocity negatively eventually, but certainly not until the dispenser of the wherewithal shall have forfeited all claim to the sympathetic spiro-vibrophonic aphonism of the material spirit.

Perhaps some of our readers fail to follow us here, but Keely, Mrs. Bloomfield Moore, and J. M. Stoddart will grasp the subtlety of our language, and they are the ones we are talking to, and we don't care very much if others don't catch on.

Most people will be with Keely when he says "To those who have not witnessed the operation of my devices, my theories must indeed seem wild." Not so with us, his arguments are more convincing than any demonstration of his apparatus could possibly be.

The article under review is divided into two parts. Those who have studied Latin will remember that "all Gaul was divided into three parts." In this respect Keely is inferior to Cæsar, but in this respect only. Cæsar was evidently talking of the Gaul which at that time occupied the western part of the European continent. Had he known of Keely's gaul he doubtless would have divided it into a million parts and then not known what to do with any one of them on account of its extreme size.

Part II is devoted to the subject "The Neutralization of Magnets." He introduces the subject by the question, "How can a magnet be robbed almost instantaneously of its magnetic power?"

Now most people would go about it in the antiquated way—not so Keely, for he tells how to do it much better in the answer which follows:

"The peculiarity of the sympathetic conditions which conserve a magnet to polar and antipolar currents of the earth [He is probably talking about Earth Magnetos here—ED.] prove perfect sympathetic equation between reception and distribution in that part of the electrical field which is classified in my system as inter-atomic vibratory oscillation.

"This oscillation represents, in its corpuscular field of action, an alternating wave motion of 128,400 vibratory exchanges per second, between polar reception and depolar distribution, thus establishing its perfect sympathetic concordance to that third of the electric triple stream which represents the sixths in vibratory sympathetic physics."

"We have now," he says, "reached a starting point from which to obtain a conception of the manner in which a magnet can be neutralized, that is, robbed of its coincident unity or subservience to polar negative attraction;" and then he states that "if a condition of antagonistic vibration is brought to bear upon it, its concordant sympathy to the polar sympathetic volume is broken up," and the magnet is robbed of its coincident unity or subservience to polar negative attraction, or, as we would say in vulgar language, is demagnetized.

He says he can do all this in fifteen seconds.

He concludes his article by announcing that he is preparing a series of experiments which will be conducted daily for one week before an expert committee for the purpose of enabling this committee to make a public announcement of the scientific and commercial value of his system of sympathetic vibratory physics. The series of experiments is as follows:

First—Operation of the polar circuit, drawing power from space, and showing control of various degrees of velocity.

Second—Sensitization of a polar disk, after having had its complete neutrality to magnetism tested.

Third—After associating it with the polar test-medium, heavily weighting it to demonstrate its attractive power: the weight remaining suspended to it by this power.

Fourth—Transmitter connected to the test-medium, while the disk is carrying weight. Negative vibration transferred: effecting complete dissociation, the disk and weights dropping to the floor.

Fifth—Rotation of compass needle, on a set of resonators, subservient to any one of the resonators, in defiance of its attraction to the north. Variations given: changing its subservience to different resonators, as the introductory impulse is changed.

Sixth—Mediums, representing the chords of different masses of metal made to float in a tall jar of water, with extraordinary changes of position.

Seventh—Operations of a sensitized globe, by sound.

Eighth—Operations of the globe under the influence of the improved polar sympathetic transmitter.

Ninth—Disintegration of water by triple vibration.

We hope that Mr. Keely will invite us to be present at these tests.

General News.

What is Going on in the Electrical World.

Hinsdale, N. H.—This town intends to put in an electric light plant at a cost of $10,000.

Pittsford, Vt.—An electric road from Pittsford to Rutland by way of Proctor is talked about.

Nortonville, Kan.—There is talk here of organizing a stock company to build an electric plant.

Bennington, Vt.—Work on the electric road between Bennington and Woodford has been begun.

Alvin, Tex.—The Business Men's Association are discussing the best means to establish an electric plant.

Oakland, Cal.—H. L. Peterman and Daniel Chisholm have applied for a franchise for an electric road in Eden township.

Tampa, Fla.—The Plant System intend putting up an electric elevator at Port Tampa for loading vessels with phosphate.

Murfreesboro, Tenn.—This city has been authorized by an act of the Legislature to issue bonds for an electric light plant.

Chattanooga, Tenn.—The time for submitting bids for the proposed municipal electric lighting plant has been extended to June 10.

Austin, Tex.—An election is to be held here on June 24 to decide whether or not the city shall issue additional light and water bonds.

Martins Ferry, W. Va.—Bonds amounting to $80,000 have been awarded, the proceeds to be applied to putting in an electric light plant.

Ironton, O.—The Ironton and St. Petersburg street railway has been sold at receiver's sale to D. Lamar of New York, who will change it to an electric line.

East Bridgewater, Mass.—The Brockton and East Bridgewater Railway Company has been granted a franchise for an electric railway in this town.

Woburn, Mass.—The receiver's sale of the Woburn Electric Light Company's plant, postponed from the 15th inst., is advertised to take place June 5.

Gadsden, Ala.—Prof. A. B. Jones, of Huntsville, will at once begin the erection of a musical conservatory here; an electric lighting plant of 200 lights capacity is to be put in.

Canfield, O.—At a special election held here a few days ago it was voted to issue $20,000 of bonds for the purpose of building an electric railway from Canfield to Lanterman's Falls.

Chester, Pa.—The city lighting contract for five years has been awarded to the Beacon Electric Light Company, whose bid was $16,250 less than that of the Chester Electric Light Company.

Lafayette, Ala.—Capt. R. J. Moore is receiving encouragement in his scheme to put an electric plant in this city. The council has agreed to take thirty lights for the streets.

Lansingburgh, N. Y.—Proposals will be received by the board of trustees until June 10 for lighting the streets of this village by electricity. Specifications will be furnished by George Gramm, the village clerk.

Quebec, Can.—The sub-committee of council appointed to consider offers made by Mr. Beemer for a franchise for an electric railway system in this city have reported in favor of granting the franchise under certain conditions.

Lansford, Pa.—The tracks and other property of the Inter-County Electric Railway, between Tamaqua and Lansford, have been ordered sold by the court because the company is insolvent and cannot pay certain claims against it.

Milwaukee, Wis.—Ninety per cent. of the bondholders of the Milwaukee Street Railway, it is reported, have assented to an agreement to place the property in the hands of a receiver preparatory to foreclosure and reorganization.

Newark, N. J.—The new trolley line to Jersey City, through Harrison and across the Hackensack Meadows, is almost ready for operation. It runs over the Lodi turnpike. The road crosses the tracks of the D. L. and W. Railroad.

Independence, Mo.—The Kansas City and Independence Rapid Transit Railway Company is considering plans for extending its electric road in Independence. The Air Line Electric Company is preparing plans for its railway in Independence.

Winchester, Mass.—The scheme for an electric street railway between Stoneham, Winchester and Arlington, which was agitated about a year ago, is being revived, and new men having taken hold of it it now looks as if the project will be pushed through.

Oshkosh, Wis.—The Oshkosh Street Railway Company have applied to the city council for the privilege of extending their line on Oregon street, and to change their motive power to electricity. They promise to give the city a first-class electric car line.

Charleston, S. C.—It is understood here that John B. Hoefgen and Edgar Moxham, representing a wealthy Brooklyn, N. Y., syndicate, have bought the two street railroads in operation here, and will consolidate them and use electricity as a motive power.

Los Angeles, Cal.—The trustees of the Los Angeles Consolidated Electric Railway have made a demand on the company for payment of the principal and accrued interest. Upon the failure of the company to meet the demand the trustees will sell the road to the highest bidder.

Detroit, Mich.—A contract has been signed with the Detroit Electric Light and Power Company by which the Detroit Railway (Everett line) secures the electricity heretofore used in lighting the city lights, and the cars will be run with it until the new power-house is completed.

Vicksburg, Miss.—The Vicksburg Electric Street Railway Co.'s franchise and other property, consisting of a mile of track, never operated, and 250 acres of land, have been sold to satisfy a New York mortgage and was bought in by C. F. Tag & Son and J. H. Benedict of New York for $17,000.

Allegheny, Pa.—The Department of Public Works has advertised for bids for electrical supplies, carbons, lamps, etc., the bids to be opened June 3. A list containing approximate quantities can be had and all information obtained by addressing Robert McAfee, director, at the department office.

Hoopeston, Ala.—The Hoopeston Electric Railway Company has been organized with a capital stock of $250,000. The company proposes to establish a system of electric railways to run in different directions from the town—to Gilman, to Sheldon, to Champaign, and Mineral Springs or Attica, Ind.

Wilmington, Del.—The directors of the Wilmington and Chester Electric Railway have held meetings lately to discuss plans of construction. The incorporators of the road are Garrett J. Hart, Peter J. Hughes, J. C. McComb, E. T. Cooper, A. J. Whittingham, Richard R. Kenney and J. Clayton Erb.

Flushing, N. Y.—The Steinway Railroad Company has taken formal possession of the Flushing and College Point Electric Railway, its purchase having been made in the interest of that company. The road itself is of little value, but the company had franchises in every important street in the village. The Steinway Company will shortly enter Flushing with a through line from Long Island City.

Dublin, Pa.—The talk of building a trolley line between Dublin and Souderton has been revived. It is said that a New York syndicate is interested in the project. Meetings in the interest of the trolley are being held in the villages through which the trolley would pass. The estimated cost of such a road is $128,000 for the eight miles between the points named, or $16,000 a mile.

Columbus, O.—The State Board of Agriculture has entered into a contract with the Fort Wayne Electric Corporation for an electric light plant for the State fair grounds. The capacity of the plant will be 200 arc light lamps, arranged on separate circuits and supplied from two separate dynamos. The plant will furnish light for night exhibitions in all the fair buildings and races on the speed track.

Leadville, Col.—Articles of incorporation of the Leadville Electric Power and Irrigation Company have been filed. The capital stock is $250,000. It is the intention of the company to use the water of the Arkansas River and to build a dam in Lake Park. The power-house will be located in Malta, four miles below Leadville. The incorporators are R. E. Goodell, of Leadville; J. H. Poole, of Denver, and E. W. Rollins of Boston.

Atlantic City, N. J.—Wm. H. Piersol, of this city, has been granted a patent for "an electric balloon elevator car." The balloon and car are combined and will run up and down a central iron tube, or frame work, to the height of 150 or 200 feet, the car revolving the while so that the passengers can obtain a wide range of view. The frame of the balloon will be covered with a yellow transparent material and the interior will be illuminated at night by electricity.

Napa, Cal.—L. Crothwell, of San Francisco, has asked for a franchise to run an electric road from this city north to Calistoga, a distance of 27 miles. He professes to represent a syndicate worth many millions, and offered to give a bond of $10,000 that the road will be built if the franchise is granted. He says he also purposes to build to Napa Soda Springs as well as to cover the town with complete lines. He estimates the cost of the proposed work at $400,000.

La Crosse, Wis.—The La Crosse, Black River Falls and Neillsville Electric Railway Company, lately incorporated, with a capital stock of $300,000, was formed for the purpose of constructing and operating an electric railway line for the carriage of passengers, mail, express and freight between La Crosse, Black River Falls and Neillsville, a distance of about eighty miles. The general offices of the company will be in La Crosse.

Milford, Mass.—It is likely that Milford will shortly be connected by a trolley railway with Hopkinton and therefore with Natick and Boston, as Boston capitalists have taken the matter in hand and proposed to help the business men of Milford who wish to have the road built. The Milford' men interested include C. W. Shippee, a local manufacturer, Treasurer R. B. Greene of the Milford Electric Light Company, and others who are very friendly to local storage battery interests.

New York.—Proposals for estimates for furnishing materials and work for completing an armory building and furnishing the same with gas and electric fixtures and kitchen ranges, on the easterly side of Madison avenue, extending from 94th to 95th street, in this city will be received by the Armory Board, at the Mayor's office, City Hall, until 12 o'clock M., Monday, June 10, 1895, at which time and place they will be publicly opened and read by said board. See *City Record* May 22 for full information.

St. Louis, Mo.—The city has filed suits against the Missouri Electric Light and Power Company, the Edison Illuminating Company and the Laclede Gas Light Company for non-payment of 2½ per cent. of their gross receipts for 1890 and 5 per cent. of their receipts for each year thereafter, as prescribed by the revised ordinances. The amounts claimed are $63,020.50 from the Missouri Company; $34,756.35 from the Edison, and $6,530.04 from the Laclede for its electric lighting department.—The county court of Jefferson county has granted a franchise to St. Louis parties to construct and operate an electric road from St. Louis to Morse's Mills.

Brooklyn, N. Y.—The Union Street Railroad Company have applied to the board of aldermen for a franchise to establish an electric railway line in this city. They offer to give the city 3 per cent of the gross receipts of the road and $30,000 in cash if the franchise is granted. The officers of the company are Reuben Leland, president; J. Greenough, vice-president; Edward M. Grout, secretary, and Edward Wilder, treasurer.—Sealed proposals will be received at the office of the Commissioner of City Works until June 4, at 12 M., for furnishing electric lights for streets and public buildings in the city of Brooklyn for the year 1895. Amount of deposit required, $1,500. Amount of surety required, $15,000.

Telephone and Telegraph.

A telephone exchange has been opened at Buford, Ga.

The Tiffin Telephone Company, of Tiffin, O., has been granted a 25-year franchise. Two hundred and fifty telephones have been subscribed for.

Superintendent A. R. Pflaum of the Hudson River Telephone Company reports he is meeting with success in introducing telephones in Port Jervis, N. Y., at the reduced rates.

The building of the long-distance telephone line between Columbus and Atlanta, Ga., is going on rapidly. Contracts have been let for the building of the line between Rome and Atlanta.

The directors of the Frankfort Telephone Company, of Frankfort, Ind., recently incorporated with a capital stock of $15,000, are Relief Jackson, Thomas Scantlin, W. B. Kramer, Jas. McClamrock, D. A. Coulter, J. C. Shanklin and James O. Hedgcock.

The Montauk, Orient and New York Telephone Company is considering whether it will increase its capital to $50,000 or submit to absorption by the New York and New Jersey Telephone Company. The latter company is extending its lines all over Long Island.

The West Shore Telephone Company is pushing its work up the Ulster and Delaware Railroad. Twenty-five new Seeley telephones have been put in at Kingston, N. Y., by the company. The Colvin instruments will be removed and the new Seeley 'phones placed in their stead as rapidly as possible.

The telephone line which has been constructed by Messrs. R. K. Van Etten & Sons, of Conashaugh, extending from Centréville, in the town of Sandyston, N.J., to Dingman's Ferry, Pa., and the Milford road to Port Jervis, has been completed and is now in successful operation.

At Lockport, N. Y., the Citizens' Mutual Telephone Company has decided to enter the field made by the Automatic Telephone Company of New York. On a three years contract, with 300 subscribers, this concern offers to put in a complete and satisfactory system at an annual rental of $30 for business houses and $20 for dwellings.

The Automatic Telephone Company, which has secured the privilege of erecting poles and wires in the streets of New Brighton and Edgewater, Staten Island, N. Y., has organized with the following officers: James Kerr, president; Dr. J. Walter Wood, treasurer; Andrew J. Hinton, secretary, and J. W. Allison, J. C. McGuire, George R. King, C. C. Pucci and Fred. W. Kerr, directors. The company proposes to furnish telephones for $30 per year, and already has over 200 subscribers.

COMMERCIAL PARAGRAPHS.

The Portable Fire Hose Bridge, for which the Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, are general agents, is meeting with the approval of the electric railways. This company has already received orders from several roads and is constantly receiving inquiries.

The Bradbury-Stone Electric Storage Company have recently installed at the residence of Mr. W. E. C. Eustis, Milton, Mass., a storage battery of 1,000 ampere hour capacity, of their very latest type, in lead-lined wooden tanks. The plant is operated by wind-mill and is the second largest installation of this character in America.

The Metropolitan Electric Company, 186-188 Fifth avenue, Chicago, report a very good demand for their well known P. & B. products. Their numerous street railway customers express themselves as being well satisfied with results obtained from the use of P. & B. Tape and Compounds.

Test of Heine Boilers.

Tests were made some time since by Wm. H. Bryan, M. E., of twelve Heine Boilers, aggregating 4,500 H. P., installed in the Edison Illuminating Company's plant at St. Louis. When run at 26 per cent. above their rating an evaporation of 8.835 pounds of water per pound Illinois coal of 11,481 B. T. U. was secured, being equivalent to 70.13 per cent. efficiency. These boilers gave an evaporation of 7.258 pounds of water per hour per square foot of heating surface with but .84 of 1 per cent. entrainment.

These boilers had been sold on the guarantee of an evaporation of 8 pounds of water per pound of coal and 7 pounds of water per square foot H. S. with less than 1 per cent entrainment. The test established the fact that the guarantees were exceeded and the Heine Company received a bonus of $1,500, as had been agreed to be paid in the event of the guarantees being exceeded.

The company makes the broad claim that no other boiler in existence has shown, nor can show, a bona fide record of evaporation on similar low grade bituminous coal anywhere near the test shown above in evaporation per pound of coal and per square foot of heating surface.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Albany, N. Y.—Building for an hospital. German Hospital Association. Directors: Gustave B. Schill, Simon W. Rosendale, Alfred H. Kestner and others.

Atlanta, Ga.—Five-story building to cost $55,000. John Ansley, Atlanta, owner.

Atlantic City, N. J.—A 150-room hotel. Bell & Scott, Atlantic City, owners.

Baltimore, Md.—Building for Southern Homeopathic Hospital, to cost $100,000. Directors; Eldridge C. Price, Elias C. Price, O. Janney and others.

Bangor, Me.—Hotel at Newcomb's Landing. Louis Greyer.

Bangor, Pa.—An opera house. W. R. Grubb, of Boonton, N. J., is interested.

Batavia, N. Y.—Hotel. John B. Arnold, proprietor.

Beaver, Pa.—Residence for Col. S. M. Moody. Architects Bartherger & East, Pittsburg, Pa.

Bennington, Vt.—Foundation of a savings bank completed.

Boston, Mass.—Apartment house, 50 suites. Rutland & Allen, Cambridge, owners. Architects Kendall & Stevens, Boston.

Bristol, Conn.—C. F. Michael has applied for permission to build an opera house here.

Brooklyn, N. Y.—The trustees of the Brooklyn Institute will erect permanent museum buildings, for which bonds will be issued by the city aggregating $300,000.—Manager Osborn of the Mansion House proposes to spend $50,000 in improvements.

Buffalo, N. Y.—Building for apartments and stores. Charles Roessler.—A similar building. George H. Lovell.

Cambridge, Pa.—Hotel. W. D. Rider, Jr., of Franklin, Pa., proprietor.

Charleston, W. Va.—Governor McCorkle will build a handsome residence in South Charleston.

Chase City, Va.—The Bank of Mecklenburg intends erecting an iron front building.

Cohoes, N. Y.—A theater will probably be erected on the site occupied by the National Bank.

Danville, Ill.—R. D. McDonald intends to erect a four-story pressed brick and stone building, to contain hotel and bank, to be lighted by electricity. Treat & Foltz, 58 Wabash avenue, Chicago, Ill., are the architects.

Flatbush, L. I., N. Y.—Building to contain flats and stores. George Moss owner.

Mt. Vernon, N. Y.—The people are to vote on the question of building a city hall and to expend $100,000 for the site and building.

Newark, N. J.—Apartment house, to contain 18 sets of apartments. Louis Mersfelder owner, Peter Charles architect.

Newport, R. I.—Business block on Broadway. H. P. Morgan owner.

New York City.—A six-story store and tenement building at 367 Broadway, by the American Express Co., Architect John B. Franklin, 56 Washington Square, South.—Four and five-story flats: At 220-228 43d st., Architect Chas. Rentz, 153 4th ave.; 112th st., south of 8d ave., Architects Neville & Baggs, 225 West 125th st.; 25-28 Amsterdam ave., Architect George F. Pelham, 1481 Broadway; 123d st., west of Lenox ave., Architect John Hauser; Forsyth st., Architects Snyder & Herter, 48 Bible House; 66th st., west of Central Park West, Architect Henry Anderson; 543 142d st., Architect John P. Walther; Union ave., southwest cor. Westchester ave., Architect James W. Cole, 403 West 51st st.; 109 East 73d st., Architect Max Muller; 114 8th ave., Architects A. R. Ogden & Son; 137th st., west of Madison ave., Architect J. Williams Lener; 289 East Fourth st., Architect C. D. Cohen; west side of Lenox ave., south of 114th st., Architect J. H. Valentine; 554 West 51st st., Architect David W. King, 198 Broadway; Lexington ave. and 121st st., Charles Richterman, Long Island City, owner; 151st st., east of the Grand Boulevard, Architects Webster & O'Brien; Union ave., southwest cor. of Westchester ave., Herman Schmuck, owner; 53d st., west of 8th ave., Wm. Rankin, owner.—The owners of the Merchants' Bank Building intend making it a twelve-story structure.—The property No. 80 Broadway has been purchased by the Standard Oil Co., who will use the ground for extensions to their present building and will also add six stories to the latter.—The Consolidated Stock and Petroleum Exchange are considering plans for adding twelve stories to their present building.—John T. Williams, 54 Franklin st., will erect a fifteen story and basement office building at 25-29 William st.—The Riverside Republican

Club will erect a club house, to be completed early in January.—It is understood that Gutwilling Bros. have purchased the property at 114 West 84th st. and will erect there a seven-story and office building, with the most modern equipments.

Paterson, N. J.—The Board of Freeholders have under consideration the question of remodeling the court house or erecting a new building.—Richard and Wm. De Gray will erect a business building at 67 Main st.

Perth Amboy, N J.—the authorities are talking of erecting a new city hall.

Philadelphia, Pa.—A club house is to be built for the Junger Maennerchor at 810 N. 6th st., Architects George F. Payne & Co.—Ex-Postmaster General Wannamaker contemplates building a hotel here for drunkards and other unfortunates.—Miles Day & Bro. are to erect a six story office building at 1521 Sansom st.

Providence, R. I.—A nine-story building is to be erected on Westminster st., on a site purchased from the Grosvenor Estate.

Pittsburg, Pa.—John C. McConnell will put up a colonial residence on Betrick st., East End, Architect J. E. Allison.

Plans have been prepared for a residence on 5th ave. for Charles Lockhart, Architect W. S. Frazier.—George K. Stephenson will erect a business block cor. Centre and Highland sts.

Richmond, Va.—The corner stone of the new Masonic Temple has been laid by Liberty Lodge F. and A. M.

Scranton, Pa.—A ten-story office building is to be erected on Spruce st., Architects Lacey & Son, Dime Bank Building.—J. C. Miller is about to erect a ten-story building to contain model club apartments for business men, a restaurant, etc.—The Traders' National Bank will put a $50,000 building on Spruce st., Architects T. R. Lacey & Son.

Toronto, Can.—The Independent Order of Foresters will soon lay the corner stone of their block.

Troy, N. Y.—The Troy Steel and Iron Works is to be re-established and extended. New and enlarged shops will be constructed on Breaker Island that will make the works the most extensive in this country.

Westerly, R. I.—Bids are asked for the construction of a new State House here. The material used will be marble. Contractors will be given until June 7 to hand in their proposals.

INCORPORATIONS.

The Northern Electric Company, Norwalk, Ohio—to manufacture and produce electricity for light, heat and power. Capital stock, $25,000. Promoters: Geo. P. Jones, Parks Foster, Mayne C. Foster, Burton P. Foster, John W. Foster.

The Keystone Amusement Reporting Company (incorporated in W. Va.), New York, N. Y.—to manufacture, vend and rent electrical and mechanical devices for electrically or mechanically reporting baseball and other sporting events, etc. Capital stock, $100,000. Promoters: Melvin D. Compton, Abram Wyckoff, Newark, N. J.; Geo. L. Thomas, Baltimore, Md.

The Chicago, Lamont and Joliet Electric Road, Chicago, Ill. Capital stock, $300,000. Incorporators; E. H. Heilbronn, S. T. Hart, E. D. Hopkins, G. Lawrence Taylor and D. C. Baldwin.

The Syracuse and Oneida Lake Electric Railway Company—to operate an electric street road twelve miles in length, the termini to be in the towns of Cicero and Salina, Onondaga County, N. Y. Capital stock, $300,000. Directors: Hiram McGonegal, of New York; W. S. Wales, W. B. Kirk, J. B. Morgan, William O'Connor, Thomas Meacham, Edwin Ledder, James N. McCormick and William E. Wheaton, of Syracuse.

The Orange County Telephone Company—to operate in Middletown and other sections of Orange County, N. Y. Capital stock, $10.000. Directors: Lewis S. Stivers, John E. Iseman, Albert B. Wilber, Frank M. Stratton, and others of Middletown.

The Hanover Telephone Company of Silver Creek, Chautauqua County—to operate telephone lines connecting villages in the town of Hanover, N. Y. Capital stock, $1,000. Directors: R. J. Quale, R. M. Evarts, E. Thomas, and others of Silver Creek.

The Sullivan County Telephone Company, Jeffersonville, N. Y. Capital stock, $5,000. Directors: Charles Homer, William H. Lawrence, and Edward Homer, of Jeffersonville.

The Blue Earth Telephone Exchange Company, Winnebago City, Minn. Capital stock, $50.000. Incorporators: W. B. Haight, Andrew C. Dunn, C. F. Howe, L. A. Smith, C. H. Patten, David Secor, W. D. Smith, W. H. Hill and W. A. Hinton, all of Nashville, Martin County, Minn.

The Utica Gas Fixture Company, Utica, N. Y.—to manufacture gas, electric and combination fixtures and electrical supplies. Capital stock, $20,000. Incorporators: Alfred Sieboth, Wilson C. Williams and Clarence B. Crouse.

The Newtown Light and Power Company of Newtown, Queens County, N. Y.—to manufacture electricity for power, light and heat. Capital stock, $20,000. Directors: J. C. Smith, of Babylon, N. Y.; George B. Gallagher, of Brooklyn; Francis McKenna and George S. Jervis, of Maspeth, L. I.

The Sanburn Electric Railway Company, Chicago—to construct and operate railways from Chicago to cities towns and villages in counties of Cook, Lake, Dupage and Kane to Aurora. Capital stock, $250,000. Incorporators and first board of directors: George O. Talbot, of DeKalb; James W. Kenney, Oscar L. McMurray, Homer K. Galpin, and J. S. McGlashem, Chicago.

The South Omaha Water Works Company, Omaha, Neb.—to establish an electric light and water plant. Capital stock, $1.000,000. Incorporators: W. A. Paxton, John A. Creighton and Louis Schroeder.

The Howard Construction Company, St. Louis—to construct the proposed line of electric road from the western part of St. Louis through Kirkwood to Meramac Highlands. Capital stock, $10,000. Incorporators: Thomas Howard, John A. Holmes, J. C. Richardson, Estill McHenry, John J. Broderick, N. C. Chapman, Charles B. Greeley, L. R. Blackmer, Thomas M. Gallagher, J. B. Case M. C. Orton, J. H. A. Meyer and J. P. Dawson.

The Guayaquil General Electric Company (incorporated in W. Va), New York, N. Y.—to prosecute electric lighting and all other business in which electricity is used, including manufacturing, generating and selling the same. Capital stock, $50,000. Promoters: Manuel de J. Alvarado, Brooklyn, N. Y.; Vincente Harvie Emes, Frank E. Rogers, New York City.

The Bell Electric Company, Trenton, N. J., and New York, N. Y.—to manufacture and sell electric singe cutting combs and other electric apparatus and appliances. Capital stock, $100,000. Promoters: Frank M. Bell, New York, N.Y.; Geo. A. Westbrook, Wm. Childs, Jr., Brooklyn, N. Y.; Abram V. Robinson, Trenton, N. J.

The Electric Amusement Reporting Company (incorporated in W. Va.), New York, N. Y.—to manufacture, vend and lease electrical and mechanical devices for electrically and mechanically reporting baseball and other sporting events. Capital stock, $100,000. Promoters: Melvin D. Compton, Abram Wyckoff, Albert Manning, Newark, N. J.

The Leadville Electric Power and Irrigation Company, Denver, Col.—to erect and operate electric light plants for light, heat and power, etc. Capital stock, $500,000. Promoters; John H. Poole, Roswell E. Hodell, Edward W. Rollins, Denver.

The Plymouth Water, Light and Power Company, Plymouth, Wis.—to erect water, light and power works, etc. Capital stock, $50,000. Promoters: H. E. Dow, A. W. Schram, H. Wheeler, Jr., Plymouth.

The Humboldt Manufacturing Company, Arcata, Cal.—to manufacture electricity, etc. Capital stock, $15,000. Promoters: C. A. Callstorm, J. Cullberg, Jr., Wm. Chaffey, J. M. Moore, Arcata.

The Suburban Electric Railroad Company, Chicago Ill.—to operate a railroad. Capital stock, $1.250,000. Promoters: Geo. D. Talbot, Jas W. Kenney, Oscar L. McMurray, Homer K. Galpin, J. S. McGlashan.

The Decker Automatic Telephone Exchange, Jersey City, N. J.—to own, lease, construct and maintain electric telephones, automatic and other switchboards. Capital stock, $100,000. Promoters: Ward Decker, Edmund A. Hinckley, John P. Bell, Owego, N. Y.; Dewitt Clinton Jones, Elizabeth, N. J.

The Sea Beach Construction Company, Jersey City, N.J.—to construct and equip electric street railways. Capital stock, $100,000. Promoters: John E. Bowles, New York, N. Y.; T. Bridgewater Jones, Staten Island, N. Y.; J. Herbert Potts, Jersey City, N. J.

The Rexford-Whitmore-Eldred Improvement Company, Seattle, Wash.—to build and operate electric plants, etc. Capital stock, $6,000. Promoters: Louis A. Rexford, Jesse K. Whitmore, Elton Eldred.

The Geauga County Telephone and Electric Company, Huntsburg Center, Ohio—to establish, conduct and operate a line of electric telephone from the center of Huntsburg Township to Chardon, all in Geauga County, Ohio. Capital stock, $2,000. Promoters: Geo. W. Pease, L. T. Wilmot, O. M. Barnes, J. C. Mastick, S. A. Rowley, M. J. Andrews.

The Monrovia Electrical Power Company, Los Angeles, Cal.—to sell and lease power, heat and light created by use of electricity and furnish power to pump water for irrigation, etc. Capital stock, $100,000. Promoters: W. N. Monroe, C. Dorland, J. H. Bartel, Monrovia, Cal.; H. V. Carter, J. F. Sartori, Los Angeles, Cal.

The Edison Phonograph Company, of San Francisco, Cal.—to buy, sell, lease and deal in phonographs, kinetoscopes, graphophones, etc.; deal in electric batteries and electrical apparatus of every character. Capital stock, $100,000. Promoters: Seymour B. Korn, Thos. J. Craig, I. Wertheimer, S. L. Ackerman, San Francisco.

The Lancaster Water, Light and Ice Company, Lancaster, Tex.—to supply water and electric light to the public, and manufacture and sell ice. Capital stock $15,000. Promoters: R. P. Henry, S. L. Randlett, W. A. Starlin, F. M. Hammond, W. L. White, Lancaster, Tex.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JUNE, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.50 P. M.	2	3.30 A. M.
2	......	..	......
3	1.00 A. M.	3	3 40 A. M.
4	1.10 “	4	3.40 “
5	1.40 “	5	3.40 “
6	No light.	6	No light.
7	“	7	“
8	“	8	“
9	8.00 P. M.	9	11.00 P. M.
10	8.00 “	10	11.30 “
11	8.00 “	11	11.50 “
12	8.00 “	13	12.20 A. M.
13	8.00 “	14	12.40 “
14	8.00 “	15	1.00 “
15	8.00 “	16	1.20 “
16	8.00 “	17	1.30 “
17	8.00 “	18	2.00 “
18	8 00 “	19	2.30 “
19	8 00 “	20	3.00 “
20	8 00 “	21	3.40 “
21	8.00 “	22	3.40 “
22	8.00 “	23	3.40 “
23	8.00 “	24	3.40 “
24	8.00 “	25	3.40 “
25	9.00 “	26	3.40 “
26	9.30 “	27	3.40 “
27	10.00 “	28	3.40 “
28	10.30 “	29	3.40 “
29	11.00 “	30	3.40 “
30	11.30 “	July 1	3.40 “

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MAY 21, 1895

ELECTRIC RAILROADS AND APPLIANCES.

589,418. Conduit System for Electric Railways. Wilson H. Cotton, St. Louis, Mo. Filed Aug. 25, 1894.

589,516. Trolley for Electric Railways. John W. Hoag, Newark, N. J. Filed Jan. 19, 1895.

589,616. Electrical Bond-Clamp. Alfred Green, Rochester, N. Y. Filed Aug. 27, 1894.

589,681. Base for Trolley-Poles. Alfred Green, Rochester, N. Y. Filed Sept. 5, 1894.

589,726. System of Controllers for Electric-Motor Cars. Charles L. Coombs, Washington, D. C., assignor to Theodore D. Dale, Marietta, Ohio. Filed Nov. 12, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

589 537. Cleaner for Incandescent-Lamp Bulbs. William O. Niles, Boston, Mass., assignor to Frank A. Chapman, New York, N. Y. Filed April 13, 1894.

589,622. Cut-Out for Arc Lamps. Peter Kirkegaard, Brooklyn, N. Y. Filed Nov. 9, 1894.

DYNAMO ELECTRIC MACHINERY.

589,404. Regulating Alternating Current Induction-Motors. Albert H. Armstrong, Schenectady, N. Y., assignor, by mesne assignments, to the General Electric Company, same place. Filed Dec. 5, 1894.

589,778. Rheostat-Switch for Electric Motors. Frank B. Rae, Detroit, Mich. Filed July 6, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

589,437. Microphone. Ernest J. P. Mercadier and Joseph M. Anizan, Paris, France. Filed June 3, 1893.

589,512. Telegraph-Relay. Alois Gruner, San Francisco, Cal. Filed July 28, 1894.

589,636. Transmitter-Diaphragm. George A. Nellis and Florence S. Welsser, Allegheny, Pa. Filed March 11, 1895.

589,712. Telephone-Call. Frederick J. Troll, Washington, D. C. Filed Sept. 22, 1894.

SIGNALS AND SIGNALING APPARATUS.

589,431. Electric Bell. Francis G. Ingersoll, New York, N. Y., assignor to the Dewey Electric Signal Company, same place. Filed Oct. 26, 1894.

589,529. Electric Railway-Signal. Henry V. Miller, Bloomington, and Alexander C. Miller, Aurora, assignors to the Miller Incandescent Railway Signal Company, Chicago, Ill. Filed Jan. 5, 1895.

589,701. Multiple Signal-Transmitter. Bernice J. Noyes, Boston, Mass., assignor to George W. Gregory, same place. Filed Nov. 4, 1890.

MISCELLANEOUS.

589,446. System of Electrical Distribution. Edwin W. Rice, Jr., Swampscott, assignor to the General Electric Company, Boston, Mass. Filed May 24, 1893.

589,450. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor, by mesne assignments, to the General Electric Company, same place. Filed Dec. 20, 1894.

589,452. Electric Meter. Charles P. Steinmetz, Schenectady, N. Y. assignor to the General Electric Company of New York. Filed Feb. 19. 1895.

589,453. Carbon Brush. Elihu Thomson, Swampscott, Mass., assignor, by mesne assignments, to the General Electric Company, Schenectady, N. Y. Filed Feb. 6, 1895.

589,454. Carbon Brush. Elihu Thomson, Swampscott, Mass., assignor, by mesne assignments, to the General Electric Company, Schenectady, N. Y. Filed Feb. 6, 1895.

589,500. Automatic Time-Switch for Storage-Batteries. William Biddle, Brooklyn, N. Y. Filed May 18, 1894.

589 501. Electrical Instrument for Medical Purposes. Benjamin Y. Boyd, Wichita, Kans. Filed Aug. 27, 1894.

589,511. Signal-Box Attachment. Alois Gruner, San Francisco, Cal. Filed July 28, 1894.

589 542. Magnetic Car-Balancing Device. William B. Purvis, Philadelphia, Pa., assignor of one-half to John Alexander Craig, same place. Filed May 26, 1894.

589,559. Electrical Low-Water Indicator for Boilers. Chas. D. Tisdale, Boston, Mass., assignor, by direct and mesne assignments, of three-fourths to John D. Gould, Brooklyn, N. Y., and Charles A. Hanson, Orange, N. J. Filed April 19, 1894.

589,576. Electric Safety System for Railway-Drawbridges. Edward Deming, Brooklyn, N. Y. Filed April 4, 1894.

589,583. Electric Cut-Out. John R. Hersh, Denver, Col., assignor to Louis E. Kenworthy, same place. Filed Jan. 11, 1895.

ELECTRICITY.

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EDITORIAL NOTES.

Where the Responsibility Lies. ELECTRICITY offers no apology for dwelling at length, and repeatedly, upon the worse than unsatisfactory condition of affairs in the electrical trade. ELECTRICITY has not created this condition, and it is only upon the theory that deception is better than truth that trade papers are expected either to publish direct falsehoods or to withhold the facts in regard to the situation.

The trade is in worse condition to-day than any other trade in the country, except possibly the cordage trade. Not one concern in twenty is making even a moderate interest upon the capital invested. While the salaried men in the direct management may boast of a big business, increasing in volume, the capitalists, who care less for volume of business than for profits, are disheartened and discouraged. It is almost impossible to obtain fresh capital in any line, no matter what the apparent showing may be. Failures in three years have been many and disastrous. They are nothing as compared with the failures which must come in the next three years unless radical reforms are inaugurated. Those who furnish the raw material, however, have learned a few lessons, and they are justly becoming chary of extending credits to concerns who sell a manufactured product at cost or less.

And it is essential that the present condition of affairs in the trade be properly appreciated. We passed through the period of depression as did all other industries. But when the time for general recuperation came *this trade was not in it*. Throughout the length and breadth of the land we hear the news of a general revival. The sure sign of increased profits to capital comes in the almost universal increase in wages. The current of prosperity is moving again. But what of the electrical trade?

With the present ideas of business which control some of the larger corporations, the general revival of business means to us only an increase in volume with a corresponding increase in losses. Prices have been established by men who have little interest in solid commercial success, by men whose only apparent ambition is to juggle with stocks and make money in an illegitimate way while the honest investor is robbed of any chance of a return on his investment.

The general business depression was not the cause which brought this business to its present disastrous state. The cause dates back to the very beginning of the industry. Such is the strength of this trade that if conducted upon proper lines we should scarcely have been aware of the depression in other lines. The very fact that it could at all survive the methods by which it has been conducted is proof positive of its marvellous inherent strength.

Instead, therefore, of concealing the truth, it is the duty of the press to point out the actual causes for the wreck of a magnificent industry, thereby to make possible the eradication of the disease which has already proved well nigh fatal. And ELECTRICITY always does its duty.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why the wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the *Electrical Engineer*, the *Electrical World*, the *Electrical Review* and the *Wester Electrician* had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us; the electrical business would have been established upon a solid basis, and would not have become a veritable graveyard for invested capital.

Whatever blame, therefore, attaches to the stockjobbing speculators who have ruined the business, upon the press lies the responsibility for allowing them to succeed. They could not have succeeded if the press had done its duty.

And it must not be supposed that this duty of telling the truth first confronted these papers in 1892 upon the formation of the G. E. Company. ELECTRICITY'S campaign against this organization was not based upon any supposition that its unjust policy and corrupt methods were new to the trade. The attack was made because this company was the climacteric, the embodiment of all the evil principles which had begun to be practised in 1880 and had gained strength year by year, driving the honest and conservative element nearer and nearer to the wall.

It was not therefore in 1892 alone that these papers should have risen to the occasion and showed their devotion to the better element. That duty had confronted them for twelve years, and not for one single issue did they ever have the courage to perform it.

It is idle for them to claim ignorance. They could not have been ignorant, at least not all of them. Possibly the publisher of the *Electrical World*, who alone is responsible for the policy of that paper, never had the mental capacity to appreciate the situation; not so with Mr. T. C. Martin or Mr. Charles W. Price. They mingled with the people and had the knowledge of affairs *forced* upon them. And if ever a paper has thrown away forever opportunities of success that paper is the *Electrical Engineer*. It has shown the white feather, to its eternal disgrace. To properly appreciate the guilt of these papers, it is only necessary to briefly review the past.

The *Electrical Engineer*, the *Electrical World* and the *Electrical Review* are the oldest papers in the field. They date back almost to the beginning of the commercial applications of the art. Their editors were familiar with the history of the business and had mingled with the leaders, both technically and commercially, from whom they could not have failed to learn the end towards which the whole industry was being driven. They had associated with the central station men and knew the injustice and humbuggery of which they had been the victims.

They had full opportunity to know that most of the men whose work had really created the industry were unalterably opposed to the prevailing methods of those capitalists and business men who came into it early, but without a single creditable motive, and who have finally succeeded in giving to the whole business the reputation of being little else than a stock-jobbing swindle.

These papers could not have existed at all, they never could have been started, except for the industry and conscientious devotion of a few scientific workers who labored early and late with the full conviction that a vast and profitable industry, based upon a sound and lasting foundation, could be built up. In fact they were not called into existence until these labors and their results had become of sufficient public interest to warrant the establishment of mediums for the distribution of information to the general public as to what the inventors had accomplished, and especially to those who by various methods had been induced to invest their capital in the business of electric lighting and transmission of power. It was to the desire of this class to know what was going on and to the smaller allied manufacturing interests who desired to lay a description of their products before the infant trade, that these papers owed their first commercial returns; and it was to the honest technical workers who made the thing possible they were first of all under obligations.

It is plain, therefore, that these papers had a duty to perform almost from their first issue. That duty was to protect the legitimate trade from the encroachment of the speculators, to nurse it and care for it, to ensure it a sound and healthy body. It was clearly their duty to see to it that those methods which have disgraced it and smirched it should never have obtained any foothold.

It is no palliation to claim that they did not foresee the results, and that they hoped for the gradual purification of the trade through the working out of natural laws. Any man with brains enough to run a newspaper could not help foreseeing just what must be the ultimate result of the policy pursued. If the press has any mission, it is to see with clearer eyes than the multitude, and to tell the truth at whatever temporary sacrifice. And if these papers had done this from 1880 up to the present time, there would, no doubt, be less money invested than there is; there would have been much less apparatus put out. On the other hand, ten times as large a percentage of central stations and railroads would have been profit earners; and if there had been fewer people engaged in the business, those who were in it would have accumulated handsome competencies, there would have been good profit to-day in every branch, and the users of apparatus would have got better value for their money.

When these papers saw Edison Electric Light stock sold at $5,000 a share upon the ridiculous claims, inaugurated by Mr. Edison himself, that the electric light would drive gas out of the market, that a 16 C. P. lamp could be maintained in commercial use at 16 cents a year—when they saw the money of investors flowing into the pockets of the unprincipled speculators upon these claims, then it was time for them to speak. When they saw the continued misrepresentations to local capitalists, in the endeavor to draw from central stations large sums of money for worthless rights made by the United States Company and others, then it was time for them to speak. When they saw the Thomson-Houston Company enter the field, and build upon the electrical manufacturing business the wickedest and most far-reaching financial swindle of the decade, then it was time to speak. When they saw all the evil and corrupt methods which had disgraced the entire history of the art culminate in the formation of a gigantic stockjobbing corporation in 1892, then again it was time to speak.

And not on one single occasion have these papers or any one of them performed their duty.

If they had told the facts to the public, made clear the actual situation, the possibilities of the art and its limitations, from 1880 to 1890, a large part of the disgrace and dishonor would have been averted, and universal bankruptcy would not now be hanging over us like a threatening cloud. If they had shown the stockholders in the large corporations how grossly their interests were being mismanaged, the irresponsible speculators who forced themselves into the management would have been displaced by those whose chief ambition would have been to establish a solid manufacturing business and to return profits to investors.

These people and their methods have got to be forced out now before prosperity will come to this trade. They should never have been allowed to gain a foothold.

When the rank and file, therefore, look for the causes of present conditions they are not hard to find. And upon the electrical press must forever rest the responsibility for ignoring the interests of those who made its existence possible, and pandering to the worst elements—upon the press rests the responsibility for allowing the fundamental causes to continue in operation, unchecked and unexposed, until the electrical trade is almost irretrievably disgraced and discredited, and electrical securities are a laughing-stock in the money markets of the country.

* * *

The Telephone Situation. In this issue we give what is undoubtedly the most comprehensive and reliable statement of the telephone situation as it appears to-day that has yet been published, and one which will astonish those who have not gone into the subject closely. It is rare, indeed, that a monopoly that has existed unimpaired for so long a time as the telephone monopoly seemed so nearly overthrown on the instant as the Bell monopoly.

In regard to this monopoly we wish to make our own position clear. The American Bell Co., by reason of fundamental patents which have stood the tests of unremitting attack from all sides, was granted a monopoly of the business for seventeen years. This they were entitled to so long as they conformed to the laws enacted for the regulation of such a monopoly as is granted by the United States patents. They have conformed to these laws, prosecuted promptly every infringer, and during the period deserved the protection which the law promised. These patents gave to the world a new and most useful art, and in return the United States has given to them a reward which its laws vouchsafe to great and useful inventions. We have not one word to say against this, for it is as it should be.

But the Bell Co. has received *more* than is vouchsafed by the patent laws. By the very nature of its business it required more, and the greatest usefulness of the invention of telephony was enhanced by this increment—this unearned increment it may be called. We refer to the hundreds of municipal and other franchises which were granted to this company and its agents, and by which it hopes to perpetuate its monopoly. Does not the Bell Company owe the public something for these? It apparently thinks not, and its policy since the expiration of its basic patents has been to use these free gifts of the public as weapons against that public which gave them. There is an old saying to the effect that the voice of the people is the voice of God. The people granted the Bell Company a monopoly for a great and useful invention, and paid them liberally for it. They granted them more—franchises by which that monopoly might be continued. This was a bonus. The public temper now is to patronize anyone in preference to the Bell people, even though there were improvement neither in the service nor in the rates. Many of the independent telephone companies now give better service and better rates, and the Bell Company, strongly intrenched as it is behind its already enormous system and valuable franchises, has been made to tremble.

We have said that we had no criticism to offer to the Bell Company's stewardship of the monopoly granted it by the United States patents, and implied that it was in some respects a model steward. This is true in regard to the fundamental Bell telephone (receiver) patent, but unfortunately there is a blot on its record whose stench rises to heaven and calls for heroic measures if our very patent system is not to be wiped out per consequence. We refer here to the disgraceful and disreputable jugglery connected with the Berliner patents by which the Bell Company hoped to perpetuate for another fourteen years of undeserved monopoly that which they had rightfully enjoyed for the full term of seventeen years.

Judge Carpenter's decision seemed to put to rest the grave fears which were aroused for our patent system by the Bell Company's dishonesty, and his characterization of their action was none too severe, but the deadly microbe has been set free again by the reversal of this honest judgment by the United States Circuit Court of Appeals of Massachusetts.

As pointed out in a recent editorial in these columns, there has in the past been such a considerable hue and cry against our patent system—due, as we are convinced, largely to the miscarriage of the laws—as to seriously threaten the system as a whole. It is known to those who are posted that this feeling is strongest in the West. Among the masses of those residing west of Pennsylvania and south of Mason and Dixon's line, there is an ill-concealed opposition to the patent monopoly to which this country owes so much of its prosperity, and it only requires a few such mal-administrations of the laws as have recently occurred to fan this feeling into a state of combustion that will entirely consume and destroy this magnificent pillar of American civilization. This clamor for the repeal or change of the patent laws if once thoroughly aroused will drown all opposition, and by the very force of its volume sweep all before it.

Since the decision of the United States Circuit Court of Appeals rehabilitating the Berliner patents has been made public we have heard the rumblings from the West. We receive newspaper clippings from the daily press from all sections of the country, and those from the West are so unanimously condemnatory of the situation as to forebode no good to the faulty yet all in all the finest patent system in the civilized world. Our Western contemporaries mistake the cause for the effect. They are justly indignant at the Bell Company, but unjustly attribute their dishonesty to faulty patent laws, whereas the fault lies not in the laws themselves but in their administration and a disgraceful acceptance of so-called expert testimony which is often nothing more than legalized perjury.

The Bell Company is firmly established and deservedly so. What we have endeavored to show in our article this week, both for the public benefit and the best interests of the Bell people themselves, is that the latter are no longer supreme. Honest competition has arisen. It is growing. It is here to stay. And to the independent companies, who conduct their businesses on sound lines and with due regard for the rights of others, and who not only forward their own interests but those of the public by forcing improved service and lower rates, ELECTRICITY extends the right hand of fellowship.

* * *

The Underrunning Trolley Litigation. In our last issue we printed eight columns of matter, including illustrations, in regard to one of the most important lawsuits in electrical history, viz., the suit of the T.-H. Company against the Winchester Avenue Electric Railroad Company of New Haven, Conn., and the Westinghouse Electric and Manufacturing Company of Pittsburg, Pa. The importance of this suit will be realized when it is understood that it was an effort on the part of the G. E. Company to establish in itself the sole ownership or monopoly of the underrunning trolley as now universally manufactured and used in this country. We considered it no great piece of enterprise to send a representative up to New Haven to attend and report the case, and are not therefore taking to ourselves any very great credit on that score. But what was our surprise upon finding that not one of our contemporaries was there to do likewise. We were not surprised so much at the absence of the *Electrical World* during the arguments, for that journal has so long ceased to be either a newspaper or a reliable chronicler even of stale facts, that no one expects much of it any more, but we were surprised that the *Electric Age*, the *Electrical Engineer* and the *Electrical Review* had allowed the opportunity to slip by.

It will be noticed that three of the contemporaries mentioned are quarreling among themselves as to their relative ages—each claiming to be the only original great *oldest* electrical periodical extant. But with age usually comes drowsiness, and if age can be safely gauged by this test, they all seem to be about on a par, with a neck in favor of the *World*. The latter has, in fact, with great foresight and wisdom, established a graveyard called the Digest, where much literature of value finds sepulture from profane eyes. If another paper gets an item ahead of the *World*, the latter comes out the following week with a "digest" of that same article, and nobody of course sees it. It goes into the index, however, and the editors are saved the humiliation of publishing, where chance readers may see it, important news that is second-handed.

One of the most important papers that have been read during the past several years was the recent one of Prof. Ewing's on his new device for testing the hysteresis of iron. We published this paper a week ahead of all of our contemporaries, and the *World* a week later gave it mention in the Digest.

We expect this week to see mention of our report of the underrunning trolley litigation in the Digest, if the latter is what it claims to be and its editor is fair. But won't it be rather galling to the *Electrical World* to credit us with important news that it missed? It will be a great strain on the editor's fairness and—will he be fair? We'll see.

Under the Searchlight.

Views and Opinions on Timely Topics.

We Can.

(From the New Haven Courier.)

ELECTRICITY can now move railroad trains.

Not only this, we can move the world. We are moving it.

* * *

THE Rome (Ga.) Gas Company recently levied upon the property of the Rome Electric Light Company for $1,800 due for rent. Of the $175,000 securities of this company, $20,000 are held by the G. E. Company, $30,000 by the United Electric Securities Company, and $36,500 by the Street Railway and Illuminating Properties. Rome has a population of 6,000.

* * *

ALWAYS ROOM FOR MORE.

ELECTRICITY welcomes to the field of electrical journalism Prof. J. P. Barrett's new venture, the *Electrical Journal*, the official announcement of which is as follows:

[COPY.]

CHICAGO, May 24, 1894.

Gentlemen: We are about to begin the publication of the *Electrical Journal*, "a newspaper devoted to the interests of Electrical Progress and Education." The publication will be issued every two weeks at the beginning, the first number will be an edition of 3,000, 32 pages and cover, the size of printed page 10⅜x7 inches, and will be as well gotten up mechanically and scientifically as it is possible to make it. The *Journal* is intended to appeal not only to commercial electrical interests but it will begin the first number with a clientele made up of 2,500 members of the National School of Electricity. The members of the school are mechanics, central station employees, telegraph and telephone men. Each one of our seventy-one classes contains at least one or two managers of central stations in the localities in which they are situated. The classes also include doctors, lawyers and business men.

We shall push this publication as rapidly as possible in the channels occupied by the other electrical journals, but shall also invade a new and unique field in this class of journalism. We should like very much to use some of your advertising matter in the first number and would request you to send at once the matter and cuts, if you care to use them, for an advertisement about the size that you usually occupy in the other electrical journals. There will, of course, be no charge for this number. If the matter in the advertisement used in the other papers is satisfactory to you, we would be glad to set it up from one of these, but we would like to use a cut or two, if you are accustomed to use such for advertising purposes. We should like very much also to have you give us some notes, either business or personal, for our news columns, and we should be glad to print some descriptive matter of any new instrument you are furnishing for the market.

Our clientele at the beginning of our publication will be made up of people interested in the kind of goods you make and sell, and we are quite sure that your wares will be given prominence through the channel of our journal.

Thanking you in advance for the courtesy of your acquiescence in our request, we are, very respectfully,

THE ELECTRICAL JOURNAL PUBLISHING CO.,
J. P. BARRETT, President.

It was of course to be expected that the Professor, with his fine commercial instincts, would think first of the advertising department of his paper. This we find he has done from the above notice.

We have already reviewed one of Prof. Barrett's editorial efforts, his World's Fair book, and we fear from the above that his paper is to be edited in the same way—that is, that advertisers will send in what they want printed, the editorial labor thus being made easy.

The *Journal* is fairly certain to start off with a good patronage. Every manufacturer who expects to sell anything to the city of Chicago will give it respectful consideration. We have no doubt that Prof. Barrett will be able to make a harder fight against Uncle William Kreidler than ELECTRICITY did in its early life in Chicago. If the Professor spends a few of the $250,000 which he is said to have accumulated on his modest salary, and makes a bright and healthy paper, the world will be the better for it.

If there were anything in his past history to denote that it would have any effect on him, we might make a few remarks upon the propriety of Prof. J. P. Barrett, holding the official position he does, engaging in the newspaper business. But we have no space to waste.

* * *

G. E. SHARES have advanced of late on renewed reports of a Westinghouse-G. E. deal. This fact shows the short-sighted wisdom of Wall Street operators. If such a deal is ever made, both organizations will go into bankruptcy with the rapidity of a comet shooting to earth. The day for successful "deals" and "trades" in this business has passed forever.

* * *

TELEPHONES FOR THE MILLION.

The Svengali Buncophone Company Organized.

Mr. P. R. O. Moter sat at his desk in his office on the 'steenth floor of Schemers' Block. He was aroused from his meditations when the door opened quietly and a man with Svengali beard and hair and Uriah Heap tread entered and tiptoed across the floor. Under his well-worn coat he carried an oblong walnut box partially concealed by an old newspaper.

"Are we alone?" the visitor whispered in phonographic tones as he sat the box on the desk.

"Yes, what do you want?"

"I don't want anything, but I'll show you what I've got, then you'll be asking me what I will take."

As he began to unwrap his package he said:

"I have here what the inventive genius of the world has long sought to create but failed; what capitalists will make millions out of and through the use of which thousands of business men will be relieved from the exactions of a huge monopoly. In short, I have the only non-infringing telephone ever made. I use the ordinary Bell receiver, but my 'phone requires no transmitter, no magneto, no induction coil, no battery, no switch, no central exchange, no hello girl. This 'phone is not affected by static capacity of conductors, by induction, or by crosses with trolley lines, or by short circuits or grounds. You just connect this binding post to the line and this one to the earth. Put the receiver to your ear, turn your back to the box and there you are—ready to talk to your next door neighbor or the Emperor of China."

"What will you take for your patents?" Mr. Moter asked.

The visitor rested his elbows on the desk before him, buried his head in his hands and his mind in about six feet of thought before replying. At last, straightening himself to his full height, he said:

"If all of the unavailable assets of the G. E. Company were turned into good hard cash, I would not trade my patents even up. But I'll tell you what I'll do. If you will give me $10,000 in cash and a royalty of ten cents on each instrument made, I'll give you the exclusive right to make the 'phone under my patents."

"Come now, let's talk business," Mr. P. R. O. M. suavely said. "I'll give you $10 in cash and $100,000 in stock for your box and patents and make you chief electrician of a company I will organize to handle your 'phone."

"I'll take your offer," the inventor eagerly cried, as he reached out his bony hand to receive the crisp new bill that fell from the lily-like fingers of the giver.

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That night at the Slick Men's Club the Svengali Autobuncos Telephone Company was organized with Mr. P. R. O. Moter as president and general manager. The capital stock was fixed at $100,000,000 with privilege to increase. The president was authorized to employ ten agents in each State and Territory to sell stock at the minimum price of 20 c. per share, and territorial rights for the use of the Svengali telephone by local companies at a rate of $7 per square mile of territory.

* * *

Business Hints.

We call the particular attention of our constituents to a new departure in ELECTRICITY—Business Hints. It has been introduced at considerable expense, and we have no doubt will be fully appreciated by a large number of hustlers.

It is with pardonable pride that we point out the difference between ELECTRICITY and our contemporaries in all the departments which spread before the trade opportunities for new business. We are not only ahead of any single competitor, but present fuller information each week than is given by all our competitors combined. Every reader can demonstrate this fact to his own satisfaction.

* * *

A G. E. LAND SCHEME.

(From a Schenectady dispatch in the Daily Press.)

Schenectady, N. Y., May 31.—It is asserted here that the General Electric Company has been offered 100 acres of land and $1,000,000 in cash to consolidate all its factories at one place in New Jersey. The company's engineers have reported that the saving of expense by consolidating the factories at some point near Philadelphia or New York would offset the loss which would result from selling their present factories.

This deal was reported in ELECTRICITY over a year ago. The syndicate referred to is composed of Elmira men, and owns a large tract of land at Elizabethport. If the trade is ever made, and possibly if it is not made, Messrs. Coffin, Griffin, Rice, Crosby and others will be called upon to explain how much cash and how much stock in the land company they were promised for their efforts.

* * *

The Brush Company.

On May 25 the Brush Electric Company of Cleveland gave to the G. E. Company a chattel mortgage on the property of the Swan Lamp Company for $30,000 due in thirty days.

We respectfully remind our esteemed contemporaries, the *Western Electrician*, the Cleveland *Leader* and the *Plaindealer*, that Messrs. Ord and Smedberg, the officers who were appointed for the purpose, have already begun the necessary work of closing up the Brush matters in Cleveland preparatory to the transfer of the entire business to Schenectady.

We do not think that Mr. S. M. Hamill would *now* put his signature to a statement that "if the Brush works are to be closed he has not heard of it."

From the removal of Messrs. Lawrence and Miles, we take it that the policy of giving away Brush apparatus in order to sell National carbons at a good price was not viewed with favor at the corner of Broad and Wall streets.

* * *

WE are pleased to record the marriage of our esteemed contemporary, Mr. Stephen Leidy Coles, and Miss Sallie E. Field, which took place on Saturday, June 1, in this city.

We salute Mr. Coles and bespeak him the full happiness which he deserves. A man is not a man until he is married.

To those students who desire to ascertain how near imbecility a "scientific" journal may go and still exist, we commend a careful reading of the editorial in last week's *Electrical Engineer* entitled "Buffalo Blindness." We shall have more to say of this next week, meantime we quote: "Apparently as fast as a new generator gets into place, a local consumer of the power starts up at Niagara." If this is so, it is susceptiable of proof that the consumer starts up quicker than the power itself. The Hous-Kennooley-Martini-Wetzleery combination were already on record to a degree sufficient to cause much subsequent and honest mortification to that beautiful bird the Unit Shark. Why should any member of the quartette again bring up the past in this way? Frankfort Lauffen, Telluride, and Sacramento cited as comparisons! Fiddlesticks, tiddledewinks and softsoap!

* * *

Our issue of May 15 *is exhausted, and we will be under obligations to some of our friends who will return us copies of that date.*

* * *

The G. E. Underground System.

(From the New York World.)

At 10 o'clock last evening, just as car No. 503 had crossed 125th street, there was a flash of fire under the car and the woodwork began to burn. The car was well filled with passengers and they tumbled out of the car from both ends. The motor was burned out. The car was pushed to the depot by another.

* * *

The Electric Construction and Supply Co.

To the Editor of ELECTRICITY.

DEAR SIR: I note your remarks on the affairs of the above company last week, and quite agree with you that such exposures are wholesome and for the public good. But how can you hold that the active managers, Messrs. Torrey and Corey are free from criticism? Yours truly,

CORTLANDT STREET.

We have not held that either one of these gentlemen is free from criticism. He is not. What we did say was that the charge of *dishonesty* in connection with the affairs of this company could not be made against either of them, and that in the grand scramble of the insiders to protect themselves neither of these gentlemen had any part. There is no doubt that Mr. Corey committed some serious mistakes, the chief of which was staying with the company at all when he knew the way it was drifting and when he was general manager only in name.

There are certain faults and human weaknesses which may under certain conditions become proper subjects of newspaper criticism; there are others which are not proper subjects for such criticism. If a man's "weakness" leads him to fail in business and protect himself by devious methods at the expense of his creditors, then it should be made more difficult for him again to engage in business and perhaps repeat the performance.

But if a man's administration of his affairs is extravagant, slipshod and careless as to details, if he allows his business to run him instead of his running the business, we do not see that a newspaper has any right to publicly call attention to his defects.—ED.

* * *

G. E. STOCKJOBBERS have again used the old story that the company is about to take a contract for the equipment of the Manhattan elevated system. Col. F. K. Hain, the general manager, says he knows nothing about it. This shows that Col. Hain is behind the times. Mr. Charles Truthful Hughes, of the G. E. Company, says he has submitted estimates. Of course this is all that is necessary.

Partnership Dissolved.

The firm of Warren & Lozier, contractors and engineers, has been dissolved by mutual consent. Mr. R. T. Lozier will sail for Europe within a few days.

The Telephone Situation.

Wondrous Growth of the Independent Companies.

With Competing Exchanges Established the People Get Lower Rates and Better Service.

The biggest, ugliest and sharpest thorn in the side of the American Bell Telephone Company to-day is the independent telephone exchange.

It is nowhere on record that the Bell Company has borne evidence to the truthfulness of this assertion, but that in no wise impairs the strength of the statement. In fact, the efforts of the Bell Company to prevent the independent exchange companies from obtaining a foothold renders an admission on the part of the New England company altogether superfluous.

In some places, where the local companies lacked the backbone to stand up for their rights the hostile policy of the Bell Company worked, and the so-called independent companies have died in a spasm of fright. In other towns the local companies were organized with courageous men at the head. They were on the ground to do business, not to sell stock or speculate in franchises. Neither were they afraid to fight America's strongest monopoly. They went ahead regardless of threats and intimidations, built exchanges, and to-day are giving a service more satisfactory than that of the Bell Company and at about half the cost to subscribers. Through the determined stand taken by these local companies, organized on a legitimate basis and for legitimate purposes, a form of opposition has arisen that promises, sooner or later, to very seriously curtail the business of the New England company which for seventeen years has enjoyed the fruits of patent monopoly to the full. It means more than that even. The organization of these local companies in scores of prosperous towns and cities begets the hope that the telephone business will, at no distant day, be conducted on a broad, honest and liberal basis.

Being utterly unable, by all the means known to its power, to stay the rising tide of progress of the independent telephone exchange companies, the Bell Company has sought to belittle the accomplishments of these companies. The agents of the Bell, and its sub-companies, have sought everywhere and at all times to create the impression that the competition of the independent exchange companies will amount to nothing.

It is represented that these competing exchanges are confined to small towns; that the service is not only unsatisfactory but is merely local in character. It is contended that no combination of capital is, or can be, made strong enough to equip a service rivalling that of the Bell Company in either efficiency or extent. It has been maintained, with no small degree of complacent satisfaction on the part of the Bell Company's experts, that a telephone equal to the Bell instrument cannot be made without infringing upon some of the chestfull of Bell patents. The company has been indefatigable in its dissemination of the New England telephone doctrine that the microphone transmitter, like infant baptism, is essential to telephone salvation.

A host of shrewd inventors have prepared a revision of the telephone creed, and the results elsewhere noted in these columns demonstrate how far the microphonists are behind the times.

A rude awakening awaits these wise men of the East, who have concluded with becoming modesty that notwithstanding the expiration of patents, decisions of courts, mutations of time and progress of inventions, they can continue to spread over the whole continent.

Instances have already been cited in these columns which serve to show the radical reductions in rates made by the Bell Company, often in the vain hope that it would be able to hold its local subscribers. Supplementary to what has already been published, and serving better in some respects to illustrate the efforts of the Bell Company to head off the independent exchange companies, a review of the situation in the State of Michigan is apropos.

When the Harrison Company began making contracts at Port Huron at $30 and $24 per year, the Bell Company dropped to $24 and $18, and offered to give a rebate of a month and a half to all who would continue as subscribers for three months from April 1. At Escanaba George W. French, with a capital of a few dollars and plenty of Michigan grit and get-there, drove the Bell Company, with a 100 drop exchange, out of the place, and to day is giving a satisfactory service for $24 and $18 per year to more subscribers than the Bell Company had.

The Gilliland Company has secured a franchise at Benton Harbor, agreeing to give service at $2 and $1 per month. This has brought the Bell Company down to $3 and $2.50, a reduction of $1 per month. The Gilliland plant will be built. The Marquette Telephone Company has proposed to give service in Ishpeming at $30 and $15 per year. To get down to these rates the Bell Company had to cut their's in two in the middle. Mere rumor of an opposition company at Ironwood sent Bell rates from $60 down to $36 per year. The Harrison Company has a franchise in Grand Rapids and expects to open its exchange with 1,200 subscribers. The Bell Company has already reduced rates from $48 and $70 to $36 and $50 for private subscribers, but with still greater reductions to municipal officials whose influence it hopes to retain in its fight. The business men of Manistee have organized a company and are prepared to install a Gilliland plant with rates at $24 and $18 per year. The cut of the Bell Company from $50 and $25 to $36 and $20 hasn't scared the local company a bit.

At Holland the Bell Company made a flat rate of $12 per year to all subscribers in the hope of freezing out the local company. The outcome has been that the local company has sixty-two subscribers and the Bell thirty. The Bell rates, before the local company entered the field, were $48 and $36.

The establishment of a Strowger Automatic Exchange plant at Ypsilanti, brought Bell rates from $48 to $30. At Cadillac the Bell Company was routed, horse, foot and dragoons. Henry W. Sill installed an exchange of the Chase system, selling the instruments outright to subscribers and charging $18 a year for exchange service. There is not a Bell instrument left in the town, and the new exchange has four times as many subscribers as the old one.

In Jackson, Three Rivers, Calumet, Kalamazoo, Ithaca, Charlotte, Ionia, Petoskey, Traverse City, Charlevoix, Marshall, Saginaw, Grand Haven, Vassar, St. Clair, Menominee, St. Johns, Sault Ste. Marie. Mt. Clemens, Owasso, Ludington, Adrian, Hillsdale, Lansing, Flint and all other towns in the State where competing companies have been organized, or even proposed, the Bell companies have cut rates from 25 to 50 per cent. In the city of Detroit, where no organized competition has yet arisen, the same old rates hold good.

Instances of reduced rates could be multiplied without end, but those above given serve admirably to show how much alarmed the Bell Company has become over the initial progress of the independent exchange movement.

The greatest activity in the organization of independent telephone exchange companies has thus far been in the Central and Southern States. Almost every town of 3,000 or more inhabitants now has its local telephone company. Franchises have been secured and active preparations are making to install an exchange service. In the large cities progress has been necessarily slow. The Bell Company has become so strongly entrenched and has such a strong pull with the municipal authorities that in many cases it is difficult for an opposition company to obtain a foothold. But even this has not deterred the onward march of the independent movement, and there are but few cities to-day in which local anti-Bell companies, with money and brains behind them, have not been organized and active steps taken to secure the necessary rights and franchises. The threadbare argument of the Bell Company, that there is no perfect instrument but the Bell and not sufficient capital to install a rival service, no longer carries weight among up-to-date business men.

Neither do threats and intimidations frighten them. When such astute and conservative business men as Smith M. Weed, Dr. W. Seward Webb, J. Wesley Allison, Silas B. Dutcher, Henry N. Whitney, John C. McGuire, A. B. Acklin, David A. Boody, John Jacob Astor, Charles F. Cox, and others of New York, identify themselves with the active management of an independent exchange company, it is safe to to assume that they have faith in the business. It shows, moreover, that in the large cities, the present citadels of the Bell Company, it is confronted with an enemy quite as well equipped as itself.

The above-named gentlemen comprise the directorate of the Mutual Automatic Telephone Company of New York, organized with a capital of $6,000,000, to establish a local exchange service in New York City. The Strowger Automatic Exchange, and the Hunnings transmitter will be used. Contracts are now being made on the maximum basis of $120 per year. Just so soon as a sufficient number of subscribers have been secured; the work of installing the plant will begin.

In Philadelphia a similarly organized company has already secured franchises. In Buffalo the local company is making five-year contracts. In Chicago, St. Louis, Pittsburg, Detroit, and a host of other large cities, independent companies with ample capital are already in the field.

The Home Telephone Company, organized in Baltimore, has already secured a large number of subscribers on three year contracts in that city. The new company will operate the Drawbaugh patents and will give a service at much lower rates than the local Bell Company. Franklin Noble, of New York, is president and organizer of the new company.

In spite of the threats, reduction in rates, manipulations of municipal governments and other practices common to a certain species of New England electrical financiers, the work of organizing local companies and installing competing exchanges has gone on apace. The net result of this contest between a bulldozing method of preventing business and an honest effort to promote it is that the independent exchange industry has attained proportions largely exceeding the expectations of the most sanguine promoters. The electrical fraternity has heard much of this branch of the business, but positive or accurate information of its magnitude has been acquired by very few.

At the expense of considerable time and trouble, ELECTRICITY has collected data which enable it to show to the telephone trade, for the first time, the true status of the independent telephone business throughout the United States.

While the companies manufacturing telephone instruments and parts are now legion, there are comparatively few that make a business of erecting and equipping complete telephone exchange plants.

Of these the Western Telephone Construction Company, the Harrison International Telephone Construction Company, the Gilliland Telephone Company, and the Strowger Automatic Telephone Exchange, of Chicago; the Mason Telephone Company, Richmond, Va.; the National Telephone Company, Boston; the American Electric Telephone Company, Kokomo, Ind., are perhaps the leading ones, particularly in volume of business done.

Of the many other companies now in the field the greater number have confined their attention to the manufacture and sale of telephone sets and parts and the installation of private lines and interior telephones, though many of them have done exchange work on a small scale.

The Western Telephone Construction Company of Chicago has established exchanges as follows:

Newark, O., 300 'phones; Winona, Minn., 300; Johnstown, Pa., 200; Mattoon, Ill., 200; Van Wert, O., 150; Webster City, Ia., 100; Hartford City, Ind., 100; Mt. Vernon, O., 200; Petaluma, Cal., 100; Fostoria, O., 200; Decatur, Ind., 100; Greensboro, N. C., 100; Selma, Ala., 150; Santa Fe, N. M., 100; Beaumont, Tex., 100; Rushville, Ind., 150; Navasota, Tex., 100; Manistique, Mich., 50; Washington, Ia., 100; Maryville, Tenn., 50; Cambridge, O., 200; Russellville, Ky., 50; Waxahachie, Tex., 100; Two Rivers, Wis., 50; Columbia, Mo., 100; Palestine, Tex., 150; Marysville, O., 100; Salisbury, N. C., 100; Perry, N. Y., 50; Palatka, Fla., 100; Askaloosa, Ia., 300; Keithsburg, Ill.; Butler, O.; Fredericksburg, and several others.

This is no doubt the best showing made by any of the independent companies. The system of the Western Company has been subject to long tests and has proved itself to be in many respects superior to the Bell system. This company has no stock to sell and is engaged exclusively in the manufacture and sale of telephone apparatus.

The Mason Telephone Company of Richmond, Va., has equipped the following exchanges with its instruments and apparatus:

Lynchburg, Va., 400 'phones; Waynesville, N. C., 30; Petersburg, Va., 300; Hanover, Pa., 150; McKeesport, Pa., 70; Anderson, S. C., 100; Rock Hill, S. C., 100; Sumter, S. C., 75; Cleveland, Tenn., 50; Marion, Ala., 50; Bryan, Tex., 150; Greenville, Tex., 200; Camden, Ark., 50, and others in Southern and Central States.

The Gilliland Telephone Company has installed an exchange with 150 subscribers at Niles, Mich., and has closed a contract for an exchange of 275 subscribers at Manistee, Mich. This company has secured franchise rights at Benton Harbor and St. Joseph, Mich., South Bend, Ind., and in many other towns in the northern central States.

The American Electric Telephone Company states that it has established one hundred exchanges, the largest of which is in Topeka, Kan. The Harrison International Telephone Construction Company claims to have established upwards of sixty exchanges.

The National Telephone Manufacturing Company and the Strowger Automatic Telephone Exchange furnish no statement of the exchange work done by them.

The data given above does not include the thousands of instruments for private lines, but only those exchanges completed and in actual operation. All of the telephone construction companies named have a large number of contracts already closed and many being negotiated, as well as many exchanges in process of erection which have not been included in the above list. The number of small exchanges installed by contracting and not manufacturing companies cannot be even approximately ascertained. From all the data at hand a very conservative estimate of the instruments now in use in the independent exchanges places the number at upwards of 100,000.

In face of the most bitter opposition of the Bell Company, perplexing uncertainty as to infringement suits, unfavorable business conditions, and a thousand and one other difficulties that have stood in the way, it is really remarkable that such headway has been made by the independent companies in the short period of practically only eight months. The number of independent exchange instruments now in use is about one-fifth of the number the Bell Company, with an unobstructed field, has been able to install during all the years of its existence.

The establishment of independent exchanges cannot be said to have fairly begun, yet there is not to day a sound telephone manufacturing company in the country that is not hundreds of instruments behind in its orders. The organization of local exchange companies goes on everywhere. The new exchanges in operation have demonstrated that an efficient and satisfactory service can be furnished by other instruments than the Bell and at a lower cost and with an entire absence of arbitrary conditions. The people are determined to have such a service, and in almost every town and city of the country there are energetic, level-headed business men forming themselves into companies to buy and install an exchange system of their own. These are the people who are causing more concern to the occupants of a certain office in Boston than any adverse patent decision or hostile acts of legislatures.

The feelings of mistrust and doubt prevalent among prospective telephone buyers, due largely to patent complications, have naturally been fostered rather than allayed or dispelled by the Bell Company. Each succeeding patent decision has created more or less distrust of a successful independent telephone business, but happily for the trade this feeling is giving way to one of confidence as the situation becomes better or more clearly understood. The most recent decision in the Berliner case, which at first was thought might seriously retard the growth of the independent telephone business, promises rather to have a stimulating effect. Even should it be established that the Berliner microphone patent of 1891 is valid, and that it is not to be annulled, the consequences will by no means be disastrous to the independent business. It will bring more prominently to public attention the fact that there are instruments made and now in operation which are not only absolutely non-infringing but superior in every respect to the now somewhat out of date Bell instruments.

As soon as the telephone buying public becomes convinced of these facts then it will want these instruments.

There is no section of the country in which there is not a strong feeling among the people in favor of an independent telephone service. There is no stronger evidence of this than is shown by the constantly increasing number of new local telephone companies. In some places the Berliner decision has had an adverse effect, but such instances form the exception and not the rule. There is everywhere a disposition to accord to the Bell Company a full measure of credit for its great achievements in telephony, yet quite as strong is the feeling that it is both unjust and unfair for it to seek to perpetuate a monopoly through a manipulation of patents. To this latter fact, and to excessively high rates, more than to a well-founded complaint of an unsatisfactory service, may be attributed the already vigorous growth of an independent telephone business.

As will be observed from the announcements in the advertising columns of Electricity, the claim of the Bell Company that the Berliner decision gives them a monopoly of the telephone business until 1908 is not only a gratuitous assumption, but it is a statement which is controverted by such influential independent companies as the Western Telephone Construction Company, the American Electric Telephone Company and the United States Telephone Company. The Western Company manufacture a line of apparatus for which they make the absolute claim that "it does not infringe any patent owned by the Bell Company." The American Company manufacture the Hunnings dust transmitter, which "does not depend upon variable pressure between electrodes in constant contact," hence does not infringe the Bell patents. The United States Company of Philadelphia, a new comer in the telephone manufacturing field, owns and controls the "Make and Break" patents "covering all possible forms of battery transmitters in which the electrodes are not in constant contact, and are not affected in any way by the Berliner transmitter patent."

To ascertain the effect of the Berliner decision and to learn what the prospects for the independent companies may be in various sections of the country, Electricity has secured from several special correspondents a review of the local situations.

From Chicago our correspondent writes:

"The recent decision of the Circuit Court of Appeals reversing Judge Carpenter's finding in the Berliner case has, of course, created much speculation. We find a great many manufacturers disposed to feel quite discouraged while others treat the matter with extreme indifference. The Bell Company's position is certainly strengthened so far as bluffing is concerned, but as the United States Supreme Court practically passed upon the matter, in view of the recent Bates Refrigerator decision, it is very hard to understand in what way the Bell Company's position is strengthened by their last victory.

"Throughout the North and West we find a decided disposition on the part of the residents of the smaller towns and cities to disregard the Bell claims entirely. They are tired of the service and the treatment received during the past, and having this prominently before them, they are even ignoring reduced rates which the Bell company make, and pay little, if any, attention to the arguments put forward by the Bell Company's representatives.

"At all points where we find people in this mood there are few difficulties to be overcome, and as a rule companies composed of the best men in the community are organized and the enterprise is invariably backed with determination, energy and money. These companies are awarding contracts for exchange construction and the purchase of apparatus and usually begin business with about twice the number of subscribers formerly having telephone service.

"We occasionally strike communities where, owing to want of interest or lack of money, it is impossible to enlist the citizens in a new telephone company. At these points little, if any, effort is wasted, and in cases where the Bell Company has made reduced rates it is really not worth the while to work up an organization. It will come sooner or later.

"One great difficulty which companies of reputation and means have to overcome is the amount of inferior and cheap apparatus put upon the market by people of comparatively no experience and little capital. It is true that their work is largely confined to interior service and short line installation, but it is really a very important class of telephone work and should be of a first-class character.

"We find that purchasers, as a rule, do not bother themselves very much about patents provided the instruments are satisfactory in service.

"Our company has recently closed some good contracts for switchboards, apparatus and construction work, which are very encouraging and afford every reason for anticipating a large and successful telephone business from this time on."

From Wisconsin come encouraging reports. Our correspondent at Milwaukee writes:

"There is a good opening in this State for independent telephone companies. Investors are still a little afraid of going into the business extensively until the situation has cleared. The Bell Company has reduced rates in the interior of the State but has not as yet made any reduction in this city, although one is momentarily 'threatened.' The prospects for private and interior installations are very good, the demand for telephones for this class of service being quite active.

"The Wisconsin Telephone Company so far has the only franchise in this city and owns the long distance line to the interior of the State. There are many prosperous cities and towns throughout the State in which a first-class telephone exchange is badly wanted. There is no doubt but that a good pushing company using a good instrument and charging reasonable rates, would find a very profitable field in this State."

With the characteristic discernment of the average Westerner, the people of Indiana are reposing confidence in the good companies, as is shown by the following from Indianapolis:

"The telephone situation in this section is very promising. There is considerable construction now under way. There is a widespread feeling of confidence by the people in those independent companies which are composed of men of sound principles.

"The Bell Company has done nothing to choke off competition except to reduce the cost of service and in some cases offer free service. This serves no better purpose than to show exactly where the Bell Company stands and how much it thinks its service is worth.

"The Indianapolis Electric Company reports that it has been all the way from 50 to 450 telephones behind in its orders for the past sixty days, and while rapidly catching up, is some 175 'phones behind yet. This company has a capacity of fifty complete telephones per day, and is only taking orders to be delivered within sixty days."

In the far West competition has not yet advanced beyond the talking stage except in a few places. In Trinidad, Col., the recent Berliner decision put a damper on the independent movement. Our Denver correspondent writes:

"The Bell Company has strengthened its position largely in the last year or two by connecting Denver by long distance system with nearly all of the important towns in the State. It is understood that their policy is to continue this extension. They have also added to their strength by putting automatic exchanges in towns not large enough to justify the use of an exchange with a resident operator."

The most determined and most thoroughly organized opposition to the Bell Company has developed in the State of Ohio. Here an organization of the local telephone companies has been formed under the name of the Ohio Telephone Association with James M. Thomas of Chillicothe as president. The association is to comprise the companies already organized, or to be organized, in the larger towns and county seats. It is proposed to connect these towns by an extension of local lines and eventually form an inter-connected system covering the whole State. Upwards of seventy-five companies are already members of the federation.

In Cleveland the Berliner decision has had an effect somewhat similar to the recent frost that killed the Buckeye fruit crop. Our correspondent writes:

"The prospects for the independent telephone companies have received considerable of a blight by the recent decision. The Union Electric Company had a number of orders countermanded, the purchasers fearing suits for infringement. The local manager of the Bell Company states that the effect will be to stop outside companies from manufacturing telephones or be guilty of infringement."

In the vicinity of Cincinnati, like other sections in the West, the independent trade received quite an impetus after the decision of Judge Carpenter. A large number of companies were organized and many plants have been built. "There is something of a lull," our correspondent writes, "since the decision of the Court of Appeals, but there is no disposition on the part of those who have taken hold of the business to let go. It seems only to have intimidated capitalists who have contemplated, but not yet made, actual investments in the business. The business, properly handled, promises to be healthy and profitable to the promoters, and highly beneficial to the business public on account of reduced prices and improved service and facilities. The interest taken and the capital invested have pushed things vigorously."

The Southern States are being invaded by the independent companies, a number of exchanges having been installed, and many others are already contracted for. The Harrison Company is actively engaged in this territory organizing local companies and securing franchise rights.

There is considerable dissatisfaction with the Bell service at different points. At Birmingham, Ala., the Bell Company until recently charged $65 per year in the first quarter mile limit but have now added $5 for each additional quarter mile from the telephone station. Thus a subscriber two miles distant from the central station has to pay $26 per quarter. An independent company has secured a large list of subscribers for an opposition exchange at a $30 yearly rate, and has been granted a franchise by the city council. The Bell Company immediately showed antagonism and announced that it would put prices down to a point that would break the opposition. If low rates did not accomplish this the company expressed a determination to give free service for a period. Just now the opposition is waiting developments. The business men of the city have warmly encouraged the new company and are anxious that the independent service be established.

The Berliner decision has created no uneasiness whatever among the independent telephone companies in New York. Without exception they state they are not only ready to take new orders but are filling those already taken just as if nothing had happened. It is the general expectation that the business will gradually increase in volume as the situation becomes better understood.

Thurlow Weed Barnes, president of the Standard Telephone Company, is the authority for the statements that the capital stock of the company is ready to be issued, that the company has given orders for the manufacture of 10,000 telephones and will commence to string wires this month. President Barnes says that the company will oppose the Bell Company and that the stories in circulation to the effect that the Standard Company is a "decoy" of the Bell Company are untrue. He says that the 52 sub-companies of the Standard Company are thoroughly organized and already in the field.

J. Wesley Allison, president of the Mutual Automatic Telephone Company, when asked what effect the Berliner decision would have upon his company, said:

"Really it has had no effect whatever upon us. We are going along with our work just the same as ever. It is a disputed question whether the Bell people have exclusive rights in the battery transmitter principle, and we will find out about that."

THE PENNOCK ELECTRIC SYSTEM.[*]

BY J. J. SWANN.

About every so often the newspaper public is startled by reading of some remarkable discovery in electricity which will revolutionize the world. The large majority of such schemes never go farther than a few columns of newspaper talk, after which they die from some more or less good reason. The Pennock System is an exception to this general rule and in the hands of Mr. George B. Pennock, its inventor, still exists in a very flourishing condition, if dependence can be placed in the prospectus issued by the company. Generally speaking, it is wisest to pay no attention to revolutionists in electrical as well as in civil life until they reach a certain danger limit. The claims of Mr. Pennock and his associates are, however, so sublime and certain, that they have reached this limit and cannot be ignored—besides the system brings out several interesting points worthy of notice.

To begin with, if we have a current of sufficient strength to heat the carbon of an incandescent lamp, and reverse it slowly, the carbon is alternately heated and cooled. As the periodicity increases the flickers grow more and more frequent until at about 30 per second, or 1,800 per minute, the flashes blend and the light becomes constant as far as the eye can detect. In practice, about 50 periods per second are used, giving a clear smooth light.

If instead of alternating the current we simply make and break a direct current, the same effects are produced, flashes growing more and more frequent as the speed of the contact-making device is increased, until, at about 2,000 per minute, a steady light is produced, which, as far as can be seen, is the same as that of the alternating lamp. An ordinary induction coil with a lamp in series with the primary will show this. And it might be interesting to note that this method can be used to regulate the candle power of lamps; for, by varying the speed of the contact-maker, the light may be varied from nothing to full candle power—the current changing in direct proportion to the speed.

The foregoing explanation regarding alternating and pulsating currents will be clearer if we remember that all direct currents are more or less pulsating. Thus we see that lamps can be run in the ordinary way—in series or in multiple—on a pulsating as well as on an alternating current.

It is at this point Mr. Pennock steps in with an instrument or machine he calls a Voltage Distributor. To avoid mistakes the following is quoted from his patent: "The object of my invention is to provide a means of distributing an electric current from the same source of supply to a number of distinct and independent electric circuits, for the purpose of supplying lamps, motors, etc., with currents of the necessary electromotive force, so that no matter what change is made in one circuit it will have no effect in or on any of the other circuits, and no matter at what potential the current is kept in one circuit, an altogether different potential can be kept in the other circuits, depending altogether on the resistance of each individual circuit. I attain this object, first, by means of a rapidly rotating mechanism, arranged to send a current of electricity through a number of different circuits in rapid succession, combined with any source of electric power, but preferably with a primary battery or batteries. . . .

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[*] From a paper read before the Electrical Society of Cornell University, in *The Sibley Journal of Engineering*.

. . . A rapidly rotated metal arm is arranged to come in contact in rapid succession with a number of metal disks or segments arranged in a circle on a fire-proof non-metallic plate, such as slate, marble or similar substance.

. . One end of each circuit is connected to one of the segments, and the other end to a general return wire. The battery is connected, one pole to the general return wire and the other to the rotating arm. Now, by rotating the arm very rapidly, a current of electricity is kept flowing through the different circuits without any appreciable break, and, as the circuits are completely independent of each other, the resistance and current in each circuit can be regulated to suit its individual requirements irrespective of the others; and throwing on or off the lamps in one or more of the circuits will have no effect on the lamps in the remaining circuits. Two thousand interruptions of the current per minute in an incandescent lamp will deceive the eye into the belief that the light remains stationary—that is, the current leaves the lamp for an instant and returns to it again. Thus, so far as the eye can detect or the motor effects inform us, so rapid is the intermittent transference of electrical force that the power may practically be said to be in a hundred places at once, exerting its full capacity."

So far we will allow that nothing particularly remarkable has been encountered, although some might dispute several statements just made.

The next step launches us into the supernatural, for Mr. Pennock states that all these lamps connected to his Voltage Distributor, whether 10 or 10,000, can be illuminated to full candle power with the current of one lamp. The explanation of this claim is given as follows: As the revolving brush is in contact with only one segment at a time and we have only one lamp connected to each segment, it is evident that no more current can flow in any one of the circuits than the lamp and circuit resistance will admit. As the arm revolves, circuit after circuit is completed, but no more than one circuit at a time is receiving current. Thus we have just as many lamps as segments illuminated with the current of one lamp. In case several lamps in multiple are connected to one segment, the current will be only what one circuit would require. To operate motors, cars, etc., the same device is used, the motor being inserted just as a lamp would be.

In a test of this system made May 4, 1895, in the Physical Laboratory, Cornell University, the following results were obtained: A circular brass disk was constructed and sliced into 10 segments. An arm provided with a brush was revolved at speeds varying from 0 to 5,000. The candle power figures are not absolute, since no photometric measurements were made. In fact such were unnecessary, for the differences were only too apparent.

Each segment and the arm were connected with a binding post for convenience in handling. To start with, one lamp was connected to segment (1)—the circuit being from line through the lamp to (1), thence through arm to the other line, each time it touched on (1) in its revolution. Placing the brush on (1) and starting while the lamp was at full C. P., the instant the brush left the segment the lamp flashed quite perceptibly until a speed of about 1,800 was reached, when the carbon assumed a steady glow, though scarcely more than a dull red. Increasing the speed gradually to even 5,000 revolutions made no appreciable difference in the C. P., current readings remaining practically constant. Connecting (1) and (2) so current was flowing for $\frac{2}{10}$ of a revolution, the C. P. increased a small amount but remained constant with varying speeds as before. By adding one segment each time and thus allowing currents to flow for $\frac{1}{10}$ of a revolution more for each segment added, the light increased with each addition, remaining constant regardless of speed.

Trying different combinations of segments, such as every other one (1—3—5—7—9), every third one (1—4—7—10), etc., produced no change. The C. P. in each instance depended only on the number of segments connected and not on their relative position.

Connecting one lamp to each segment and repeating, increasing speeds as before, each lamp acted as first explained, giving only $\frac{1}{10}$ its C. P., the sum just equaling the light of one lamp. Connecting lamps to two segments, making 5 in all, each lamp emitted $\frac{2}{10}$ its C. P.—the five giving $\frac{10}{10}$ or equaling one lamp.

No of lamps.	Ratio of contact.	Equivalent No.
10	$\frac{1}{10}$	1 lamp
5	$\frac{2}{10}$	1 "
2	$\frac{5}{10}$	1 "
1	$\frac{10}{10}$	1 "

The same will be true of 100 segments, and so on, limited only by mechanical difficulties. In any and all cases the light obtained per lamp varies directly as the ratio $\frac{c}{2\pi}$, where c is the angle through which contact is made. As c increases, the fraction approaches 1 as a limit, or when $c = 2\pi$, $\frac{c}{2\pi} = 1$, or we are getting current for one lamp. As c decreases, the light decreases until $c = 0$, when no light is given out. The same holds true in the case of motors or any other electrical machinery.

We now have data for solving the problem. Suppose we take a 50 light machine, 110 volts. Under ordinary circumstances this would run fifty 110 volt lamps each giving 16 C. P This means $.6 \times 50 \times 110 = 3{,}300$ watts and 800 C. P. Let us connect our dynamo to a V. D., and, as has been shown, if we wish to light 100 lamps, each lamp will get one-half its current and give one half its C. P., or $100 \times .3 \times 110 = 3{,}300$ watts and $100 \times 8 = 800$ C. P., exactly the same as before. Of course our lamps will burn dimly. If, however, we substitute 100 100-volt 10 C. P. lamps we will have 100 lamps burning brightly, but still only 800 C. P. The difference in size between a 10 C. P. and a 16 C. P. lamp is small, so the layman is greatly impressed by the brilliant light.

Personal.

Mr. E. R. Gilman of Chicago was in New York last week.

Among our welcome visitors on Monday was Mr. B. M. Barr, of the Walker Company, Cleveland.

Mr. F. G. Fuller has retired from his connection with the Day's Kerite sales office.

Mr. J. B. Crouse, senior member of the firm of Crouse & Tremaine, Fostoria, was in New York recently on a business trip.

A Pittsburg Power-Plant Scheme.

According to the *Commercial Gazette*, it is proposed to do away with the smoke nuisance in Pittsburg by erecting at some convenient coal mine a mammoth electric power plant to furnish the city with current for electric lighting, heating and power, thus entirely doing away with the burning of coal in and immediately about Pittsburg. It is thought by Mr. Robert Marshall of the firm of Marshall Bros., elevator builders, the originator of the scheme, that electricity could be furnished from such a plant cheaper than power could be generated in isolated city plants.

BOOK REVIEWS.

STREET RAILWAY INVESTMENTS. A STUDY IN VALUES. By EDWARD E. HIGGINS. 102 pp., 8vo. New York: Street Railway Publishing Company.

There are few if any who have given the subject of street railway investments the intelligent study that the author of this book has given it, and there is certainly no one who can speak with more authority on this subject than he. With the advent of the electric railroad the stocks and bonds of street railroads, both projected and in operation, have taken on a new interest to the investing public, and the rich promises of reward have led many into ill-judged investments. While there is probably no class of bonds and stocks which is safer than those under discussion, when judiciously chosen, it is often difficult for the layman to decide intelligently between the good and the bad. Mr. Higgins's book comes to the assistance of such and will be welcomed wherever it is known. He divides the securities now in existence into classes representing:

1st. The purchase or valuation of the old horse railway properties at a large advance on their original costs.

2d. The reconstruction and re-equipment of such properties, accompanying a change of motive power, at a cost usually in excess of that for which the same or superior work could now be done.

3d. The extension of the re-organized properties into new territory.

4th. The development of entirely new properties in unoccupied territory.

5th. Construction, promotion, banking and brokerage profits.

And after stating that the vast sums which have been drawn from other investment channels are exciting some uneasiness in conservative financial circles, he gives the keynote of the book as aiming to assist in separating the good from the bad—speculative from investment values.

He believes that it is not impossible to lay down certain principles which will serve to determine the limits of success in particular cases, and to establish the broad lines of a "theory of values" in this comparatively unknown financial field.

The book is divided into ten chapters and an appendix, in which are separately discussed surface railways in American cities and towns of less than fifteen thousand inhabitants, in those of from fifteen thousand to twenty-five thousand, twenty-five thousand to thirty-five thousand, thirty-five thousand to fifty thousand, fifty thousand to one hundred thousand, one hundred thousand to five hundred thousand, and surface and elevated railways in American cities of over five hundred thousand inhabitants. One chapter is devoted to interurban railways, and in a pocket in the back of the book is a most elaborate table of statistics which is explained in an appendix.

The work is a small one, but compressed within its space is a very large amount of data which it would be difficult to obtain elsewhere, and this seems to have been collected with extreme care and good judgment. Those interested or likely to become interested in investments of this kind will find this book a most welcome guide to their judgment, and can rely upon everything as authentic which the author offers as such. We most heartily commend the book to all who are interested in the subject of street railway investments as the most intelligent and reliable treatment of the subject thus far attempted.

The Hollenden Hotel.

We have received from Mr. Frank Brobst, manager of the Hollenden Hotel at Cleveland, a magnificent photographic view of the lobby which is so familiar to electrical men. It is neatly framed and now adorns the walls of ELECTRICITY's sanctum.

General News.

What is Going on in the Electrical World.

Worthington, Minn.—A vote will be taken here the present month on the question of electric lighting.

Grand Ledge, Mich.—The city council has awarded the electric light contract to the Westinghouse Company.

Belfast, Me.—The question of building an electric railroad in this city parallel with the river is being agitated.

Le Mars, Iowa.—The project of an electric railway line between Le Mars and Sioux City is again being agitated.

Vicksburg, Miss.—The Mayor has been authorized by the city council to advertise for bids for electric lighting.

San Francisco, Cal.—Ground has been broken for a new electric road from West Berkeley to the foothills near Piedmont.

Defiance, O.—The electric light and power house here was damaged by fire May 24 to the extent of $6,000. The loss is fully covered.

Barton, Vt.—This village has voted to issue bonds to the amount of $10,000 for the purpose of putting in an electric light plant.

Venice, Ill.—Tracklaying is in progress on the new street railway to Granite City. The road will be completed about the 1st of July.

Braintree, Mass.—Joel F. Sheppard, of East Braintree, has been elected president of the Braintree, Randolph and Holbrook electric road

Rome, N. Y.—The city council has granted the Rome City Street Railway Company permission to change its motive power from horses to electricity.

Westport, Conn.—The street railway company has applied to the board of selectmen for permission to use electricity as a motive power instead of horses.

La Crosse, Wis.—Engineer Cole has been instructed to make plans for and estimate the cost of an electric light plant for street and other public lighting.

South Orange, N. J.—The South Orange and Maplewood Railroad Company has applied for a franchise to operate a trolley road on South Orange avenue.

Lockport, N. Y.—Work on the street railroad here is being pushed as rapidly as circumstances will permit. Several carloads of rails and ties have arrived.

Santa Ana, Cal.—The board of trustees have appointed W. B. Herey and W. F. Lutz a committee to draw up plans and specifications for an electric light plant.

Aberdeen, S. D.—Mr. Zeitlow, manager of the electric light plant in this city, has gone to Willmar, Minn., to prepare plans and specifications for the erection of a similar plant at that point.

New York.—It is reported that the New York and Northern Railroad will introduce electricity as the motive power on the road between Yonkers and the Harlem terminus.

Knoxville, Tenn.—The board of public works and lighting committee of the city council have rejected all bids which had been made for lighting the city and will advertise for new bids.

New Brunswick, N. J.—The projectors of the new trolley system in Middlesex County have secured a site at Milltown for their power house. They have already begun work.

Lexington, Mo.—The city council has granted a franchise to J. Wolfe & Co., of Kansas City, Mo., for an electric light plant. A special election will be held June 18 to ratify the franchise.

Moorhead, Minn.—The new electric light plant now being erected by this city will be capable of furnishing fifty arc lights and 2,000 incandescent lights. The system selected is the Westinghouse.

Waukesha, Wis.—Rights of way for the proposed electric railway line between Milwaukee and Waukesha are being rapidly secured, and members of the company state that the line will be completed within ninety days.

St. Louis, Mo.—The Florissant Avenue Electric Railway Company have accepted the provisions of the ordinance granting them the right to build and operate an electric railway on the avenue named.

Wilmington, Del.—Engineer W. B. Carswell has laid out a proposed route for the Wilmington and Brandywine Springs Electric Railway Company. Mr. Carswell's plans will be submitted to the company.

Oshkosh, Wis.—The Central Wisconsin Company has begun laying tracks for its street railway in this city. Mr. Tillotson says the work will be pushed without cessation until the entire mileage is laid and equipped.

Kasson, Minn.—There is a scheme on foot to unite the villages of Kasson and Mantorville by an electric street railway and to light both places by electricity. Water power is available for a generating plant.

Alton, Ill.—The directors and stockholders of the Middletown and Upper Alton motor line and those of the Alton and Upper Alton Horse Railway and Carrying Company have decided in joint meeting to equip their lines with electric cars.

Wrightsville, Pa.—E. H. Leffler, of Millersburg, Pa., has been granted a franchise for an electric light plant in this place. His company has applied for a charter under the name of the Wrightsville Electric Light, Heat and Power Company.

Indianapolis, Ind.—The *Journal* says: "The use of electric motors for power to run and control elevators is creating a great demand for motors of twelve to fifteen horse-power capacity, and is furnishing a good many orders for local manufacturers of electrical apparatus."

Brooklyn, N. Y.—The directors of the Kings, Queens and Suffolk company, organized to build the new electric railroad on Long Island, after hearing the report of the treasurer showing a favorable state of the company's finances, have decided to proceed at once with the work.

Georgetown, D. C.—The Falls Church and Potomac Railroad Company, lately organized, proposes to build an electric railroad from Falls Church to Georgetown. The stockholders are to hold a meeting at Falls Church early in June to talk over the plans for the road.

Newburgh, N. Y.—Surveyors have been making preliminary surveys in the towns of Newburgh, Marlboro and Lloyd for the purpose of establishing a trolley route to connect the Walden extension of the Newburgh and Walden Electric Railroad with the Poughkeepsie Bridge.

Rochester, N. Y.—Bernard O'Reilly is about to build a six-story block for manufacturing purposes on Otsego street, which will be leased to the Rich-Sager Company, manufacturers of bicycle saddles. The power for the whole building will be furnished by electric motors, and all machinery will be of the latest pattern.

Jacksonville, Fla.—It is reported that the Jacksonville and Tampa Bay Railway Company, recently incorporated, with $2,000,000 capital, by C. C. Thompson, Martin Dodge and T. S. Appleyard, has applied for a franchise for fifty miles of electric road to Tampa via Palatka, Sanford and Kissimmee.

Dearborn, Mich.—The township board has granted a franchise to Thomas D. Kearney, representing Eastern capitalists, to run an electric road to the western limits of the village from Ann Arbor. If the road is built, Detroit men will get the right of way to Dearborn and connect with the Ann Arbor road.

Middletown, Conn.—It is stated that the projectors of the Hollow Pond race track and pleasure grounds are making preparations to light the premises with an independent electric plant, and that not only will they manufacture sufficient electricity for their own uses, but they will be enabled to furnish lights to anyone else in that section who may want them.

Reading, Pa.—The Penn Electric Light, Heat and Power Company, recently organized, will erect a large plant in the northern section of this city. They will, if granted permission, place conduits underground in the different streets for their wires, and as soon as their system is completed will bid for the contract to furnish the city with light and heat.

Chattanooga, Tenn.—The survey on the Rossville electric road, which it is proposed will be built from Rossville to Chickamauga-Chattanooga National Military Park, has been actively commenced, and in a few days the franchise will be let finally. D. M. Steward, one of the principal stockholders, says the road is a sure go.

Montgomery, Ala.—The entire $30,000 capital stock of the Phœnix City and Girard Railway Company has been subscribed, ten per cent. paid in and work will begin at once. The officers of the company, elected a few days ago, are: J. F. Flournoy, president, Columbus, Ga.; J. Wainwright, vice-president, Baltimore; W. S. Drake, treasurer, Boston; Cliff. B. Grimes, secretary, Columbus, Ga.; J. H. Henderson, superintendent.

Lexington, Ky.—Sealed bids will be received until June 19 for lighting the streets on an all-night schedule with gas or electricity or both, on a five or ten years' contract, on and after Oct. 1. All bids must specify the kind, quality and candle-power of the light offered. The successful bidder must execute a good and sufficient bond in the sum of $5,000 with a guarantee company as security for the faithful performance of the contract.

Albany, N. Y.—The General Term has sustained the ruling of the Railroad Commissioners refusing permission for the building of the proposed Amsterdam, Johnstown and Gloversville Railroad. The commissioners refused to grant such authority on the ground that the proposed road would parallel the Fonda, Johnstown and Gloversville line, and that no idea of public necessity or convenience required the building of another road.

Syracuse, N. Y.—The Syracuse and Oneida Lake Electric Railway Company has filed articles of incorporation. Its principal office will be in Syracuse. The incorporators are Hiram McGonegal, of New York; William O'Connor, J. B. Morgan, William B. Kirk, William F. Wheaton, Edwin Lodder, George H. Wright, A. H. Pierce, Walter A. Wales, T. W. Meacham, J. P. West, Charles A. Fowler, John Witter, Thomas Harvey and James McCormack, of Syracuse.

Columbus, O.—Managers of electric light plants throughout the State have formed an organization for the purpose of mutual conference and protection against unjust legislative measures, etc. The officers elected are; President, A. W. Field, Columbus; vice-president, W. C. Hedges, Mansfield; secretary-treasurer, Samuel Coville, Cleveland; executive board, G. S. Long, Troy; L. C. Newson, P. P. Holmes, Youngstown; H. K. Wood, Piqua.

Little Falls, N. Y.—It is authoritatively stated that work on the Little Falls and Herkimer electric railroad will shortly be commenced. The right of way for the entire distance has been secured with the exception of the entrance into this city. No difficulty will be experienced in getting this. The road will traverse the various streets of Little Falls and Herkimer and the south bank of the Mohawk, taking in Jacksonburg and Fort Herkimer.

Mount Holly, N. J.—The Mt. Holly branch of the Pennsylvania Railway system, which has been transformed into an electric railway, is almost ready for a test of the new motive power. The power for the line will be generated at the Mt. Holly end, where a generating plant has been erected. There a 250 horse-power Westinghouse direct-connected engine and dynamo of the latest improved design has been placed in position and is expected to furnish ample power for the present needs of the road.

Marysville, Cal.—The work of constructing the Marysville and Auburn Electric Railway has begun. The road will be built from Marysville eastward through the foothills of Yuba and Madera counties and southeast to Auburn. It will cover nearly fifty miles of track. The purpose is to afford the orchardists and farmers in the foothills easier facilities for getting their produce to market and at lower cost. Passengers will be carried as well as freight. The electric power for the road will be furnished by the South Yuba Water Company.

New Orleans.—Frank Howard, one of the directors in the New Orleans Traction Company, who has just returned from a Northern trip, says he paid "special attention to the street railways in New York, Philadelphia and Washington, and he saw at once that the cars in this city were superior in size, workmanship and in everything to those of the cities mentioned. The tracks also are much better here."—The trolley mail car system is to be introduced here as soon as arrangements can be made.

Baltimore, Md.—The Baxter Electric Motor Company's Works in this city were sold at auction a few days ago, and bought in by Jesse N. Hilles, secretary of the company, for $25,000.

The Baxter Company has been in liquidation for some years, and the sale was by order of court. The works of the company are valued at $100.000 and upward. It is understood that the business of the company will be continued.—The Bayview Electric Light and Power Company of Baltimore County has consolidated with the Chesapeake Water Company under the name of the Chesapeake Electric and Water Company.

Buffalo, N. Y.—Alonzo C. Mather, of Chicago has a plan to construct a power bridge across the Niagara River here which is to be used to sustain 200-foot turbine wheels to be driven by the current, the power to be utilized in generating electricity for manufacturing and other purposes. The bridge, if the bill authorizing it becomes a law, will be constructed under a positive guarantee from Mr. Mather, with proper bond, that it will próve no obstruction to navigation. It will have a draw 200 feet or more in length, and, besides affording a means of almost unlimited power, will have footpaths, carriage-ways, and tracks for trolley cars.—The consolidation of the Buffalo and Niagara Falls Electric Railway with the Buffalo and Tonawanda Electric Railway, forming the Buffalo and Niagara Electric Railway, has been consummated. The directors of the consolidated company are: W. Caryl Ely, Charles B. Gaskell and Burt Van Horn, Jr., of Niagara Falls; Robert L. Fryer, Henry J. Pierce, George H. Dunbar and John J. McWilliams, of Buffalo; Frank A. Dudley, of Niagara Falls, and Willard P. Whitlock, of Elizabeth N. J. The consolidated capital is $1,250,000.

Telephone and Telegraph.

The city council of Columbus, O., has granted a franchise to the Columbus Telephone Company.

The Bradley telephone system, with headquarters at Forman, N. D., has been extended to Lisbon, twenty-five miles north of Forman. The line will be extended to Tower City before the end of the season.

The Central Union Telegraph Company will reduce its rates at Shelbyville, Ind., to $12 a year for business places and $8 for residences. The cut is made to meet the rates of the new company, which has placed a $10,000 plant in operation.

The Pierre, S. D., Telephone Company has begun to put up a plant for Pierre, East Pierre and Fort Pierre. Other towns will be connected in the future.

Neighborhood telephones are becoming popular in Indiana. A line has been put between Dr. I. N. Neeley's and White Cloud, in Spencer township, another from Moberly to Sharp's Mills and a line is to be built from White Cloud to Wyandotte Cave.

The following have been elected directors of the Missouri Pan-Electric Telephone Company at St. Louis: Charles H. Peck, Dr. K. Morgner, J. Clifford Richardson, Samuel M. Kennard, Ephraim Catlin, F. W. Mott, James Black, Thomas Rankin, Jr., Luther H. Conn, Wallace Delafield, J. W. Avery, F. S. Ramsdell and E. A. B. Garesche.

A convention of Railway Telegraph Superintendents is to be held at Montreal on the 12th inst. Between 75 and 100 prominent telegraph men from all parts of the United States and Canada are expected.

John F. Sherman, Fred Wardenburgh, A. Hansbach and others, all of Trinidad, Col., have organized the Citizens' Telephone Company to operate in Las Animas County and other counties. Capital stock, $15,000.

A telephone company has been organized at New Auburn, Minn., for putting in a telephone system between that place and Glencoe. The company will be known as the New Auburn and Glencoe Telephone Company. The officers are as follows: President, Wm. Reimers; vice-president, John Supple; secretary, Jacob Koons; treasurer, A. Streich.

The Louisville, Ky., general council (lower board) has passed an ordinance granting the American Long Distance Telephone and Telegraph Company the right to erect, operate and maintain its lines within the limits of the city of Louisville. In the upper board of the general council the ordinance was referred to the streets and revision committee.

At Ottumwa, Iowa, preliminary steps have been taken to organize a new telephone company to construct toll lines through the State of Iowa. Some of those interested in the enterprise are: Neil Wilkin and John Walsh, of the Burlington Improvement Company, operating the new Burlington and Oskaloosa telephone exchanges; John C. Delkolty, of the Albia exchange, and the members of the new Ottumwa telephone exchange.

R. P. Green, superintendent of the gas works at Columbus, O., and Charles F. Kline, known as the penitentiary electrician, have filed the necessary papers to secure letters patent for Kline's new telephone invention. The main claim will be for having discovered a substitute for the carbon now used. The system they have adopted enables them to run either a long or short distance circuit.

At a meeting held at Clarksville, N. Y., for the purpose of organizing a company to erect a telephone line between that place and Jerusalem (N. Y.) the following officers were elected: President, Cornelius Slingerland; vice president, R. C. Bagley; secretary, Charles Hummer; treasurer, S. J. Wright; manager, C. L. Shear; directors, M. F. Barber, J. M. Wright, A. Houck, Elmer Shear, H. Wideman, Andrew Joslin, Casper Mead and George Rothaupt.

The trustees of Cohocton, N. Y., have granted permission to the American Telephone Company to erect poles and wires in the village. The line is being built from Corning to Avon. An office will be established in each village through which the line passes.

At Ishpeming, Mich., the Marquette County Telephone Company has let contracts for the immediate construction of a telephone system to compete with the Bell system operated by the Michigan Telegraph and Telephone Construction Company.

The Illinois Central road has caused the novel telephone line between Williams and Webster City, Ia., to be discontinued, the local supposition being that the line interfered with the business of the Western Union, which operated the telegraph line along this road. The telephone was put up as an experiment and proved a success. The wire on the fence along the railroad was used as a conductor, connections being made underground at road crossings.

The board of street commissioners of Saratoga, N. Y., has granted a telephone franchise to local applicants. A new system will be introduced and the customers will own their instruments. The new line is in opposition to the Hudson River Telephone Company.

The Framingham Telephone Company, organized under Massachusetts laws and capitalized at $150,000, has applied to the Framingham selectmen for the right to introduce a line of telephone service and have a concession for sixty-five years. Behind the project are A. W. Worthley, H. H. Hunt, George H. Conant, Moses S. Case, all of Boston, and M. E. Maher of Framingham. These gentlemen propose to introduce a system with modern improvements, of which they have control, and make war upon the New England Telephone and Telegraph Company, their maximum monthly rate for houses to be $2, and for stores and places of business $2.50, against the New England's rates of $3.50 and $4.25 for similar service.

The Watertown branch of the Fitchburg Railroad is shortly to be equipped for about three miles of its length with the new electric device for the automatic control of railroad trains, so that when there is a misplaced or open switch, or a broken rail, or even another train to make danger ahead, the electric current will at once act as brakeman, and traveling through the rails and wires of the track set the air brakes on the approaching train and bring it to a stop. The system does away with block signals of all kinds.

The Phœnix Telephone Company hopes to be able soon to make an arrangement with the board of works of Indianapolis, Ind., by which it can begin work in that city. The managers claim to have over 2,000 subscribers.

The Forked Deer Telephone Company has lately been formed at Alamo, Tenn. The company proposes to construct a telephone line from some point on the Newport News and Mississippi Valley Railroad in Dyer County, by the way of Alamo, Crockett County, to Bells, on the Louisville and Nashville Railroad. Branch lines from Alamo to other points in Crockett County are contemplated, and will doubtless be constructed. W. H. Biggs, of Alamo, has been elected president of the company.

Mr. W. H. Mackay.

In securing the services of Mr. W. H. Mackay as manager of its New York office, the Columbia Incandescent Lamp Company has added to its force of sales agents one of the most experienced and best known members of the hustling fraternity. When electric lighting was in its swaddling clothes, back in 1879, Mr. Mackay began his career as assistant to Frank Ridlon, who was representative of the Brush Company in Boston, and was prominently identified with the construction of the early Brush plants throughout New England. In the construction department of the Schuyler Electric Co., Edison Electric Light Co., United Edison Manufacturing Co., Edison General Electric Co., and General Electric Co., Mr. Mackay acquired experience and acquaintance among central station managers of the United States, Canada and Spanish American countries that will be highly useful to him in his new position. His four years' management of the Roanoke Light and Power Co., Roanoke, Va., familiarized him with the wants and needs of a central station man, from the latter's point of view, which he will not fail to turn to valuable account of both lamp users and the Columbia Company.

MR. W. H. MACKAY.

Improved Service.

Patrons of the West Shore Railroad will be very much pleased at the great improvements made in the train service of that line in connection with their new time-table that went into effect Sunday, May 19.

It will be noted that the local service is greatly improved, trains making much faster time, and the suburban residents having more frequent trains on which to go to and fro. The express service to Albany and Buffalo, as well as its connections, has been made much faster.

The New York and Chicago Limited Express, formerly leaving at 5 o'clock in the evening, now leaves New York at 6 and will arrive in Chicago nearly two hours earlier than heretofore.

Another new departure is the running of a special train for the accommodation of the Boston sleepers in connection with this fast train, and in order to save time the baggage and passenger cars will run through via N. Y. C. and St. Louis Railway (Nickel Plate) from New York without change. The return East-bound train from Chicago has been made equally as fast as the West-bound train.

It will be seen that the management of this popular road are ever anxious to serve the interests of their patrons.

COMMERCIAL PARAGRAPHS.

The Newton Rubber Works, Newton Upper Falls, Mass., is distributing a handsomely designed and printed hanger illustrating their well-known electrical products.

"Steel Plate Chimneys" is the title of an interesting pamphlet recently put in circulation by the Philadelphia Engineering Works, Ltd., of Philadelphia.

The Central Electric Company says that although the frost seems to have caught the young grapevines and pingree potatoes and the Hessian flies have chased wheat almost out of the pit, up to the present there are no flies on the Lundell Fan Motor, Hessian or otherwise, and while the atmosphere in the neighborhood of a Lundell is always more or less frosty it does not reach an uncomfortable degree. Inquiries are pouring in just the same and prospects for a brilliant Fan Motor season are very promising. They also report a steadily increasing demand for Interior Conduit and kindred supplies. Architects and owners are rapidly learning the value and expediency of the perfect work made possible with Interior Conduit. A recent large order covered several thousand feet for an Illinois post office.

Written in Red.

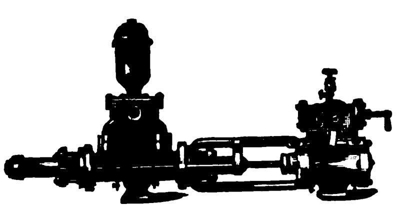
The Columbia Incandescent Lamp Company, St. Louis, is distributing a handsome work of the printer in the shape of a catalogue devoted to an illustrated description of the standard and special lamps made by this company. The cuts are full sized and represent the coiled filament, regular high and low voltage, anchored filament railway, double carbon railway, special decorative, candelabra and candle lamps, as well as the different bases now in general use.

The cover of the book is handsomely lithographed and embossed in gold. The text is printed in red.

The Yough Steam Pumps.

In a steam pumping engine of any type the valve motion is a very important part. In the Yough Steam Pump the designers have sought extreme simplicity, believing that there is no simpler valve than the old and well-known plain slide valve, covering two steam ports and one exhaust port. In this pump the valve consists of a slide valve and a piston valve, with oscillating valve at side of steam chest, having direct connection with main piston rod by a crosshead attachment. By this simple device all complication of rocker shafts, plug valves or their equivalents is done away with. The simplicity of this construction is apparent when comparison is made with the more complicated forms of pumps, the steam chest of which contains from two to four distinct valves and from thirteen to eighteen steam passages and ports, many of them so small that they are liable to become closed by gumming oil.

The accompanying illustration shows a Special Boiler Feed Pump of the Yough type, with double plungers, adapted for cold and hot water. As in all different sizes and patterns, the steam cylinder is fitted with self-acting steam packing rings, no bolts or nuts being used. The water cylinder is fitted for square piston packing which can be replaced in a few minutes. The water chests that contain valves and seats are separate castings from the water cylinder. The water chests and valves are very simple, easily examined, repaired or replaced. In large pumps the piston rod is made in two pieces, connected by a crosshead and keys, thus permitting either steam or water piston rods to be taken out without disconnecting both ends of the engine.



In addition to the boiler feed pattern described above the Yough pump is made in all sizes and for any pumping purpose, including tank, heavy and light pressure, mining, fire and deep well pumps. These pumps are manufactured by Boyts, Porter & Co., Connellsville, Pa. The manufacturers have supplied the Yough pumps for a variety of purposes—to electric plants, to the mine operators and mill and factory owners of Pennsylvania, the far West and the South and foreign countries. The testimonials received from users of the pumps indicate that all the claims of the makers are fully met.

The Walker Manufacturing Company.

Among the recent orders taken by the Walker Manufacturing Company for their Improved Street Railway Motors and Generators may be mentioned the following:

The Detroit Railway Company, Detroit, Mich., one 750 K. W. direct connected generator; this being the second machine of this size which the Detroit Railway have ordered from the Walker Company.

Aurora Street Railway Company, Aurora, Ill., nine complete car equipments, eighteen 25 H. P. steel motors. This order was awarded this company after a thorough test had been made of three or four of the leading makes of motors, and is the second order awarded the Walker Company by the Aurora Company.

Akron Street Railroad Company, Akron, Ohio, two 200 K. W. direct coupled generators, three complete car equipments, six 30 H. P. steel motors. This is the third order which has been received from the Akron Street Railroad Company.

New York, Elmsford and White Plains Railroad Company, White Plains, N. Y., one 75 K. W. belted generator, three complete car equipments, six 25 H. P. steel motors.

Lakeside Railway Company, Mahonoy City, Pa., two complete car equipments, four 50 H. P. steel motors.

W. C. Thayer, Cleveland, Ohio, two 200 K. W. direct coupled generators; ten complete car equipments, twenty 50 H. P. steel motors; one complete car equipment, two 100 H. P. steel motors.

Ashland and Catlettsburg Street Railway Company, Ashland, Ky., two complete car equipments, two 30 H. P. steel motors.

The Walker Company's shops are still running both day and night and their force is being increased almost every day.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Atlanta, Ga.—Masonic Temple, North Pryor st. and Alden ave. W. A. Hemphill president, W. F. Parkhurst secretary.

Barton, Vt.—First-class hotel, site of American House. Mr. Stone of St. Johnsbury owner.

Bedford, Westchester Co., N. Y.—Reformatory for Women.

Boston, Mass.—Private residence, Beacon st. and Commonwealth ave., for George Morgan, son-in-law of George Willcomb.—An unknown Boston woman has signified her intention of giving $250,000 for the erection of a new Emergency Hospital.

Braddock, Pa.—The Westinghouse Electric and Manufacturing Company has begun the erection of a building for its general office at East Pittsburg. It will be a large three-story brick building, to cost about $20,000.

Brattleboro, Vt.—Town hall.

Brooklyn, N. Y.—Residence for Frederick Pratt of the Pratt Institute, lighted by electricity, Architects Babb, Cook & Willard, 55 Broadway, New York.—Building for the Brooklyn Guild Association, 245 Concord st., money donated by Henry W. Maxwell.

Buffalo, N. Y.—Apartment house, corner Allen and Mariner sts. Frederick B. Robbins sold the ground to a syndicate.

Champaign, Ill.—A new public library, to be known as Burnham's Athenæum. Plans prepared by Julius A. Schweinfurth of Boston.

Chester, Pa.—A. F. Brooks, of Cramp's shipyard, Philadelphia, will build a handsome residence here this summer.

Detroit, Mich.—Brick car-house on Warren ave., by the Detroit Railroad Company, to be lighted by electricity.

Denton, Tex.—New court house; $100,000 issued for the purpose.

Greenwich, Conn.—Commodore E. C. Benedict will build a house on the site of the American Club House, to cost $1,000,000.

Hoboken, N. J.—The Hoboken Land and Improvement Company, owners, will spend several thousand dollars on improvements in the Hoboken Theater. Architect G. M. Pollard, Manager George Hartz.

Jacksonville, Fla.—The Atlantic and New River Home Co. have selected plans for a hotel which they propose to erect.

Kingston, N. Y.—Architect A. F. Mason has prepared plans for the enlargement of the Ethings clothing store; lighted by electricity.

Lawrence, Mass—A hall for the Turn Verein Society. Architect James E. Allen.

Manchester, N. H.—Austin & Stone are treating with owners of a building on Elm st., adjoining the Weston block, with the view of converting it into a theater.

McKeesport, Pa.—The foundation of the Odd Fellows Home on Market st. has just been commenced.

Middletown, Conn.—A new armory for the Mansfield Guards is projected.

Milwaukee, Wis.—Architect Anderson has commenced work on the plans for the proposed Masonic Hall.—George Brunber has purchased a site for his new block. The structure will be eight stories, to contain stores, offices, etc.

Minersville, Pa.—A building for the Minersville Bank. Contractor Daniel McGurl of Pottsville.

New Brunswick, N. J.—Brick building, at Neilson and Church sts., to contain club rooms, assembly rooms, stores, etc. Owner, Wm Miller. Contractors Wm. Taylor and Peter Hendricks.

New London, Conn.—Ronald Massett, of New London, and John B. Lathrop, of Montville, will erect an apartment house cor. Pearl and Union sts.

New York City.—Architect George B. Post, 33 East 17th st., is drawing plans for a $250,000 building for Meyer Jonasson & Co., cloak manufacturers, in the neighborhood of Union Square....The Union Club committee's report on the proposed new club house will recommend the erection and fitting up of a building equal to any now existing at a probable cost of $1,000,000. The club at its annual meeting will vote on the question of purchasing the St. Luke's Hospital property, cor. Fifth ave. and 54th st. The address of the president, Clarence A. Seward, is 31 Nassau st....The board of governors of the New York Athletic Club have been discussing plans for the proposed new building, to cost $850,000. James Whately president, J. Gulick seretary....Architect T. Jackson, 61 Broadway, has completed plans for a bank building to be erected at 115 Chambers st. and College Place, for the Irving Institution....Flats, Apartments and Tenements: 3 five-story apartment houses at 61-65 86th st., Architect George F. Pelham, 1481 Broadway; 4 five-story flats on south side of 64th st., west of Central Park West, Architect John C. Burne, 201 East 86th st.; 3 five story tenements on south side of 105th st., east of 5th ave., owner Isaac C. Ogden, of Orange, N. J.; Theodore Cordier will erect 4 five story tenements cor. 119th st. and Madison ave.; Builders Schriner & Fennell, 6 five story stores and tenements, at Madison ave. and 113th st.; C. D. Cohen, owner and architect, 3 five story flats on west side of Madison ave. north of 116 st.; John L. Miller, Riverside Drive and 85th st., will erect 2 five story brick flats 66th st., east of Columbus ave.; Abraham Davis, 127 East 112th st., five story and basement brick flat at 127 East 112th st.; Wm. Hayes, 135 East 122d st., a five story brick tenement at 135 East 122d st.; Bernard Hananagh, 469 West 147th st., a five story brick flat on Amsterdam ave., southeast corner of 147th st.; Peter Eagan, 249 East 116th st., a five story brick flat, 111 East 117th st.; Annie C. Doyle, 421 West 148th st., a seven story brick flat, St. Nicholas ave. south west cor. of 150th st.; John J. Farley, 140 West 137th st., a five story brick flat, 7th ave. southwest cor. of 118th st.; Louis Essler, 482 West 51st st., 2 five story brick flats at 535-537 West 130th st.; four story brick store and tenement on Third ave. north of 164th st., Architect Michael J. Garvin; Architect Charles Stegmeyer, 306 East 82d st., has prepared plans for 8 five story brick flats to be erected on 98th st., west of Columbus ave.; five story brick flat on 135th st. east of Willis ave., owner George F. Picken; five story brick flat on 135th st. east of St. Nicholas ave., Architect Wm. J. Fryer, 137 Broadway; 4 five story brick flats at 46th st. east of 2d ave., Architect Solomon D. Cohen; five story brick flat at 160 Mott st., Architect George F. Pelham, 1481 Broadway; 2 five story brick flats on Water st., No. 678, Architect George F. Pelham; five story brick flat on 143d st. east of 8th ave., Architect Geo. F. Pelham, 1481 Broadway; three story brick store and tenement on Forest ave. south of 156th st., Architect A. F. Schmitt; five story brick store and flat at 56 Monroe st., Architects Horenburger & Straub; a six story brick flat, 170 Henry st., Architects Schneider & Herter; 3 four story brick stores and tenements on Forest ave., south of 156th st., Architect A. F. A. Schmitt; 2 five story brick flats on Amsterdam ave. north of 100th st. Architect George F. Pelham, 1481 Broadway; five story brick flat on West End ave., north of 101st st., Architects Thom & Wilson, 1267 Broadway; 2 four story brick flats on Elton ave. south of 158th st., Architect Herman Horenburger; 6 five story brick flats 134th st. south of 7th ave., Architects Neville & Bagge, 227 West 125th st.; a five story brick store and flat, 56 Monroe st., Architects Horenburger & Straub; Architect H. H. Carter is preparing plans for 5 flat buildings, to be erected at southeast cor. of 3d ave. and 74th st. for the Jackson estate; three similar houses will adjoin on the ave., and another will front on 74th st., it will be five stories, brick and stone; L. Z. Bach has engaged H. H. Carter to make plans for 7 five story brick and stone tenements on northeast cor. of 57th st. and 1st ave; 4 five story brick and stone flats from plans prepared by J. H. Valentine; 2 three story frame tenements 163d st. west of Trinity ave., Architect J. H. Valentine; 2 five stor brick and stone flats at 80th st. east of 10th ave., Architects Neville & Bagge, 227 West 125th st.; Heibner & Wolf are having plans prepared by Neville & Bagge for 3 five story brick and stone flats cor. Amsterdam ave. and 178th st.; five story brown stone front store and apartment house, east of 2d ave., south side of 19th st., Architect Herman Horenburger; four story brick tenement on 3d ave. north of 164th st., Architect Michael J. Garvin; 4 five story brick flats on 147th st. west of Brooke ave., Architect J. H. Valentine; five story brick flat on 90th st. east of Amsterdam ave., Architects Neville & Bagge; five story brick flat on Melrose ave. cor. 137th st., Architect J. A. Leiver; 2 five story brick flats on Monroe st. east of Market, Architect Joseph Wolff, 55 Liberty st.; Albert Wagner will erect four story brick store and apartment house at 47-51 59th st; O. Oppenheimer will build 3 five story apartment houses on south side of 84th st. west of Columbus ave.; 2 five story brick tenements are to be built at 241-243 Monroe st. by B. Wolff; four story tenement on north side of 135th st., east of St. Anne's ave., Architect Herman Horenburger, 682 East 159th st.; the same architect has plans in progress for a five story brick and brown stone front tenement to accommodate 16 families, to be erected by Michael Wolbach, northwest cor. of 158th st. and Elton ave.; Builders Jung & Mohr have had plans prepared by Charles Stegmeyer, 306 East 82d st, for 8 five story flats, north side of 98th st. west of 9th ave.; Architect Herman Horenburger is preparing plans for a five story brown stone front dwelling to be built on north side of 192d st. west of St. Anne's ave.; John H. Picken, 54 West 118th st. will erect three story brick dwellings on 120th st. west of Manhattan ave., Architect John Hauser; Mr. Picken will also erect a five story brick flat on 135th st. east of Willis ave.; Joseph L. O'Brien, 347 Grand st., will erect 3 five story brick flats, 151st st. south of Boulevard; Robert L. Gray, 235 Lenox ave., 4 five story brick flats on Amsterdam ave. north of 167th st.; Andrew Brose, a five story brick flat 101st st. west of West End ave.; A. F. A. Schmitt, 606 Cortlandt ave., a four story brick flat on Willow ave. cor. 133d st.; Mary E. Jenkins, 55 Lenox ave., two brick flats on St. Nicholas ave. cor. 113th st.; Adolph S. Kalisher, 1186 Lexington ave., a three story brick flat on Monroe st. cor. Market; Jared W. Bell, 248 Lexington ave., 2 five story brick flats on 109th st. east of Amsterdam ave.; Margaret L. King, 322 West 14th st., a five story brick flat at 544 West 51st st.

New London, Conn.—The contract for the erection of a public building has been let to C. W. Green & Co., of Chicago.

North Adams, Mass.—Fred C. Dowlin has purchased the Sibley property on Main st., and will erect on it a five story business block with opera house in the rear, at a cost of $150,000.

Orange, N. J.—Architect Charles N. Horr, of New York City, has the plans for a colonial cottage to be built at Orange for James W. Stover.

Parkersburg, W. Va.—J. W. McKinney will erect a building at 4th and Market sts., to contain hall, etc., Architect W. H. Patten.

Paterson, N. J.—John Habben has had plans prepared for transforming his residence on Broadway into an apartment house.

Philadelphia, Pa.—Hamilton & Giesenger, the silversmiths, have purchased the property at 1208 Chestnut st. and are having plans made for an eight story office building to be erected....Architect Hutton has prepared plans for addition to be built to the Aldine Hotel; the new building will be ten stories....Charles J. Mills will erect a brown stone dwelling at northeast cor. of Broad and Dauphin sts., after plans prepared by Harold Goodwin. A. J. Wood will make alterations to his house at 1425 Poplar st., including introduction of electric work and hot water heating.....A six story addition will be made to the Baker Building for offices and studio....J. W. Hallahan will rebuild the properties at cor. Chestnut and 17th sts., the new structure to contain stores and bachelor apartments.

Pittsburg, Pa.—Architect Joseph L. Neal is preparing plans for a large hotel to be built out of the city....Application for a charter for a new hospital to be known as the Eye and Ear Hospital of Pittsburg has been made; Wallace H. Rowe, Robert B. Petty, M. Atcheson and others are interested.

Pittston, Pa.—A resolution has been introduced in council for the erection of a city hall.

Rock Island, Ill.—Plans for a new county court house have been filed.

Rome, N Y.—Dr. J. M. Showerman has under consideration the erection of a sanitarium.

Roxbury, Mass.—The Board of Aldermen have referred to the finance committee an order providing $30,000 for the erection of a new city hall.

Russell, Mass.—A site on Main st. has been selected for the proposed town hall.

Somerville, Mass.—Plans, specifications and the cost for erecting a new city hall are wanted. Councilman Stevens will give information.

Seneca Falls, N. Y.—A summer hotel is to be erected at Cayuga Lake Park.

Syracuse, N. Y.—S. Rosenbloom & Sons are having plans prepared by New York architects for a new block seven stories high....L. C. Smith will erect a residence on the Stolp property to cost $100,000.

Tarrytown, N. Y.—John D. Rockefeller will build a fine residence on the hills back of Tarrytown.

Toronto, Can.—Robert Simpson will build a five story store to cost $200,000. Architects Burke & Horwood.

Utica, N. Y.—Northrop & Latchen propose erecting a twelve story apartment house to contain 140 suites of apartments, 30 bachelors' apartments, library, reception hall, gymnasium and cafe.

Washington, D. C.—Proposals will be received at the Office of Public Buildings and Grounds, War Department, for materials for a building to be erected on the site of the Government Printing Office and adjoining ground... H. D. Nichols will erect an eight story apartment house on B street.

Watertown, N. Y.—The Odd Fellows are talking of building a temple to cost about $100,000.

Willard, N. Y.—B. F. Peck of Seneca Falls has the contract for a State Hospital at this place.

Wilkes-Barre, Pa.—Contractor R. T. Long is building new fire-proof business block for Lawrence Myers.

Worcester, Mass. A fire-proof block is to be erected cor. of Mechanic and Norwich sts. by Manager F. B. Hunt of the local telephone company.....Wm. R. Dean will erect 8 six story apartment houses near his residence, 28 Piedmont st. Architects Fuller & Delano.

INCORPORATIONS.

The Brockton and Northeastern Street Railway Company, Brockton, Mass.— o build and operate an electric railway. Capital stock, $50,000. Incorporators: John P. Morse, Judge Warren A. Reed, Horace B. Rogers, of Brockton; G. H. Campbell, of Lawrence, and Edwin S. Webster and Alfred A. Glasier, of Boston.

The Milwaukee and Waukesha Railway Company—to construct and operate an electric railway system in and between Milwaukee and Waukesha, Wis. Capital stock, $1,000,000. Incorporators: Max Rosenthal, James Petley, A. B. Myers, Stutley J. Henderson, Charles Pittlekow, Jacob Wellhauer, Joel W. Bingham and L. D. Rosenheimer, of Milwaukee, and John J. Constantine, Andrew Snyder and Ernst Merton, of Waukesha.

The Springer Electric Company of McCordsville, Hancock County, Ind.—to manufacture electrical apparatus and operate telephone exchanges. The directors are T. L. Springer, S. Morrison and A. C. Morrison.

The West End Electric Light and Power Company, West Hazleton, Pa.—to supply light, heat and power. Capital stock, $10,000. Promoters: Thos. H. Powell, Hazleton; Walter McAvoy, Wilson S. Betterly, West Hazleton, Pa.

The Tilmann Portable Electric Light and Reflector Company, New York, N. Y.—to manufacture and sell dynamos, reflectors and various mechanical devices. Capital stock, $100,000. Promoters: H A. Ockershausen, J. J. Lamler, T. A. Fay, Jno. McCarthy, New York City.

The Fort Madison Water Company, Portland, Maine—to manufacture gas and electricity, machinery and fixtures for gas and electric and water plants in the city of Fort Madison and other places. Capital stock, $250,000. Promoters: Wm. C. Eaton, Edw. D. Noyes, Geo. F. Noyes, Portland.

The Globe Telephone Company (incorporated in W. Va.), New York, N. Y.—to acquire patents, electric bells, etc.; buy, sell and lease patents, etc.; operate telephone lines, etc. Capital stock $5,000,000. Promoters: Geo. W. Williams, Portland, Ore.; Frank B. Carpenter, Chas. L. George, Edw. Bradley, New York City.

The Pugh Electric Light and Power Company, Cincinnati, Ohio—to furnish electric light and power or either, and all wiring apparatus, etc., connected with said business. Capital stock, $5,000. Promoters: A. H. Pugh, Alfred Mack, Geo. W. Pickard, Obert Spencer, Jno. Galvin.

The Missouri Gas Company, Kansas City, Mo.—to deal in gas, electric light, heat and power. Capital stock, $1,500,000. Promoters; Irwin Reu, Henry C. Reu, Chicago, Ill.; C. J. White, J. C. James, J. M. Lowe, Robert M. Snyder, Kansas City, Mo.

The Citizens' Electric Light and Street Railway Company, Anna, Ill. Capital stock, $12,000. Incorporators: Christian Nordling, Charles V. Nordling and John C. Nordling.

The La Harpe Electric Light and Power Company, La Harpe, Ill. Capital stock, $15,000. Incorporators: Joseph R. Crabill, George Coulson and O. Buelen.

The Home Electric Company, Baton Rouge, La. Capital stock, $100,090. President, S. J. Laycock; vice-president, C. J. Barrow. Directors: Dr. T. J. Buffington, T. J. Kernan, Edward Wax, Solon Farrnbacher, Joseph Gebelin, S. J. Laycock and C. J. Barrows. The new company has negotiated for the purchase of the plant of the Capital Railway and Lighting Company, and the transfer of the property will take place at once.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MAY 28, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

539,786. Conduit Electric-Railway System. Ferdinand Barrell, New York, N. Y. Filed July 19, 1894.

539,798. Combined Trolley Head and Wheel. William H. Dalbey, Indianapolis, Ind. Filed Oct. 11, 1894.

539,825. Electrical Connection. Peter Rieth, Chicago, Ill. Filed Feb. 28, 1895.

539,854. Trolley-Breaker. William G. Carey and Augustus A. Ball, Jr., Schenectady, N. Y., assignors to the General Electric Company, same place. Filed Nov. 15, 1894.

539,931. Rail-Bond. Frank E. Buxton, Worcester, Mass. Filed April 15, 1895.

540,010. Conduit Electric Railway. Frank B. Widmayer, New York, N. Y., assignor of one-half to Charles E. Ball, same place. Filed Aug. 3, 1894.

540,029. Means for Connecting Motors to Car-Axles. Sidney H. Short, Cleveland, Ohio. Filed Oct. 19, 1893.

540,054. Locating Faults in Electric Railways. John C. Henry, Westfield, N. J. Filed Jan. 24, 1894.

540,060. Conduit Electric Railway. William E. M. Jackson, San Francisco, Cal. Filed Oct. 25, 1893.

540,090. Electric Passenger Register and Recorder, Joseph W. Ellis, Albany, N. Y. Filed Jan 12, 1895.

540,187. Closed-Conduit System for Electric Railways. Herluf A. F. Petersen, Milwaukee, Wis. Filed March 26, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

539,838. Process of Producing Incandescing Bodies for Electric Lamps. Konrad O. E. Trobach, Pankow, Germany, assignor of one-half to Sigmund Bergmann, New York, N. Y. Filed April 18, 1894.

539,863. Controller for Electric Search-Lights. Elie F. G. H. Faure, John MacHaffie, and Sam H. Libby, Schenectady, N. Y., assignors to the General Electric Company, same place. Filed Jan. 29, 1895.

539,877. Electric-Arc Lamp. John A. Mosher, Chicago, Ill. Filed May 1, 1893.

539,959. Shade for Electric Lamps. Albert S. Marten, East Orange, N. J. Filed Feb. 11, 1895.

DYNAMO ELECTRIC MACHINERY.

539,849. Electric Motor. John B. Atwater, Chicago, Ill. Filed Sept. 24, 1894.

539,876. Stationary Transformer. Walter S. Moody, Lynn, Mass., assignor to the General Electric Company, of New York. Filed May 15, 1894.

539,881. Armature-Coil and Method of Making Same. Otto F. Persson and David P. Thomson, Schenectady, N. Y., assignors to the General Electric Company, same place. Filed Oct. 6, 1894.

539,943. Armature-Winding and Method of Making Same. William Lochhausen, Brooklyn, N. Y. Filed Feb. 10, 1888.

540,035. Brush Holder for Dynamo-Electric Machines. Elihu Thomson, Swampscott, assignor to the General Electric Company, Boston, Mass. Filed Feb. 20, 1893.

540,216. System of Electrical Distribution, Ernst G. P. Oelschlaeger, Charlottenburg, assignor to Siemens & Halske, Berlin, Germany. Filed April 6, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

539,939. Electric Cable. William D. Gharky, Philadelphia, Pa. Filed Oct. 18, 1894.

540,012. Telephone Central Station. Gaston D'Adhemar, Paris, France. Filed June 20, 1894.

540,117. Conductor-Distributing Frame. Theodore Spencer, Cambridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Jan. 24, 1895.

540,159. Metallic Base for Telegraph or Other Poles. Frank E. Garner, Cornwall, Conn. Filed Jan. 9, 1895.

540,168. Electrical Exchange. Alexander E. Keith, Frank A. Lundquist, John Erickson, and Charles J. Erickson, Chicago, Ill., assignors to the Strowger Automatic Telephone Exchange, same place. Filed Nov. 7, 1894.

BATTERIES.

539,871. Galvanic Battery. Harry T. Johnson, New York, N. Y. Filed Nov. 10, 1893.

540,076. Secondary Battery. William L. Silvey, Dayton, Ohio. Filed Jan. 21, 1895.

540,185. Secondary Battery. Clement Payen, Philadelphia, Pa. Filed Aug. 17, 1893.

MISCELLANEOUS.

539,585 Rheostat Face-Plate with Supplemental Rheostat. Frank Kraemer and Max Kruger, Chicago, Ill. Filed Sept. 19, 1894.

539,725. Cut-Out Block. Frederic A. Chapman, Philadelphia, Pa. Filed Feb. 5, 1895.

539,737. Electric Treasure-Guard. Robert A. Habersham, Portland, Oreg. Filed Jan. 3, 1895

539,804. Electromagnetic Gold-Separator. Joseph D. Gibbens and William B. Murray, Portland, Oreg. Filed Oct. 20, 1894.

539,840. Safety System for Railways. Albert L. Ware, Cambridge, Mass. Filed Oct. 15, 1894.

539,870. Annunciator. Franklin A. Jennings, Ithaca, N. Y., assignor to the Electric Bulletin Company, Chicago, Ill. Filed March 23, 1893.

539,886. Electric Meter. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company of New York. Filed Feb. 18, 1895.

539,966. Electric Bell. Charles B. Sterling, New York, N. Y., assignor to the Dewey Electric Signal Company, Jersey City, N. J. Filed March 14, 1895.

540,008. Electrical Thermometer. George C. Whipple and Henry E. Warren, Newton, Mass. Filed Dec. 5, 1894.

540,073. Electric Heater, Charles J. Reed, Philadelphia, Pa., assignor, by direct and mesne assignments, to the Reed Electric Company, same place. Filed June 5, 1894.

540,153. Apparatus for Determining Differences Between Phases of Two Electric Alternating Currents. Michael von Dolivo-Dobrowolsky, Berlin, Germany, assignor to the Allgemaine Elektricitats-Gesellschaft, same place. Filed Oct. 27, 1893.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JUNE, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.50 P. M.	2	3.30 A. M.
2	......	..	......
3	1.00 A. M.	3	3.40 A. M.
4	1.10 "	4	3.40 "
5	1.40 "	5	3.40 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	8.00 P. M.	9	11.00 P. M.
10	8.00 "	10	11.30 "
11	8.00 "	11	11.50 "
12	8.00 "	13	12.20 A. M.
13	8.00 "	14	12.40 "
14	8.00 "	15	1.00 "
15	8.00 "	16	1.20 "
16	8.00 "	17	1.30 "
17	8.00 "	18	2.00 "
18	8.00 "	19	2.30 "
19	8.00 "	20	3.00 "
20	8.00 "	21	3.40 "
21	8.00 "	22	3.40 "
22	8.00 "	23	3.40 "
23	8.00 "	24	3.40 "
24	8.00 "	25	3.40 "
25	9.00 "	26	3.40 "
26	9.30 "	27	3.40 "
27	10.00 "	28	3.40 "
28	10.30 "	29	3.40 "
29	11.00 "	30	3.40 "
30	11.30 "	July 1	3.40 "

ELECTRICITY.

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ELECTRICITY

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EDITORIAL NOTES.

The "Engineer's" Blindness, or Ignorance, Which? Our esteemed contemporary, the *Electrical Engineer*, published in its issue for May 29 a two-column editorial, entitled "Buffalo Blindness," which for imbecility and recklessness takes the palm. That journal is consistent, however, for originally having given space to a long article by Messrs. Houston and Kennelly demonstrating (?) that power could be economically transmitted by electricity from Niagara Falls to Albany, it would not do to go back on any proposition, however absurd, that might be made by the Power Company to the city of Buffalo. Such misrepresentations as are contained in the editorial referred to are just the agencies which, acting cumulatively, have brought the electrical business into its present lamentable condition. It is a mistaken kindness to the electrical trade to boost an ill-advised project, and it is to save the electrical trade and profession from friends like the *Electrical Engineer* that Electricity has its chief cause for existence.

The *Engineer* thinks that Buffalo has been blind to its own interests in not accepting at once one of the several propositions made by the Niagara Power Company. It mentions that the Power Company offered "to sell power to the city in blocks of 10,000 H. P., delivered at *Niagara* either as 'undeveloped' power, 'developed' power, or 'electrical' power, at the *low* prices of $10, $13 and $18 per H. P. per annum respectively" (the italics are ours), and seems to think these figures are entirely reasonable. To the layman they do appear low, but to the honest engineer they mean something entirely different from what appears on their face. If the Niagara Company charge $3 per annum for developing H. P. it means *at least* as much for Buffalo, viz., $30,000 per annum for 10,000 H. P. The legal rate of interest in New York State is 6 per cent. This development, if undertaken by the city, means an investment of $500,000. Also by the last proposition—$18 per H. P.—it means a yearly output cf $80,000, or an investment of $1,333,333, with the power still undelivered. The most feasible method of transmitting this power to Buffalo—twenty miles distant—is still an open question, and how much it will cost to deliver it is not yet determined. The Niagara Company itself, in reply to a demand from Buffalo that a maximum price shall be named, says that there are so many contingencies in the practical fulfilment of the plan that it is *impossible* to name a maximum price. As we had occasion to remark once before, "If the Niagara Power Company after having studied this question all these years cannot tell what it is going to cost to deliver its power in Buffalo, who can?" And we may add here that we would consider it the height of folly for the city of Buffalo to undertake the solution of the problems of transmission and distribution, in regard to which the Power Company confess themselves too far in the dark to make even now a definite proposition.

The *Electrical Engineer* gives these figures as though they meant something definite, whereas they mean absolutely nothing. They would have the city of Buffalo grant an exclusive franchise for something which might mean a dead loss of a million and a third dollars in addition to the cost of getting the power where it could be utilized, because, with the experimenting and other operating expenses, that power when delivered would cost more than it could be generated for on the spot.

Assuming that the city of Buffalo bought the power at $18 per electrical H. P. per annum at the dynamo terminals, does the *Electrical Engineer* know how much of that power it will have to sell to its customers after deducting line losses in transmission, transformer losses and distribution losses? Does it know what the load factor will be? Does it know what the cost of administration, including interest on investment and depreciation will amount to? The Niagara Power Company with all their facilities confess that they cannot yet tell. If they can't, how can the city of Buffalo arrive at even an approximate figure when the calculations involve, in addition to the usual unknown quantities, that other one known as political management? Buffalo would be blind indeed if it allowed itself to be drawn into any such scheme. Why doesn't the *Engineer* give some figures by which the public can judge of the cost of power delivered by municipal enterprise? It does to this extent—it says: "Recent tests of the cost of steam power in Buffalo made since the publication of the printed statement of the Power Company, and by so competent an expert as Mr. Horatio A. Foster, show that no large plant in the city of Buffalo can be found using 1,000 H. P. or more where the cost of the steam power is less than $50 per H. P. per annum."

We presume that Mr. Foster's figures are entirely correct. Dr. Emery states that with coal at $2 per ton power can be produced under fairly continuous operation for 365 days of 20 hours each for $36.56 per H. P. The coal alone costs at $2 per ton $11.22. At Buffalo, it is stated, coal costs but $1.50 per ton. The cost per H. P. at this price would therefore be but $33.76. We find a discrepancy between Mr. Foster's figures and those attainable in ordinary practice under favorable conditions of $16.24 or about 32.5 per cent. To what is this discrepancy due? Undoubtedly to the load factor, and yet this very load factor is entirely ignored. It will be as great, if not greater, for the whole city of Buffalo than for the establishments cited as paying $50 per H. P. Why does the *Engineer* disregard this important item?

There is another important fact that is ignored, i. e., that a H P. at the terminals of the generator at Niagara is not a H. P. delivered at Buffalo, or a H. P. salable to a customer. How much will this loss in transit amount to? We are not advised.

Our contemporary then proceeds with a number of statements that seem to indicate either a most profound ignorance of the subject of which it professes to be an exponent or a wilful attempt to mislead. It says: "*It is a well-known fact that if the mechanical power were given* to the *Buffalo General Electric Company free of charge*, the local lighting company could not *at cost* furnish arc lamps at $50 *per H. P. per annum.*" Is this a well-known fact? If so the Buffalo General Electric Company would better go out of business at once—it is a disgrace to the business, its management is a monument of incapacity, and Mr. Huntley is not the competent station man that he is universally credited with being. We do not believe that this is "well known," or known at all.

As to the *practicability* of transmitting the power from Niagara to Buffalo, our contemporary says: "But those who know of the Frankfort-Lauffen transmission of 108 miles, and the more recent successful operation of the various plants in this country, such as at Telluride, Sacramento and other places where the distance exceeds 20 miles, recognize in this situation no reason for doubt of the entire success of the Niagara transmission to even greater distances."

After making such a statement as that, can the *Electrical Engineer* ever again hold its head up before the public as an exponent of electrical knowledge?

Does not our friend Martin *know* that in the Frankfort-Lauffen transmission the power cost when delivered at Frankfort *five times* as much as it could be produced for locally by means of steam? If he does know this, why does he cite this as an example of the practicability of transmission? If he does not know this, we refer him to as high an authority as Prof. William Cawthorne Unwin, F. R. S., who says on page 3 of his recent book "On the Development and Transmission of Power": "The fact must be borne in mind that the cost of the power when it reached Frankfort was five times as great as that of an equal amount of power produced directly in Frankfort by a steam engine."

The transmission at "Telluride *and other places* where the distance exceeds 20 miles" is also cited. Does not our contemporary know that there is quite a difference as regards *practicability* of transmission to a place like Buffalo, where coal costs $1.50 to $2.00 per ton, and to a place like Telluride, where it costs $15 to $20 per ton and is difficult to get at *any* price? If it doesn't, it ought not to set up as a teacher of economics. *And further*, does it not know that the distance of the Telluride transmission is but 16 *miles?*

The original Telluride transmission was but three miles. It has recently been extended to the Tom Boy mine, making a transmission of about sixteen miles. Soft lump coal costs in Telluride from $10 to $12. It costs fully $10 to transport this coal to the Tom Boy mine, making the price of coal at the point where power is delivered somewhat *over* $20 per ton. Hard coal costs about $2.50 more than the above. During many months in the year transportation to the Tom Boy mine is entirely interrupted.

The Sacramento transmission plant from the American River near Folsom is also mentioned as a successful example of the transmission of power "where the distance exceeds 20 miles." Will the editors of the *Electrical Engineer* tell us when this plant will be put into operation? If it is already in operation, it is of such recent date that it could scarcely be cited as yet as an example either of successful or unsuccessful transmission. Its status at present is so little further advanced than that of Niagara that it would be almost as appropriate to cite Niagara as a precedent for Folsom as to cite Folsom as a precedent by which to judge the practicability of Niagara.

Steam coal costs at Sacramento $8 per ton, at Buffalo $1.50 to $2.00.

Does the *Engineer* regard the commercial conditions the same here as at Buffalo? If not, why is the comparison drawn unless to mislead?

The Tivoli-Rome installation abroad is also cited by the *Electrical Engineer* as an example "where the distance exceeds 20 miles." Does not it *know* that this line is *less* than 20 miles? If not, we refer it to the numerous descriptions that have appeared both in the American and in the foreign electrical journals. If it does know that this line is but 18 miles long, why does it cite it as an example of one that "exceeds 20 miles"?

And now, since none of those mentioned by our contemporary that are in operation to-day exceeds 20 miles or even equals that distance, let us ask about "the other places where the distance exceeds 20 miles."

Can the *Electrical Engineer* name a single case in this country where current for both light and power are transmitted to a distance of 20 miles? Can it name a single instance in the whole world where such a transmission is now in successful operation and where coal costs less than $10 per ton?

We have gone into detail in regard to this part of the *Engineer's* argument, simply to show how utterly regardless of truth it can be, and how utterly worthless its statements of facts are. This is the class of journalism that is ruining the whole electrical industry, and it is the kind that must be stopped—either this or the people must stop patronizing such journals if the public is again to feel confidence in electrical investments. This is the class of journalism that rendered possible the selling of Edison electric light stock at $5,000, and which has resulted in G. E. stock selling down to less than $30. This is the class of journalism that is now trying to involve the city of Buffalo in an unwise contract merely because it is an electrical scheme, and it is this class of journalism, which if persisted in, will do as much injury to the development of future legitimate transmission of power schemes as it has heretofore done to general electrical progress.

Now as to the other features of the case.

Transmitted power can only compete with locally generated power when the former can be delivered to the customer on favorable terms as compared with the latter. If electricity can be generated cheaply at the distant point it can compete successfully with local steam power when the latter costs more than the former delivered. In the Western mining regions where coal is scarce and transportation, labor and all other supplies are expensive, it may pay to transmit power electrically to very considerable distances. Where labor is plenty and fuel is exceedingly cheap, as at Buffalo, the commercial conditions favorable to long transmissions are exactly reversed.

Why should the city of Buffalo grant a franchise to the Niagara Power Company unless the latter can assure it that it can benefit the city? It seems to us that Buffalo would be blind indeed if it fell into any such trap. It is all well enough to say that if permitted to come into Buffalo the Niagara Company will have to meet the prices of locally generated steam power or go out of the business. But why doesn't the Niagara Company *say* what it will do—name a maximum price that is fair? It declines to do so and says that it can't. It considers, according to our contemporary, that any demands of this kind on the part of Buffalo are entirely unreasonable. To the contrary, such demands are the most reasonable that could be conceived and should form the basis for all other negotiations. If the Niagara Company would name such a price as would be favorable to the city, the latter then could and doubtless would be generous in the other terms. Without such a basis to go on we do not see how negotiations can be further continued. We think that some of the other conditions talked of by the city *are* onerous. One of these is that the company shall furnish the city 4,000 H. P. at $20 per H. P. Another is that the franchise if granted should be so limited in time. But without an agreement as to maximum price the requirement of power at $20 per year for the waterworks would be $20 per year too much. Without a maximum price a term of franchise for one day would be too long; *with* a satisfactory maximum price $20 is unreasonably low and fifty years' life of franchise none too long.

But after all this babble about franchises and transmission which the *Engineer* indulges in is cleared away there is another feature of the situation which is also entirely beyond the comprehension of our contemporary—the stockjobbing part of the Niagara enterprise, which has already proceeded far enough to be conspicuous to those who give any real thought to the scheme, and which will soon be even more apparent.

With a franchise in the city of Buffalo and with sufficient misrepresentation as to what it might do in the way of selling current there, the Niagara Power Company would soon be doing a thriving business in the sale of stock. Without that franchise the scheme will be harder to work. The *Electrical Engineer*, therefore, is doubly guilty—guilty of exposing its own gross ignorance of the general subject of transmission and disgracing the technical press, and guilty of assisting the speculators, as far as is in its power, to carry through one more scheme to blacken the fame of this industry by its failure.

The city of Buffalo is not far wrong so far in the stand it has taken, and every citizen of that town should exert his influence to prevent the granting of a franchise which will be used to extract money from the pockets of investors under false pretenses—for nothing else but speculative purposes.

* * *

The Tacoma Steal. The public will be under obligations to Messrs. P. D. and J. O. Armour if they carry their protest against the swindling methods of the T.-H. Company to the extent of making it plain just how C. A. Coffin and his fellow swindlers worked the various schemes which have disgraced the entire electrical trade of the country and placed electrical securities under the ban in all conservative financial institutions. Full exposure would have ended Mr. Coffin's career before he succeeded in robbing New England investors of millions in bogus bond transactions. We shall give in early issues further information as to the T.-H. financiering scheme which will be interesting to the Messrs. Armour, to the public generally, to Messrs. Coffin and Byllesby, the Old Colony

Trust Company, the United Electric Securities Company, and which ought to interest some of the grand juries in various States.

Most of our readers would suppose that this Tacoma game has been played to its limit. Not so. Even now Mr. C. A. Coffin, O. Z. Mitchell and G. W. Bird, the latter two receivers of the property, are planning for another reorganization and another bonding. The new blood this time is to be the absorption of the Point Defiance Railway, lately purchased by Mr. Mitchell.

Under the Searchlight.

Views and Opinions on Timely Topics.

READING NOTICE EDITORIALS.

Elsewhere we discuss an editorial in the *Electrical Engineer* of May 29 on Niagara transmission. Other editorials in the same issue were one on the "Cold Snap," which may be passed without comment, and one on "Street Car Speeds" which shows the depths to which a once dignified journal may descend in abject puffery. A daily paper paragraph is copied, relating how a bicycle rider fell in front of a 125th street cable car and was saved from death because the car was stopped in time. Then the *Engineer* says: "Now, it is well known that these cable cars are equipped with the Gennett air brake and not the later, better form of it either."

Nothing of the kind is *well known*. It was not known in the office of our contemporary until it was supplied with the clipping and the request for editorial mention by the Gennett Air Brake Company. The editorial had no purpose except to puff this special brake, which is no better than a half-dozen others.

Advertisers in the *Electrical Engineer* should understand the situation clearly, and to be sure they have what they are entitled to should stipulate in their contracts that they are to have so many columns of editorial space free during the year.

Readers seeking honest opinions and expert views of what is going on should also understand that the editorials in that sheet are supplied by advertisers and are just as valuable as the matter in a trade circular—and no more so.

* * *

MORE TROUBLE AT CLEVELAND.

(From the Cleveland Leader.)

The General Electric Company has met with a snag in its wholesale absorption of electrical concerns.

David L. Einstein, of New York, has begun proceedings to compel the officers of the Swan Lamp Manufacturing Company to produce the books, contracts, records, etc., for an examination by experts.

Einstein says that there are 380 shares of stock which was issued by the Swan Company at $100 each outstanding. He owns fifty of them, and the General Electric Company the remainder. The Swan Lamp Manufacturing Company holds, he continues, in his petition, a judgment against the Brush-Swan Company of New England, but the General Electric Company, by controlling both the Brush Electric Company and the Swan Lamp Manufacturing Company, effected as a result of a series of suits between the Brush Electric Company and the Brush-Swan Company, a settlement whereby the Swan Lamp Manufacturing Company received nothing more substantial of its judgment against the Brush-Swan Company than a fictitious judgment.

He claims that the judgment was so manipulated by the General Electric Company that the company in which he owns fifty shares of stock was left out in the cold. Einstein says that President Hamill informed him that the Swan Lamp Manufacturing Company earned more than $20,000 in 1893, and between $12,000 and $15,000 in 1894. He further claims that the Swan Incandescent Light Company obtained a judgment of $5,000 against the Swan Lamp Manufacturing Company, but that in order to secure itself against the payment of the judgment, the General Electric Company executed a fictitious chattel mortgage in favor of itself and against the Swan Lamp Manufacturing Company for $55,000.

There is no way, Einstein concludes, in which the condition of the business affairs of the Swan Lamp Manufacturing Company can be ascertained other than by the examination of the books by experts.

* * *

"Digest of Current Technical Electrical Literature."

(From ELECTRICITY, May 29.)

If the *Electrical World* is fair, and if its Digest is what it claims to be, the readers of that paper will see a report of this case (the underrunning trolley litigation) in the Digest a *week after this*, credited to ELECTRICITY. Will it be fair? We'll see.

(From ELECTRICITY, June 5.)

We expect this week to see mention of our report of the underrunning trolley litigation in the Digest, if the latter is what it claims to be and its editor is fair. But won't it be rather galling to the *Electrical World* to credit us with important news that it missed? It will be a great strain on the editor's fairness and—will he be fair? We'll see.

(From the Electrical World Digest, June 8.)

"EL'TY", May 29, publishes at some length the records of the final hearing of the litigation between the General Electric and the Westinghouse Companies, the main points of which were given in the *Electrical World* two years ago."

Here are the "*main points*" given by the *Electrical World* two years ago:

(From the Electrical World, May 6, 1893.)

GENERAL ELECTRIC COMPANY'S TROLLEY PATENTS.

After several years of contention and interference before the Patent Office, two broad fundamental patents have been granted to Chas. J. Van Depoele, covering, it is claimed, all the essential features of the trolley. The patents are assigned to the Thomson-Houston Electric Company; the applications were filed Aug. 12, 1887, and June 18, 1888, and both patents granted April 11, 1893, the patent numbers being 495,443 and 495,383 respectively.

In detail, the claims allowed cover, first, the underneath contact made either by a rolling wheel or sliding spoon contact pieces (sic); secondly, the converse of these two cases; and thirdly, the reversibility of the trolley pole on top of the car, enabling the contact to be made on either side of the trolley, as the case may be.

The possession of this patent practically means, it is claimed by the interested parties, the entire control of the overhead system throughout the United States. The acknowledgment of the claims under this patent granted to the dead inventor made by the Patent Office is claimed as an important victory by the General Electric Company and may develop another *cause celebre* in patent litigation.

It seems that the *Electrical World's* foresight is better than its hindsight (an unusual thing), for it saw two years ago that the awarding of these patents was likely to develop another *cause celebre*, but now that that *cause celebre* has developed it can't see it at all. Here is another evidence of the decadence of the *World*. It had energy enough two years ago to print something although what it did print was wrong. It now hasn't energy enough to print anything—not even to correct the mistakes of two years ago. It stated that the two applications referred to were filed Aug. 12, 1887, and June 18, 1888, whereas in fact the first one was signed and sworn to on Jan. 17, 1887, and filed in the Patent Office March 12, 1887.

What a great and enterprising sheet the *Electrical World* is in these days! What would it do with its dead if it weren't for its Digest?

* * *

ACCORDING to Henry Villard's plan for reorganizing the Milwaukee street railways, there are to be $7,000,000 5 per cent. mortgage bonds, $8,500,000 guaranteed 5 per cent. stock and $3,500,000 common stock. Of the bonds $1,500,000 is to be used for betterments and the remainder to be distributed pro rata to present holders of bonds.

WHAT DOES IT MEAN?

This is Too Much Land for an Instrument Factory.

(From the Newark Sunday Call.)

The Weston Electric Instrument Company, of which Prof. Edward Weston is the presiding genius, has found its quarters too contracted in the building at the corner of William and Shipman streets, and has arranged for an extensive plant at Waverly. The company has purchased about forty-eight acres of land on both sides of Frelinghuysen avenue for the purpose, the last purchase of a little more than twenty-three acres being concluded last week with William R. Ward, executor of the Meeker estate, which lies on the west side of Frelinghuysen avenue north of the road to the gates of the Fair Ground, and runs back into the cove. This will be opened up in building plots for employees of the works, and the property will be rented or sold upon easy payments to the employees of the company. About 100 cottages will be built upon this tract by the company.

The actual work of building can hardly be started until early in September, as the plans are not yet made. The buildings upon the factory tract will all be constructed of steel and brick, with a view to making them as fire-proof as possible. A spur will be run into the yard from the Pennsylvania Railroad when the plant is completed, and the company will thus have every facility for getting stock and fuel and for shipping its products. At the same time it will have the advantage of the proximity of the Lehigh Valley road on the west and the trolley line on Frelinghuysen avenue.

* * *

Louisiana Electric Light Co. in Trouble.

The United Electric Securities Co. has applied for a receiver at New Orleans for the Louisiana Electric Light Co. Of the latter company's securities, the Securities Company has $435,000 bonds and $212,500 stock.

* * *

WE welcome Dr. J. Allan Hornsby to the field of electrical journalism and expect to have considerable fun with him. To be consistent he will need to give his hearty support to all the electro-medical frauds which bought their way into the Electrical Building at the Fair; for Dr. Hornsby is well remembered as their ardent supporter.

* * *

ARGUMENTS in the T.-H. regulator patent suit have been concluded in Chicago. This is before the United States Circuit Court of Appeals.

* * *

IT is stated that the low prices at which G. E. 800 motors have been offered lately, $550 per complete car equipment, is due to the fact that the company are anxious to work off a large accumulated stock before putting out a new and improved motor.

* * *

G. E. Removal Talk.

(From the Evening Advertiser.)

Advices from Schenectady are to the effect that the reports of a probable removal of General Electric's works from that city are the outgrowth of efforts on the part of the company to get donations of certain lands in Schenectady which it needs at present and cannot get otherwise.

* * *

IF the creditors of the Electric Construction and Supply Co. are wise men, they will get together and find out just how much of the property and accounts transferred to Mr. F. R. Upton can be recovered.

* * *

Quite True.

(From Chambers's Journal.)

The promised applications of ELECTRICITY are almost innumerable.

* * *

This Was Not a Gas Engine Man.

The *Railway Review* prints the following: "I had occasion recently, says J. Allen in *Dixie*, to call upon a manufacturer in regard to the securing of some information relative to a certain machine that he is making. It was a gratification and somewhat of a surprise to find that he seemed more than willing to enter into all of the details of his wrinkles and arrangements and show everything that he had about the premises.

It was an experience so different from that which one is so apt to meet with that I was more than gratified and perhaps looked it. At any rate, in the course of conversation, the proprietor remarked that it was his habit to throw everything that he had open to everybody, competitors included, and court the widest publicity; he said that he lived in an atmosphere of patents, every new device that he produced was patented, and he regarded this as far better security than secrecy. Even when experimenting with a new device before the patents were applied for, he makes no concealment of what is going on, so that, in case of an interference, he will have ample proof of priority if he really is entitled to it, and if he is not entitled to it he says that he does not want it. It is one of the best practical exemplifications of what I have always advocated : that there are only two ways of preserving inviolate the rights in new ideas; one is to maintain an absolute secrecy, which is an absolute impossibility if any goods are sold, and the other is in courting such publicity that everyone shall know that the goods are yours and no one will dare to infringe. It is, however, a hard doctrine to inculcate, for the old idea of burying the head in the sand and fancying that no one sees has a strong hold and is not easily eradicated."

The Periodic Law of the Chemical Elements.

As the law of periodicity of the elements has been specially noticeable of late in connection with argon, it may be of interest to mention three new points of discovery in 1894 by which the probability of this law has become strengthened. The points are referred to in an article on "Progress in Physical Chemistry During 1894," by J. W. Rodgers, in *Science Progress* for the current month. (1) Töpler has found that the volume-change observed when a metal melts is a periodic function of the atomic weight; (2) Bailey has discovered that in an *even* series of elements the temperature of decomposition of an oxide is higher the higher the atomic weight, in *odd* series the reverse rule holds; and (3) Deeley observed that if the density of an oxide is divided by the atomic weight of the contained metal the quotient is a periodic function of the atomic weight. It is interesting to observe the steadiness with which the pile of evidence in support of one of nature's most beautiful laws grows higher and higher every year.

The Electrostatic Capacity of Coils.

A suggestive little paper was recently communicated by J. Cauro to the Paris Academy of Science on the subject of the electrostatic capacity of coils. As is well known, coils that are double wound may be regarded as possessing a capacity which increases rapidly with the resistance, but as having a self-induction which is small enough to be negligible. In the ordinary method of estimating self-induction, the algebraic sum of the self-induction and the capacity is ascertained, and since capacity is equivalent to a negative self-induction, the result of such a measurement may be either positive or negative. If positive the algebraic sum may be made equal to zero by the introduction of a sufficient amount of paraffin so as to increase its capacity; if negative the self-induction may be increased by the introduction of a suitable soft iron core. The capacity may be considerable, and must be eliminated whenever the elimination of self-induction is considered necessary. Cauro relates that in his attempts to reduce the combined effect of self-induction and capacity in resistance coils, he has obtained excellent results by starting the winding of alternate layers of wire from the same end of the bobbin. For further details the original paper may be consulted, *q. v.*, *Comptes Rendus*, CXX (1895), p. 308.

THOMSON-HOUSTON FINANCIERING METHODS.

THE G. E. COMPANY, C. A. COFFIN AND PAUL SCHULZE CHARGED WITH GROSS FRAUD.

P. D. and J. O. Armour Seek to Establish Their Rights as Stockholders.

THE TACOMA ENTERPRISE AND ITS MORAL.

The following has appeared in slightly varying form in the daily press throughout the country:

Tacoma, Wash.—In attempting to foreclose the $1,350,000 mortgage against the Tacoma Railway and Motor Company the New York Guaranty and Indemnity Company has encountered the Armours of Chicago—P. D., jr., and J. O.—who have set out to compel a compromise or to show up the alleged street railway wrecking methods of the General Electric Company.

The Armours became interested in the local street railway company several years ago when it had $750,000 in capital stock. On this Paul Schulze, the president, issued $1,500,000 in bonds and disposed of $1,350,000 through the New York Guaranty and Indemnity Company. The Armours are innocent stockholders, and claim that the bond issue was excessive and unwarranted. In placing these bonds, it is alleged, Schulze made use of a dummy syndicate. Another feature of the deal was the purchasing of a suburban railway for $350,000 when it was valued at only $60,000, besides turning over to the seller a bonus of $141,000. All this, the Armour stockholders assert, was done in collusion and with a view to permitting the General Electric Company to wreck the local street railways.

It is evident that the Armours have not got a clear understanding of the situation, and with a view to assisting them and the public generally to properly appreciate the Coffinesque system of financiering electrical properties, ELECTRICITY will explain the case more fully, as the Tacoma deal was only typical of dozens of others. The primary object of the T.-H. people was not to wreck a railroad, but to GET BONDS and sell them—no matter what kind of bonds.

Turning to our card index of General Electric information, we find under the letter T a large mass of data in regard to this Tacoma enterprise some of which is embodied herein.

The Tacoma Railway and Motor Company was incorporated in 1889, and was partially equipped with Sprague apparatus. The town had in 1890 36,000 inhabitants. In 1892 the railway had issued $750,000 each of stock and bonds.

The Thomson-Houston Company had a road in the same town, the Tacoma and Steilacoom Electric Road. In line with Mr. Coffin's policy of consolidation and more bonds, these two properties were brought together almost immediately upon the formation of the G. E. Company, which was on June 1, 1892.

It was in connection with this deal that the Armours claim they were swindled, and we guess they were.

The chief swindle, however, was perpetrated upon the small investors of New England who bought series 7, 8 and 9 of the bonds of the United Securities Company, each of which had for a part of its basis $200,000 of the bonds of the Tacoma Railway and Motor Company.

The T.-H. road from the outskirts of Tacoma to the fishing hamlet of Steilacoom never had any legitimate reason for being built. It was a T.-H. deal from the start, local capitalists not being willing to touch it. It was built beyond question for just the purpose it was subsequently used for—a plain swindle. Steilacoom had a population of 500; it was eleven miles from Tacoma, with no intervening towns of any size. No sane and *honest* man would have put one dollar into it, yet by Coffinesque management it yielded a good profit to the T.-H. Company and no doubt a large rake-off to Mr. Coffin and his associate, Paul Schulze, who has since been driven by his many crimes to commit suicide.

When the consolidation deal was first talked of the Tacoma Railway and Motor Company was not in good condition. It was already over-capitalized and was not able to pay its debts. The Steilacoom road was also in bad shape. The purchase of the latter by the former offered no possible chance for improving the condition of either property. The only hope it offered was for a bond swindle, which was the sole stock in trade of Mr. C. A. Coffin. No other plan of financiering was ever known to him. Accordingly he arranged matters through Mr. H. M. Byllesby, then in charge of the Northwest G.-E. Company, and Paul Schulze.

It was not deemed wise in the beginning for

1.—TACOMA RAILWAY AND MOTOR COMPANY—JUNE 1, 1892.

ASSETS.

Stock of Tacoma Street Railway Company (1889)			$250,000.00
Franchises			125,000.00
Construction and equipment			870,191.87
Notes receivable			977.00
Accounts receivable			2,719 14
Material on hand			6,282.56
			$1,255,170.07

LIABILITIES.

Capital stock			$500,000.00
Bonds (issued)	$750,000,00		
Not certified	18,000.00		
		$737,000.00	
Placed as collateral, not sold		612,000.00	
Bonds sold			$125,000.00
Accounts payable			25,005.52
Due Edison General Electric Company, open account			1,098.43
Due Northern Pacific Railroad Company, freight			14,287.84
Due Henry Villard			106,556.09
Interest due on same to date, not paid		$5,159.25	
Due Paul Schulze			29,708.98
Interest on same to date, not paid		562.90	
Notes payable			410,841.61
Interest on same to date, not paid		12,326.00	
Interest on coupons due October 1, 1891, not paid		600.00	
Interest on coupons due April 1, 1892, not paid		1,800.00	
Total interest accrued, not paid			20,447.45
Cash overdraft Bank of B. C			3,450.41
Surplus, per books, April 1, 1891		$51,355.12	
Gain from operations, April 1, 1891, to April 1, 1892	$39,595.25		
Gain from subsidies, April 1, 1891, to April 1, 1892	2,805.00		
Gain from operations, April 1, 1892, to June 1, 1892	7,039.08		
		49,439.33	
		$100,794.45	
Deduct interest paid April 4, 1891, to April 4, 1892	$51,441.76		
" " " April 1, 1892, to June 1, 1892	4,199.23		
" " accrued (above)	20,447.45		
	$75,087,44		
Unusual expenses paid but not deducted in operations	$6,933.27		
Surplus, June 1, 1892		82,020.71	18,773.74
			$1,255,170.07

the T.-H. people to appear openly, so it was represented by Mr. Schulze to his people at Tacoma that he was trading with an Eastern syndicate who would take over a new and increased issue of bonds. The proposed purchase of the Steilacoom road was kept a secret between Coffin, Byllesby and Schulze. The bonds were issued and $1,250,000 of them were sold, $250,000 remaining in the treasury to provide for future "betterments." The "syndicate" took $910,000 at 80. These bonds with later additions to the G.-E. holdings are now held as follows:

G. E. Company	$800,000
United Electric Securities Company (Series 7)	200,000
" " " " " 8)	200,000
" " " " " 9)	200,000
Street Railway and Ill. Properties	200,000

The purchase price of the Steilacoom road was then fixed at $350,000, with a bonus to the seller of $141,060. The property was worthless as a matter of fact, though the Armours admit it might have been worth $60,000. As a part of the bargain the T.-H. people agreed to newly equip their system, though this clause in the contract, it is claimed, was subsequently cancelled by Schulze and Byllesby in collusion. Schulze also turned over to the Northwest Company $100,000 in bonds for new apparatus which was never delivered.

The Armours claim that in the deal with the T.-H. Company with the $910,000 of bonds sold at 80 went a bonus of $910,000 of stock; also that in pursuance of Schulze's agreement with Byllesby a fictitious stock issue of $141,000 was made and for this stock and $1,250,000 of bonds the company received in money and property only the sum of $800,000. The debt created, it is alleged, exceeded the indebtedness permitted by the company's by-laws by $800,000 or over, and it is declared the whole transaction is a fraud against the State constitution and laws. All this, it is alleged, was done collusively with the Thomson-Houston Company by hoodwinking the motor company's stockholders, the entire frauds aggregating $746,000.

We present herewith a statement of assets and liabilities taken from the records of the Tacoma Railway and Motor Co., showing clearly the situation of that company on June 1, 1892; it was already hopelessly entangled—over-capitalized and in debt. It was in no shape to justify the purchase of any additional property. These facts were ignored by Coffin, Byllesby and Schulze, who saw in the situation an opportunity for the application of their favorite plan, and although the enterprise had been unable to pay interest on borrowed money, freight charges, even wages, it was rehabilitated, saddled with $750,000 more debts, and the securities floated in the Boston market.

This statement was the one on which the bonds were floated through the New York Guaranty and Indemnity Co. Its padding is too evident to admit of dispute. The franchise account of $125,000 had no value unless the company could make money. The item of $250,000 in stock of the Tacoma Street Railway Company should have been wiped out—that road was now a part of the Tacoma Railway and Motor Company, and all it had of value was already in the franchise or construction and equipment account. This financial statement, however, speaks so clearly of bankruptcy that it needs no analysis. We also present from the original, signed "G. W. Bird, Auditor," the statement of earnings and operating expenses for the quarter ending October 31, 1892—the first three months of the consolidation. This table is eminently worthy of analysis by those who want to know just what kind of property Mr. Coffin thought would stand a total capitalization of $2,500,000.

The statement is a decidedly unfavorable one on its face; but we are advised that the gross

BOND AGREEMENT—(FAC-SIMILE).

This Indenture, Made this first day of July, A. D. 1892, by and between the TACOMA RAILWAY AND MOTOR COMPANY, a corporation duly organized under the laws of the State of Washington, and having its principal office in the City of Tacoma, in the County of Pierce and State aforesaid, (said company being hereinafter called the Railway Company,) party of the first part, and the NEW YORK GUARANTY AND INDEMNITY COMPANY, a corporation duly established under the laws of the State of New York, and having its principal place of business in the City of New York, in the last named State, (said company being hereinafter called the Trustee,) party of the second part, WITNESSETH, that

WHEREAS, at an adjourned annual meeting of the stockholders of the Railway Company, duly called, and held on the twenty-seventh day of June, 1892, the following vote was duly adopted:—

WHEREAS, The Tacoma Railway and Motor Company is largely indebted for extensions and additions made to its property, said indebtedness having been contracted for purposes necessary for the transaction of its business; and

WHEREAS, It is desirable to retire the present issue of bonds secured by a first mortgage covering the property of said company; and

WHEREAS, It is desirable to provide for future additions and extensions to said property, and pursuant to the lawful purposes of its incorporation;

NOW, THEREFORE, BE IT RESOLVED, That the Trustees of this Company be, and they are hereby authorized to make and issue, in the name of this Company and by its proper officers, first mortgage coupon bonds for one thousand dollars ($1,000) each, to the amount of one million five hundred thousand dollars ($1,500,000), payable thirty years from their date (subject, however, to call at $1040 each and accrued interest, at or after five years from their date and before maturity,) with interest at the rate of six per cent per annum, payable semi-annually, said bonds to be of such form as the Trustees may deem best. Twelve hundred and fifty of said bonds, of the par value of one million two hundred and fifty thousand dollars ($1,250,000) are to be certified and delivered by the Trustee forthwith, upon the order of the President and Treasurer of the Tacoma Railway and Motor Company, and the President of the Northwest General Electric Company of St. Paul. Two hundred and fifty of said bonds, of the par value of two hundred and fifty thousand dollars ($250,000), to be issued only for future additions and extensions to the property of this Company, real or personal, or for paving, and under such terms and conditions as said Trustees may make. And to secure the payment of the principal and interest of said bonds the Trustees are hereby authorized to execute and deliver to the New York Guaranty and Indemnity Company, as Trustee for the bondholders, in the name and behalf of this Company and by its proper officers, a mortgage or deed of trust constituting a first lien on all the property, assets and franchises of the Company, both present and future acquired, and said deed of trust shall contain such terms and conditions as may be agreed upon by the Trustees and said Trustee for the bondholders, including a provision for the retiring of a certain number of bonds before maturity.

AND WHEREAS, The Trustees of the Railway Company did thereafter, on the twenty-seventh day of June, 1892, at a meeting duly called and notified, a quorum being present and participating, examine and approve this Indenture in the terms in which the same is now written, and did by vote, under the power conferred upon them by said resolution of the stockholders of the Company, as well as by virtue of every other power enabling the Trustees so to do, authorize and direct the execution of said Indenture by the President and Secretary of the Company, and the acknowledgment and delivery thereof by said officers, or by either of them alone, and did also examine and approve the said bonds and coupons, in substance as herein set forth, and did, by vote, authorize and direct the execution thereof and the delivery of the same to the Trustee for certification and issue;

AND WHEREAS, Said bonds, with interest coupons attached, have been executed and are now ready to be authenticated by the Trustee and issued as authorized and directed as aforesaid, said bonds being consecutively numbered from 1 to 1500 inclusive, and the coupons attached to each of said bonds bearing the number of the bond to which they are attached, and being also consecutively numbered from 1 to 60 inclusive, which bonds and coupons, and the Trustee's certificate endorsed upon said bonds, are substantially in the following form, to-wit:

UNITED STATES OF AMERICA.

No........ FIRST MORTGAGE 6/100 BOND $1000.

OF THE

TACOMA RAILWAY AND MOTOR COMPANY,

OF TACOMA, WASHINGTON.

ORGANIZED UNDER THE LAWS OF THE STATE OF WASHINGTON.

Sinking Fund. TOTAL AUTHORIZED ISSUE, $1,500,000. Gold Bond.

For value received, the Tacoma Railway and Motor Company promises to pay to the New York Guaranty and Indemnity Company, Trustee hereinafter mentioned, or to the bearer hereof, or, in case of registration, to the registered holder, the sum of one thousand dollars, in gold coin of the United States, equal in weight and fineness to the present standard, at the office of said New York Guaranty and Indemnity Company, in the City of New York, N. Y., in thirty years from the date hereof, to-wit, on the first day of July, A. D. 1922, (or on call at or at any time after the expiration of five years from date as hereinafter provided,) with interest thereon at the rate of six per cent per annum, payable semi-annually in like gold coin on the first days of January and July in each year, at the office of said New York Guaranty and Indemnity Company in said New York, according to the tenor of the coupons hereto attached, upon the presentation and surrender of said coupons respectively.

This bond is one of a series of one thousand five hundred bonds for one thousand dollars each, amounting in the aggregate to one million five hundred thousand dollars, numbered consecutively from 1 to 1500, both inclusive, all bearing even date herewith, and being of the same tenor and for the same term of thirty years, executed and delivered in pursuance of a vote of the stockholders and a vote of the Board of Trustees of said Tacoma Railway and Motor Company, authorizing the issue of said bonds and the execution and delivery of the mortgage hereinafter mentioned.

Payment of this bond and of the coupons attached is secured in the manner and upon the terms therein stated, by a first mortgage upon all the property, assets and franchises (both present and future acquired) of said Tacoma Railway and Motor Company, bearing even date herewith, executed and delivered by it in pursuance of said votes of the stockholders and of the Board of Trustees, to said New York Guaranty and Indemnity Company, as Trustee for the bondholders, which mortgage has been duly filed and recorded both as a chattel mortgage and real estate mortgage, in the office of the County Auditor of the County of Pierce in the State of Washington. Said mortgage is hereby referred to, and the terms thereof made a part of this bond.

This bond may, at the option of the obligor, be redeemed at or after the expiration of five years from the date hereof, and before maturity, by payment of one thousand and forty dollars ($1040), together with all interest accrued to the time of such payment and unpaid, due notice of the call therefor having first been given by publication as required by the terms of said mortgage.

This bond may be registered at the option of the holder, on the books of the said Railway and Motor Company, kept at the office of the Trustee, such registration to be noted thereon. If registered, it shall pass only by transfer on the books of the Company, noted also on this bond; but it may be discharged from registration by being so transferred to bearer, after which it shall pass by delivery until again registered. The coupons shall in all cases be negotiable by delivery whether the bond itself be registered or not.

This bond shall not be valid until the certificate indorsed hereon shall have been signed by the Trustee.

IN TESTIMONY WHEREOF, Said Tacoma Railway and Motor Company has caused its corporate seal to be hereto affixed, and these presents to be signed in its name and behalf by its President, and attested by its Secretary, and the coupons attached to be authenticated by a fac-simile of the signature of its Treasurer, this first day of July, A. D. 1892.

TACOMA RAILWAY AND MOTOR COMPANY,

[SEAL.] ....*President.*

Attest:

..................................*Secretary.*

$30. COUPON. $30.

The Tacoma Railway and Motor Company promises to pay to bearer thirty dollars at the New York Guaranty and Indemnity Company, in the City of New York, N.Y., January 1st, 1893, being six months' interest then due on bond No. 000, dated July 1st, 1892, in United States gold coin, equal in weight and fineness to the standard at the date thereof, unless said bond shall be previously redeemed as provided therein.

..................................*Treasurer.*

[NOTE.—The provision "unless said bond shall be previously redeemed as provided therein" is not contained in the first ten coupons.]

TRUSTEE'S CERTIFICATE.

The undersigned Trustee, named in the within bond and in the mortgage therein referred to, certifies that this bond is one of the series of fifteen hundred bonds specified in said mortgage as thereby secured.

NEW YORK GUARANTY AND INDEMNITY COMPANY,
Trustee.
By..................................*President.*

FORM OF REGISTRATION.

No writing below except by an officer of the New York Guaranty and Indemnity Company.

Date of Registry.	Owner's Name and Address.	Registrar.

(2)

earnings were padded to an astonishing degree, and that honest bookkeeping would have shown a loss every month. However that may be, the figures as they stand show that the property was in no condition to warrant any financiering scheme except the confession of bankruptcy and reorganization on different lines. The net earnings claimed for the best four months in the year were barely sufficient to pay the interest on the bonds without setting anything aside for depreciation. For the other eight months the showing must have been much worse, and if the Armours go deep enough into the facts they will probably learn that the whole system never earned one dollar of honest profits to apply upon interest, and that the accounts were manipulated to present an entirely false showing. Interest on the bonds was $90,000 per annum, and net earnings claimed were, on the basis of the best four months in the year, just about the same.

The entire history of this Tacoma Railway after the Edison and T.-H. companies appeared as factors is one of dishonor and disgrace. It is deemed worthy of all the space we give up to it this week because it is typical of those very methods which have brought the electrical industry and electrical securities into deserved disrepute, against which ELECTRICITY has directed its attack, and to abolish which we shall continue to wage relentless warfare.

This history embodies the two main features of the evil policy of the parent companies—the sale of worthless apparatus and the swindling financiering schemes.

The horse railroads of Tacoma were capitalized at $250,000 When the Edison General Company, through Mr. O. Z. Mitchell, had equipped it electrically it was capitalized at $1,500.000. It

2—*Tacoma Railway and Motor Company.*

STATEMENT OF EARNINGS AND OPERATING EXPENSES OF ELECTRIC AND CABLE LINES.

Month ending October 31, 1892.

Lines.	July.	Aug.	Sept.	Oct.
Cable mileage	1.64	1.64	1.64	1.64
Miles run by cable	13,582	12,884	12,997	13,179
Average No. of cable cars run	125	124	120	124
Electric mileage	21.82	34.88	34.88	34.88
Miles run by electric.	59,882	80,620	78,144	70,985
Average No. of electric cars run	597	672	652	614
Passengers carried for revenue	360,739	371,455	426,400	326,743
Total passengers carried	367,328	379,221	435,446	332,727
EARNINGS.				
Car receipts	$17,997.20	$18,509.22	$21,320.01	$16,337.15
Ticket sales	39.75	63.50	106.00	145.00
Advertising	160.00	41.25	106.25	116.25
Hospital dues	68.00	78.00	74.50	72.00
Miscellaneous	215.34	22 25	276.12	408.39
Power receipts	1,038.50	1,496.00	1,536.50	1,393.50
Earnings per car-mile	24	20	23	19
Total earnings	19,518.79	20,210.22	23,419.38	18,472.29

SUMMARY OF CAR RECEIPTS.

	July.	Aug.	Sept.	Oct.
North Tacoma	3,916.60	3,543.95	5,921.35	3,133.10
Pacific Avenue	4,450.30	4,219.35	4,504.15	3,910.50
Jefferson Avenue	1,667.85	1,295.17	1,290.11	1,156.25
Sixth Avenue	2,122.30	2,067.80	1,833.75	1,638.20
Tacoma Avenue	362.65	452.05	1,114.35	543.00
K Street	914.00	948.00	1,061.90	895.00
Cable	4,568.50	4,449.50	4,457.20	4,051.90
Steilacoom Line		961.30	722.05	561.65
Eleventh Street		572.10	415.15	446.75
Total car earnings	17,997.20	18,509.22	21,320.01	16,337.15
OPERATING EXPENSES.				
Gen'l miscellaneous.	1,751.60	1,480.93	1.591.27	1,384.85
Car service	5,568.64	6,249.48	6,621.66	6,270.65
Car house expense	221.40	288.58	274.57	315.05
Motive power	1,790.64	2,425.14	2,543.06	2,024.00
Maintenance of rolling stock	1,728.68	1,688,32	1,368.45	1,136.45
Maintenance of power plant	619.98	481.29	463.44	608.74
Maintenance of track and buildings	263.50	507.49	658.47	567.54
Maintenance of overhead system	70.50	142.10	189.79	131.91
Total oper'g expenses	12.014.94	13,208.23	13,630,71	12.434 19
Per cent. of earnings.	66 p c.	65 p c.	58 p c.	76 p c.
Cost per car-mile	16	14	15	15
Net earnings	7,503.85	7,001.99	9,788.67	6,038.10
Net earnings 1891	6,300.20	6,107,56	5,497,89	4,506,50
Increase	1,203.65	894.43	4,290.78	1,531.60

NOW, THEREFORE, THIS INSTRUMENT WITNESSETH, That the said Railway Company, in consideration of the premises, and of one dollar to it in hand paid by the Trustee, the receipt whereof is hereby acknowledged, and in order to secure the payment of the principal and interest of the bonds aforesaid, and every part thereof, as the same shall be and become payable according to the tenor of said bonds and of the coupons thereto attached, has granted, bargained, sold, conveyed, transferred, assigned and mortgaged, and by these presents does grant, bargain, sell, convey, transfer, assign and mortgage unto the said party of the second part, as Trustee, and its successor or successors in the trust, all the property of said Railway Company, real, personal and mixed, and also and including all tenements and hereditaments acquired or appropriated, or which may be hereafter acquired or appropriated for the purpose of the rights of way of the lines of railway of said Railway Company, or any of them, and all the easements, appendages and appurtenances thereunto belonging or in anywise appertaining, and all the railways, ways and rights of way, buildings, tracks, viaducts, culverts, stations, water tanks, turn tables, fences, and other superstructures, erections and fixtures, whether now held and owned or hereafter acquired and owned by the Railway Company; and also all machinery, locomotive engines, stationary engines, boilers, steam motors, dynamo electric machines, generators, electric motors and other electrical apparatus and appliances, rolling stock, cars, poles, lines, wires, tools, horses, cables, fastenings, rails, ties, switches, supplies and material of every description, and all other property, personal and mixed, of whatever description and wherever situated, together with all and singular the privileges and appurtenances thereto belonging, and whether now held or hereafter acquired by it; all things in action, contracts, claims and demands of the said Railway Company, whether now owned or hereafter acquired, as well in law as in equity, together with all the rents, issues, profits, income, privileges and franchises growing out of or appertaining to said property; and with full power on the part of the Trustee (so far as it lawfully may) to succeed to and enjoy all the rights, privileges, immunities and franchises, corporate or otherwise, of said Railway Company, also all the right, title and interest of the said Railway Company by deed, lease or otherwise, in and to the following described real estate:

All those certain lots, pieces or parcels of land, situate in the City of Tacoma, in the County of Pierce, and in the State of Washington, and bounded and particularly described as follows, to-wit:

Commencing at a point where the northerly line of South Thirteenth street terminates, seven and fifty-four hundredths (7.54) feet easterly from the northeasterly corner of South Thirteenth and "A" streets, which said point is also the southeasterly corner of Block No. twelve hundred and one (1201) according to the plat of New Tacoma, recorded the third day of February, 1875; thence from said point north eighty-one degrees thirty-two minutes east eighty-one and seventy-five hundredths (81.75) feet to within one hundred and four and nine-tenths (104.9) feet of the westerly line of the Northern Pacific Railway Company's right of way; thence south three degrees twenty-six minutes west two hundred eighty-seven and five-tenths (287.5) feet; thence south eighty-one degrees thirty-two minutes west twenty-nine and ninety-five hundredths (29.95) feet to the easterly line of "A" street; thence north eight degrees twenty-eight minutes west along said easterly line of "A" street two hundred forty-six and eighty-one hundredths (246.81) feet; thence north three degrees twenty-five minutes eighteen seconds east (along the easterly boundary line of South Thirteenth street) thirty-six and sixty-two hundredths (36.62) feet, to place of beginning.

Also all of lots one (1), two (2), three (3), four (4) and five (5) in Block one (1) of Ridgedale Addition to the City of Tacoma, said Ridgedale Addition to the City of Tacoma being situated in Section one (1) Township twenty (20) north of Range two (2) east of the Willamette Meridian (reference being had herein to the recorded and established map or plat of said Ridgedale Addition).

Also the right, title and interest of said Railway Company, by deed, lease or otherwise, in any other real estate in the City of Tacoma or elsewhere, which said Railway Company may own (now or hereafter) or have an interest in.

Together with all and singular the tenements, hereditaments and appurtenances thereunto belonging or in anywise appertaining, and the reversion and reversions, remainder and remainders, and rents issued and profits thereof.

TO HAVE AND TO HOLD the above described property, rights, franchises and privileges unto the said party of the second part, Trustee as aforesaid, its successor and successors in said trust, and their assigns; IN TRUST HOWEVER, under the terms hereof, for the equal pro rata benefit and security of the person or persons, firm or firms, and corporation or corporations which shall become and be the lawful owners of the said bonds and coupons, without any preference of one bond over another by reason of priority of issue or of any act or thing whatsoever. For the further carrying into effect of this conveyance, the Railway Company hereby appoints the Trustee and its successors in the trust, the attorneys of the Railway Company, in its name and behalf to ask, demand and receive for the Railway Company payment and delivery of any and all sums of money, notes, chattels and effects assigned and transferred to the Trustee by this Indenture, or intended so to be, and to give effectual releases and discharges in the name of the Railway Company to the party or parties making such payment or delivery; and for any or all of the purposes aforesaid or of this instrument, the Trustee may appoint an attorney or attorneys, agent or agents, may from time to time revoke such appointment, may use the name of the Railway Company, and generally act in relation to the premises as it or they shall think best.

ARTICLE 1. Provided, however, that until default shall be made in the payment of the principal or interest of said bonds to be issued hereunder, or some of them, or in the performance by the Railway Company of any of the covenants of the said bonds or coupons or of this Indenture, the Railway Company shall possess, operate, maintain, and enjoy all the franchises, rights and property of every kind conveyed by this Deed of Trust, and every part thereof, with the appurtenances, and take and use the tolls, income, rents, issues and profits thereof, in the same manner and with the same effect as if this deed had not been made.

ARTICLE 2. And if the Railway Company shall well and truly pay the principal of said bonds, and every one of them, and all interest thereon, when the same shall become due and payable, according to the meaning of these presents and of said bonds and coupons, and shall well and truly perform and keep each and all other its covenants, promises and agreements herein contained, then and thereupon all the estate, right, title and interest of the said Trustee and its successor and successors in the trust hereby created, shall cease and determine; otherwise this instrument shall remain in full force and effect.

ARTICLE 3. But if any default shall be made by the Railway Company in the payment of the interest on said bonds or any of them, or any part thereof, or in the payment of the principal sum of said bonds, or any of them, or any part thereof, when the same shall become due according to the tenor of said bonds and coupons and of this Indenture, or if the Railway Company shall fail to make the yearly payments required by Article 13 of this Indenture, or any of them, or if the Railway Company shall fail faithfully to observe and perform any of the requirements made of it by said bonds and coupons or by this Indenture, and such default or failure shall continue for the space of thirty days after written notice thereof has been given by the Trustee to the Railway Company, then and thereupon it shall be lawful for, but not obligatory upon, the said Trustee to terminate and put an end to the possession of said premises by the Railway Company, and to take possession of, operate and enjoy the said property hereinbefore described, and the rents, issues and profits thereof, for the benefit of the bondholders, in which case the Trustee shall be entitled to the appointment of a Receiver, having such powers and duties and acting under such limitations as the court making the appointment shall confer and impose; and the Trustee may also, or instead of so doing, and with or without taking possession, treat the whole amount of the principal of said bonds, together with all accrued and unpaid interest, as immediately due and payable, and thereupon proceed to sell and dispose of, by one sale, or successively through several sales, all and singular the premises, property, rights, interests, franchises, bonds and stocks hereby conveyed and mortgaged, or intended so to be, or such portion thereof as the Trustee may deem necessary, at public auction in said City of Tacoma, upon such terms as to credits, partial credits and security for payment as it may think proper or expedient, having first given public notice of the time and place of the sale or sales by advertisement printed once a week for at least six successive weeks in some newspaper printed and published in said City of Tacoma, and also twice a week for the said six weeks in some daily newspaper printed and published in said City of New York; and no other notice or demand whatsoever to or upon the Railway Company, except the said thirty days' written notice prior to the commencement of foreclosure proceedings, shall be necessary. The Trustee shall have the right to adjourn such sale or sales from time to time in its discretion, giving reasonable notice of each adjournment; and, after so adjourning, to make the sale at the time and place to which the same may be adjourned. The Trustee is hereby further authorized and empowered, either in its own name or in the name of the Railway Company, to make, execute, acknowledge and deliver to the purchaser or purchasers at such sales, good and sufficient deeds of conveyance of the property so sold; and any sale made as aforesaid shall be a perpetual bar, both in law and equity, against the Railway Company, and all persons claiming by, through or under it, from claiming the property, rights, interests or franchises, so sold, or any interest therein. And for the purpose aforesaid, the Trustee, and each of its successors in the trust, are hereby constituted irrevocably the attorneys of the Railway Company. As affecting the title to any property purchased at any such sale, the facts set forth in any affidavit, made by the President or Vice-President of the Trustee and appended to the deed of conveyance, relating to the time and manner of giving such written notice, or to the time and manner of giving notice of the sale, shall not be open to contradiction or dispute by any party or parties, but the same shall conclusively be deemed to be true.

Out of the proceeds arising from such sale or sales, the Trustee shall first defray the expenses thereof (including its just and lawful charges for services and expenses, and reasonable allowance for attorney and counsel fees), and refund any advances or expenses reasonably made or incurred by it in operating, maintaining or managing the property or business of the Railway Company while in possession, and all payments made for taxes, assessments, insurance and other proper charges upon said premises and property. The balance of said proceeds shall be applied and paid as follows, viz.:

If the said balance shall not exceed the aggregate par value of all the bonds hereby secured, which may at the time be issued and outstanding, then the money shall all be applied in payment, or partial payment, as the case may be, of the principal of said bonds, the several bondholders to receive the net proceeds in proportion to the amount of bonds held by them respectively, and in the contingency herein provided for, after foreclosure, all coupons shall be wholly excluded from sharing in the distribution of said balance of proceeds. If, on the other hand, the balance of proceeds available for distribution shall exceed the aggregate par value of the bonds at the time issued and outstanding, then the money shall be applied first in payment of the principal of the bonds, and next in the payment had on January 1, 1892, thirty-seven miles of track, two of which were cable. At the then prices of apparatus, its outfit should have cost about $780,000, and with the traffic in sight it would have done fairly well on a legitimate capitalization of $800,000. But that prince of wreckers, Mr. Henry Villard, was interested, and pursued his usual policy, engineering the capitalization of $1,500,000 through his agent Schulze.

When Mr. Coffin came to the front he stepped in where Mr. Villard had quit. The king of robbers followed the prince and raised upon an already bankrupt property $750,000 more of money.

From the figures herewith submitted it is easily apparent that the property, earning capacity, or condition of the Tacoma Railway and Motor Company did not justify any increase of bonded debt. We have charged that the Steilacoom road, for the absorption of which Mr. Coffin planned the consolidation, had even less value.

No further proof of our charge is necessary than Mr. Bird's own figures in statement No. 2. This road was acquired at a total cost of $491,000 in 6 per cent. bonds. The interest on this sum would have been $29,460 annually. The total gross earnings for the first three months after the consolidation, the best months of the year, were $2,245 or at the rate of $8,980 per annum. Operating expenses or net earnings are not given on this branch, and they don't need to be.

The total gross earnings were less than one-third of the interest on the purchase price.

Enough has been said, we think, to show just what the essence of this entire deal at Tacoma was. The failure of the Tacoma Railway and Motor Company was not an accident. It was the result of a carefully planned swindle, born under the regime of Henry Villard in the Edison General Electric, and all but dead when he retired; revivified in the brain of Charles A. Coffin, given new life, and carried out by the carefully coached Byllesby with the assistance of the weak-minded Schulze.

The data here presented are simply introductory to that which we shall print in the next few months bearing upon the various financing schemes of the T.-H. coterie. It is all at hand and is now being classified.

When we have completed our work, we are confident that every honest man engaged in the industry in any capacity will doff his hat to ELECTRICITY, the only journal in America which has dared to expose the rascals and hasten their expulsion from the trade.

THE BOND AGREEMENT.

We reproduce a fac-simile of the bond agreement upon which this swindle of three-quarters of a million was carried out, merely for the consideration of those who are not familiar with such matters. It is not, however, meaningless. It shows the invariable method of Mr. Coffin when he had a dishonest scheme of this nature to carry through. The first thing for him to do was to get a reputable financial institution to lend its name to the plan; thus the ignorant were led into a false belief as to the stability of the enterprise, and into the half belief that the financial institution stood as guarantor for the fulfilment of the bond agreement. The Old Colony Trust Company had been Mr. Coffin's favorite usually, but for the Tacoma deal the New York Guaranty and Indemnity Company was used. Its very name must have given confidence to the ignorant New England laboring men and washerwomen who had a few thousand dollars to invest.

ELECTRICITY expects to live long enough to force these financial and trust companies to use a great deal more caution as to the schemes to which they lend their names. We believe it to be a safe assertion that of all the electric railway and lighting enterprises in which the Old Colony

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pro rata of interest, as represented by the outstanding matured coupons, and (in case of distribution between two successive coupon days) by a just proportional part of the several coupons then next maturing. In making the distribution of said net proceeds on the interest account, the overdue coupons, whether still attached to the bonds or severed therefrom and owned separately, shall not be paid in the order in which they fall due respectively, but all shall be treated alike, save as amounts due thereon (to be paid in full or ratably, according to the amount of the balance of money available for the purpose) shall vary by reason of the computation of interest on said coupons from their respective maturities. If, after payment of the principal of said bonds and all interest, as aforesaid, computed to the time of making the payment, any balance of said proceeds still remain, the remainder shall be paid over to the Railway Company or its assigns.

ARTICLE 4. The foregoing provision for sale under the power aforesaid is cumulative with the ordinary remedy of foreclosure by entry or suit therefor, and the Trustee is hereby given also the right to make such foreclosure upon all of the property at one time and in one proceeding, or upon portions of it successively and in separate proceedings. And the Railway Company hereby waives any and all rights of sale and redemption now or hereafter provided by the statutes of Washington. It is further distinctly understood and agreed that upon and after the expiration of thirty days' notice in writing given by the Trustee to the Railway Company of any default by the Railway Company under this deed, the entire principal of said bonds shall, at the election of the Trustee, be deemed immediately due and payable; and the Trustee shall not be required to signify its said election in any manner other than by beginning a suit to foreclose, or by proceeding to sell the mortgaged property. It is hereby declared and agreed that any one or more of the bondholders, or any person in his or their behalf, may purchase the property at any sale of the mortgaged premises, whether made under the power of sale hereinbefore contained, or pursuant to a judicial decree; and that the receipt of the Trustee shall be a sufficient discharge to the purchaser or purchasers for his or their purchase money. And if the sale be in parcels, each purchaser shall take good title, notwithstanding that enough may have been already received to satisfy the debt hereunder. By whatever method or proceeding the mortgage may be foreclosed, the order and method of distribution of the net proceeds realized on a sale or sales of the property shall be as hereinbefore provided.

ARTICLE 5. Before proceeding to take possession of the mortgaged property, or to foreclose this deed or mortgage (whether the foreclosure be made by sale under said power or otherwise), the Trustee shall have the right first to require from the bondholders reasonable indemnity against loss and liability that may be incurred by it in so doing; and upon the tender of such reasonable indemnity by the holder or holders of a majority of the bonds at that time outstanding and unpaid, whether such indemnity shall have been previously requested of them or not, it shall be the duty of the Trustee, in case of default on the part of the Railway Company continuing for the above mentioned space of thirty days after written notice as aforesaid, and not waived as hereinafter provided, to take such action pursuant to the terms of this deed as the party or parties tendering the indemnity may in writing request. In all cases of any instructions or requests by bondholders to the Trustee hereunder, the same shall be in writing, and the Trustee shall have the right to demand proof of the ownership or legal holding of the bonds, the alleged holders or owners of which claim the right hereunder to instruct or request; or said Trustee may require deposit of the said bonds.

ARTICLE 6. No delay or omission by the Trustee in exercising the rights and powers herein granted shall be held to exhaust or impair such rights and powers, or be construed as a waiver thereof; but it is hereby mutually agreed that the holder or holders of a majority in amount of the bonds outstanding at the time of any default as aforesaid on the part of the Railway Company, may, by an instrument in writing, signed and acknowledged by them, at any time, whether before or after the institution of foreclosure proceedings, waive, or instruct the Trustee to waive, any such default; provided always, that no such action on the part of the bondholders shall extend to or be taken to affect any subsequent default, or impair the rights resulting therefrom. The Trustee agrees, on any default in the payment of interest on the said bonds, or any other default, on the written request of the holder of any of said bonds, to give written notice to the Railway Company of any such default under this Indenture as the person requesting such notice to be given shall allege to exist.

ARTICLE 7. The Trustee may act by agents or attorneys, and shall not be responsible for their acts or omissions, but shall be bound to use due care in their selection and retention. It shall be liable only for reasonable care and diligence in relation to taking possession of, operating, controlling, managing and selling the premises and property aforesaid, or otherwise carrying out the provisions of this instrument. It shall not be bound to recognize any person or party as a holder of any of said bonds, nor to take any action at his request, unless his bond or bonds are submitted for its inspection, or his ownership thereof is otherwise shown to its satisfaction; and it may, if it so desires, require the bonds so submitted to be deposited with it and retained until it shall have completed the action requested by such bondholder.

ARTICLE 8. It is further agreed that the Trustee may at any time resign the trust by resignation delivered to said Railway Company, and that, in case of such resignation, or of the removal or incapacity of the Trustee, by reason of insolvency or other cause, the Railroad Company shall have the right to nominate and appoint a successor to the said office of Trustee, with the consent in writing of the owners of a majority of the bonds hereinbefore described as secured hereby at the time outstanding and unpaid; but any vacancy of more than sixty days' standing may be filled by any court having jurisdiction, on application of the outgoing Trustee, or any person interested. No bond shall be required of any Trustee, unless ordered by court for cause shown. Upon the appointment of any successor to the trust by either method above mentioned, all the mortgaged or trust property shall immediately, and without conveyance, vest in the new Trustee; but the outgoing Trustee shall, nevertheless, at the request of any person interested, but at the expense of the Trust, execute, acknowledge and deliver to the new Trustee such deeds of conveyance or other instruments in writing as may be appropriate to vest or confirm in the new Trustee the mortgaged or trust property.

ARTICLE 9. The Railway Company agrees at all times on request to furnish the Trustee a schedule showing with reasonable detail the items of the estate, property and other things covered by the lien hereof, or intended so to be. And the Trustee shall have power from time to time to release from the lien of this deed any of the property embraced or intended to be embraced herein, and shall not be responsible in any way on account of such release if the same be made on receipt of a written certificate from some person (selected by it with due care for the purpose) to the effect that the security will not thereby, in the judgment of such person be unreasonably impaired, the attendant expense being paid by the Railway Company. The Railway Company covenants and agrees that, having possession as aforesaid, it will diligently preserve the rights and franchises now or hereafter granted or conferred upon it by the laws of said State of Washington, or by the ordinances or laws of any city, town, municipality or county wherein its road is or shall be constructed, that, using and operating its railway tracks and lines as the same are now constructed, or as the same may hereafter be constructed or extended, it will at all times maintain and preserve said tracks and lines, and every part thereof, together with the rolling stock, fixtures and appurtenances, in thorough repair, working order and condition, and fully supplied with motive power and equipments; and that it will, from time to time, make all needful and proper repairs and replacements, so that the traffic and business of the road and of every part thereof, shall at all times be carried on with safety and despatch. And until default as aforesaid, the Railway Company may sell or otherwise dispose of such rolling stock, machinery, equipments or other property, including real estate, as shall have become worn out or unsuited to the business of the Company, provided it renews the same or substitutes therefor other property of equal or greater value, or invests the proceeds in equipments or property useful in the operation of the road, the Trustee's assent to such sale, exchange or other disposition, to be expressed in writing. All the renewals, or new materials and property so acquired shall thereupon be covered by and subject to this mortgage. The Trustee shall not be responsible in any event for its action, if based on a written certificate from some person (selected by it with due care for the purpose) that the proposed sale, exchange or disposal will not diminish the security, the expense of obtaining such certificate to be paid by the Railway Company.

ARTICLE 10. The Railway Company hereby expressly covenants and agrees to pay any and all taxes, assessments and governmental charges assessed or laid upon the property hereby conveyed or intended so to be, and also to keep said premises and property at all times insured, in such sum as shall reasonably protect the insurable property, payable in case of loss to the Trustee as its interest may appear. In case of loss, the Trustee shall allow the insurance money received to be applied by the Railway Company toward the replacement of the property destroyed or injured, if the Railway Company so requests in writing, and shall, upon such request, pay such money over to the Railway Company for that purpose, on receipt of proper vouchers signed by the President and Treasurer, or Vice-President and Treasurer, of the Railway Company, to the effect that said property has been replaced by new or additional plant or property costing as much as the amount of money paid over on said vouchers; but if the Railway Company should not, within sixty days from the loss, request in writing to have the insurance money so applied, then it shall be invested by the Trustee in good securities, and form part of the trust property hereby conveyed, and shall, together with all interest and accumulations thereon, be subject to the provisions of this Indenture in like manner as the other property hereby conveyed, except that the possession thereof shall be held by said Trustee until the securities are disposed of according to this Indenture.

ARTICLE 11. The Railway Company covenants and agrees to cause this mortgage or deed of trust to be recorded and filed both as a mortgage of real estate and of personal property, in such manner and in such places as may be required by the laws of any State in which property now or hereafter embraced in this deed may be situated, so as to preserve and protect the security of the bondholders and the rights and remedies of the Trustee. The Railway Company also agrees hereafter, from time to time during the existence of this trust and mortgage, to make, execute, acknowledge and deliver all such further instruments and conveyances as, in the opinion of the legal counsel of the Trustee, may be necessary or proper to facilitate the execution of said trust, or to further secure said bonds, all of which additional instruments and conveyances the Railway Company agrees to keep properly filed and recorded.

ARTICLE 12. The Railway Company hereby expressly reserves the right to pay and redeem said bonds or any of them at the expiration of five years from the date hereof, or at any time thereafterwards and before maturity, by paying for every bond called, the amount of the principal thereof, and, in addition, four per cent (4%) premium thereon, together with all interest accrued on the same and unpaid at the time fixed for such redemption, provided notice thereof be given to the holder or holders of the called bond or bonds, printed once a week for at least four successive weeks in a daily newspaper printed and published in said City of Tacoma, and also in some daily newspaper printed and published

Trust Company has been interested as the agent of the T.-H. schemers a majority have been very much like Tacoma, Pueblo and Little Rock.

We note in this bond agreement a phrase peculiarly Coffinesque in its wording, viz., "These bonds are subject to call at $\$1{,}040\frac{00}{100}$ each, and accrued interest, at or after five years from their date and before maturity."

This was a peculiar characteristic of all Mr. Coffin's schemes—holding out to the purchaser of worthless bonds the possibility of unusual gains from the investment, sometimes more and sometimes less. The same rule was applied to all the issues of the Securities Company.

It will be seen that Messrs. Schulze and Kershaw were compelled to swear that the proceeds of these bonds were legitimately applied. Schulze killed himself in April last, but Kershaw is still living, and we hope that both he and Byllesby and Coffin, may be compelled to testify before the court what became of the money.

When we are through with this campaign the atmosphere will be clearer.

Among the entries for the Bedford two-year-old plate at the Newmarket races (England) recently was "Dynamo by Peter out of Electric Light." The reports say that "Dynamo made the whole running." That is as it should be—and by gracious how the dynamo did run!

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in said City of New York, the first publication of notice in each case to be at least four weeks before the time fixed in said published notice for such redemption; and, at the expiration of such time, all interest on the bonds called shall cease. But all such calls for redemption shall be made through the Trustee, and the numbers of the bonds to be redeemed shall be determined by said Trustee by the casting of lots. It is further expressly understood and agreed that if, after any bond has been called for payment in accordance with the foregoing provisions, the same shall not be presented to the Trustee for redemption on or before the day fixed therefor in the published notice, the Railway Company may deposit with the Trustee to the credit of such bond, designated by the number thereof, a sum of money equal to the principal thereof, and, in addition, four per cent (4%) premium thereon, together with a sum equal to the interest accrued on the bond up to the date fixed for redemption as aforesaid and remaining unpaid, which deposit shall be full payment of the bond and coupons belonging thereto, as between the Railway Company and the holder thereof. Said deposits in the hands of the Trustee shall draw no interest. Thereupon and thereafterwards, such bond and the coupons thereto belonging shall be excluded from participation in the lien and security afforded by these presents, and the holder shall look for the payment of the bond and accrued interest only to the sums so deposited in the hands of the Trustee, and in no event to the Railway Company; but said sums so deposited shall be held by the Trustee to the credit of and for the payment of said bond, and shall be paid by the Trustee to the holder thereof upon the presentation and delivery to it of such bond, together with all the outstanding coupons thereto belonging. And upon the presentation to the Trustee, cancelled, of all said authorized issue of bonds and coupons which at the time shall have been issued and outstanding, or upon the presentation of a portion thereof canceled (all of said bonds having been duly called for payment), and the deposit by the Railway Company with the Trustee of a sum of money sufficient, together with all amounts then on deposit under Article 13, to pay at the rate aforesaid all of said bonds and interest that are not presented to the Trustee in accordance with the call therefor, the Trustee shall cancel and discharge this mortgage or deed of trust as fully and to the same effect as if the total issue of said bonds and coupons had been duly paid by the Railway Company at the maturity thereof. The bonds called and redeemed under this Article 12, together with the coupons thereto belonging, shall be forthwith canceled by the Trustee, and delivered, with the coupons attached, to the Railway Company.

ARTICLE 13. The Railway Company agrees, during each of the years specified in the following schedule (said years being understood to commence on the first day of July), to pay over to the Trustee in cash, an amount sufficient to call (including the cost of advertising) and redeem, according to the provisions of Article 12 hereof, the number of bonds of the issue hereby secured, which are set opposite said years respectively, that is to say:

During	1897 to 1901	inclusive,	redeem	10	bonds each	year, or	50	in all.
"	1902 to 1906	"	"	20	"	"	100	"
"	1907 to 1911	"	"	30	"	"	150	"
"	1912 to 1916	"	"	40	"	"	200	"
"	1917 to 1921	"	"	50	"	"	250	"
	Total,	-	-	-	-	- -	750	bonds.

The Trustee agrees, from time to time, upon receipt of the amounts deposited with it for the purpose of such redemption, forthwith to call and redeem said bonds; and all bonds so called and redeemed under this Article 13, shall, together with the coupons attached, be forthwith canceled by said Trustee and delivered to the Railway Company. The provisions of Article 12, so far as applicable, shall affect all bonds called for redemption under this Article 13.

ARTICLE 14. The Railway Company covenants that, as the coupons attached to the bonds secured hereby mature, they shall be paid by it and canceled; and it is agreed that no purchase or sale of, or loan made of or upon, said coupons, on behalf, at the request, or with the privity of the Railway Company, whether before or after maturity, and no redemption of the said coupons by any guarantor of the payment of the same, shall operate as keeping the said coupons alive or in force as a lien upon the mortgaged premises, as against the holders of the bonds secured hereby, and of the coupons annexed thereto.

ARTICLE 15. Any of the bonds issued hereunder may be registered, at the option of the holders, on the books of the Railway Company, such registration to be noted also on the bonds themselves. If registered, they shall pass only by transfer on the books of the company, noted also on the bonds. But they may be discharged from registration by being so transferred to bearer, after which they shall pass by delivery until again registered. The coupons shall in all cases be negotiable by delivery, whether the respective bonds themselves be registered or not. The Railway Company agrees that it will at all times, so long as the bonds issued hereunder or any of them remain outstanding and unpaid, cause to be kept at the office of the Trustee, in said City of New York (or other place in the City of New York, of which due notice will be given), suitable books for the registration and transfer of such bonds as may be presented for the purpose. And the Railway Company hereby constitutes and appoints the Trustee its bond registry and transfer agent, with all powers usual and proper in such cases.

ARTICLE 16. The Railway Company will also, at any and all times, upon the written request of the Trustee, furnish to the Trustee, upon blanks provided by it for the purpose, a statement in writing showing accurately the Railway Company's financial condition, including in such statement especially an exhibit of the Company's earnings and operating expenses, given month by mouth for and during a period of at least a year prior to the time of making such request.

ARTICLE 17. The term "Trustee," as employed in this instrument, shall be taken to mean the Trustee hereunder for the time being, whether said party of the second part or its successor or successors in said trust. Every such Trustee shall, in all matters involving active duty or interference with the trust, be entitled to suitable indemnity against all loss, liability and expense; shall be entitled to the advice of counsel in all matters concerning the trust; and shall be entitled to reasonable compensation for services, and to receive, on demand, all sums due it for services and expenses, which sums shall be a first lien on the property hereby conveyed and all the property in its hands belonging to said trust.

ARTICLE 19. Notwithstanding anything hereinbefore contained, no Trustee hereunder shall in any event have any duty or responsibility as to the validity hereof, or the security hereby afforded, nor as to the execution, acknowledgment, recording or renewal hereof; nor (unless and until said Trustee is called upon to take active measures to enforce the security by foreclosure or otherwise with due indemnity) as to insurance, taxes or repairs, or any other matter affecting the security; and in general it is understood that, prior to being so called upon, its sole duty is confined to certifying the bonds as of the series mentioned herein, and acting as agent in the payment of coupons and in the drawing and redemption of bonds. The representations and recitals herein contained are those of the Railway Company, and in no sense those of the Trustee.

ARTICLE 20. Twelve hundred and fifty of said bonds, numbered from 1 to 1250, both inclusive, amounting to one million two hundred and fifty thousand dollars, are to be certified and delivered by the Trustee forthwith on the written order of the President and Treasurer of the Railway Company, and the President of the Northwest General Electric Company, of St. Paul, Minnesota. But it is hereby understood and agreed that the remaining two hundred and fifty of said total issue of bonds, numbered from 1251 to 1500, both inclusive, are not to be certified by the Trustee or delivered out of its hands, except for paving or for building additional track and equipping the same, or for the purchase of additional equipment for the track already built, or for the purchase of additional rolling stock, or for making other extensions or additions to the property of said Railway Company, and then only upon the written consent of the Northwest General Electric Company, said extensions and additions to be owned, (at the time of said certification) by said Railway Company and in practical use or operation, and free from any and all liens or liability, other than the lien of these presents.

Conclusive evidence to the Trustee of the amount expended for paving or for the extensions and additions above mentioned shall be a sworn certificate of the President and Treasurer of said Railway Company setting forth said expenditures in detail, with copies of the vouchers covering such expenditures attached thereto and forming part thereof; and upon the receipt of such certificate, together with a certified copy of a resolution of the Board of Trustees of said Railway Company requesting the Trustee to certify and deliver any of said bonds, and together also with the written consent of the Northwest General Electric Company of St. Paul, Minnesota, the Trustee shall deliver to the written order of the Treasurer of said Railway Company an amount of said bonds remaining in the hands of said Trustee equal at par value to the cost of said paving or of said extensions and additions, as per said certificate, until the total amount of bonds authorized as hereinbefore set forth shall have been certified and delivered by said Trustee. But it is hereby agreed by the Railway Company that all additions to the aforesaid property that may be required to keep the same in as good order and condition as the same now is, shall not be made or allowed to become a basis for such certification and delivery of any bonds in addition to those above certified and delivered forthwith on the basis of the existing plant; and as said plant, now owned and hereby conveyed by the Railway Company, is destroyed, worn or depleted, the Railway Company agrees to replace it with other property of equal or greater value.

IN WITNESS WHEREOF, Said Tacoma Railway and Motor Company has caused these presents to be executed in its name and behalf and under its corporate seal by Paul Schulze, its President, and P. H. Kershaw, its Secretary; and said New York Guaranty and Indemnity Company has caused the same to be executed in its name and behalf and under its corporate seal by its President, and its Secretary, the day and year first above written. Executed in duplicate.

TACOMA RAILWAY AND MOTOR COMPANY,

Witnesses:

By.......................................*President.*

....*Secretary.*

NEW YORK GUARANTY AND INDEMNITY COMPANY,

Witnesses:

By.......................................*President.*

....*Secretary.*

STATE OF WASHINGTON, }
COUNTY OF PIERCE. } ss.

BE IT REMEMBERED, That on this day of July, A. D. 1892, before me, a notary public in and for said State of Washington, duly commissioned, personally appeared Paul Schulze, President of the Tacoma Railway and Motor Company, the corporation described in the foregoing instrument as the party of the first part thereto, who is personally well known to me, and he, being by me duly sworn, did depose and say that he is, and at the time of the execution of said instrument was, the President; that P. H. Kershaw is and then was the Secretary of said Company; that he knows the corporate seal of said Company, and that the seal affixed to the foregoing instrument as such is said corporate seal; that the seal was so affixed by authority of the Board of Trustees of said Company, and that he, as President aforesaid, signed, and the said P. H. Kershaw, as Secretary aforesaid, attested, the said instrument by like authority; and the said Paul Schulze, President as aforesaid, acknowledged the execution of said instrument as the act and deed of said Tacoma Railway and Motor Company for the uses and purposes therein expressed.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed my official seal the day and year in this certificate first above written.

....
Notary Public in and for the State of Washington, residing at Tacoma.

STATE OF NEW YORK, }
CITY AND COUNTY OF NEW YORK. } ss.

BE IT REMEMBERED, That on this day of July, A. D. 1892, before me a commissioner for the State of Washington in and for the State of New York, residing in said City of New York, personally appeared President of the New York Guaranty and Indemnity Company, of the City of New York, the corporation described in the foregoing instrument as the party of the second part thereto, and who is personally well known to me, and he, being by me duly sworn, did depose and say that he is, and at the time of the execution of said instrument was, the President, and that is, and then was, the Secretary of said Company; that he knows the corporate seal of said Company, and that the seal affixed to the foregoing instrument as such is said corporate seal; that the said seal was so affixed by due authority of the Board of Directors of said Company, and that he, as President aforesaid, signed, and the said as Secretary aforesaid, attested the said instrument by like authority; and the said President as aforesaid, acknowledged the execution of said instrument as the act and deed of said New York Guaranty and Indemnity Company for the uses and purposes therein expressed.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my official seal the day and year in this certificate first above written.

....
Commissioner for the State of Washington in the State of New York.

ATTEMPTED ELEVATOR MONOPOLY.

Questionable Business Methods of a Quasi Trust by which it is Hoped to Drive the Electric Elevator Out of the Market.

Electricity, ever alive to the interests of its constituents, has unearthed another plot to ruin a portion of their business, and true to its traditions makes herewith a complete exposé of the same.

By way of introduction it is necessary to go a little way back into history.

Before the complete development of the electric motor to its present perfection, the increasing demand for elevator service in all modern buildings created a lively competition among those engaged in the construction and installation of this class of goods. The profits resulting from this business were large and this attracted others into the business until it was feared that with the increased competition these profits would disappear. Up to this time practically all of the manufacturers employed either one or the other of three general types of hydraulic lift, which in their hands had reached a perfection of development leaving little room for further progress. But these types of hydraulic lift were not patentable and the various manufacturers had to rely more upon business prestige and acumen than upon the detail patents which they were enabled to procure.

New comers into the business labored under the disadvantage of being less widely known to the public, but by installing first-class apparatus at a moderate and sufficient profit, bid fair to cut a wide swath in the business of the older companies. The latter to protect themselves got together and formed an alliance by which it was hoped not only to maintain the old prices but to drive out competition, no matter how honest or meritorious it might be, from those who were threatening their supremacy.

The companies thus bound together were:

The Crane, of Chicago, and its purchased company, the Hale.

The Otis, of New York, of which Mr. Crane is a prominent stockholder.

The Whittier, of Boston, largely controlled through the last two; and

The Stokes & Parrish, of Philadelphia.

To prevent competition amongst themselves these companies divided up the country into five districts in each of which one of the five companies was to hold undisputed sway. Each would bid in the others' territory, however, but not so low as to take the contract from the owner of that territory. Thus if a Chicago man asked bids from the Otis Company he was sure to find the latter underbid by the Crane, whereas if a New Yorker asked bids in Chicago for the *same* thing, he would find the Otis Company the lowest bidder. But how was this managed? It was managed in this way—all of the bids for all of the companies were made out by the same party, and that party had his headquarters in New York City in the offices of the Otis Company. All being prepared by the same deft hand, there was no likelihood of conflict between bids.

With the advent of electric wires in our streets which could be conveniently tapped on short notice in almost every business street of our large cities, and with the general installation of isolated electric lighting plants in all large modern business blocks, a new competitor threatened the supremacy of the big five. It will be understood that all of those in the combine made hydraulic elevators of nearly equal merit—for this was practically admitted by the big five—else why the combination? Besides these five, Messrs. Morse, Williams, McAdams & Courtright, in Philadelphia; Graves, in Rochester; the Standard, founded by members of Mr. Crane's family and former employees of his company; Eaton & Prince, and Winslow Brothers, of Chicago, together with some other smaller concerns, were making elevators on the hydraulic system of equal merit and all so nearly realizing the highest attainments of the art that little improvement seemed possible.

There was at least one serious defect in all hydraulic systems which seems inherent in the method, viz., that the power required to operate an elevator by hydraulic means will not adapt itself to the load. It required exactly as much power to raise the cab empty as it did to raise it with its maximum load. This was a most serious defect from the economic standpoint, and while many intelligent attempts to remedy it have been made, none have succeeded to this day. The one characteristic of the electric motor that has done more to bring it into popular favor than anything else is that it *does* adapt itself to its load, and consumes energy only in exact proportion to the requirements. It required no invention to substitute the electric motor for the hydraulic appliances, or for the steam engine and gears for steam driven elevators, and thereby was gained the decided advantage that the power required was strictly proportional to the load.

Here was a competitor which in its broadest application could not be controlled by the elevator trust or any one else. The trust secured detail patents for electric elevators, but none of these were broad enough to shut out successful competition. They therefore resorted to business methods such as would not be tolerated in Baxter street.

Practically all of the electric elevators of today, with the exception of the Sprague-Pratt machine, which is unique, consist of the old Tuft steam screw elevator with the steam cylinders and reversing valve replaced by an electric motor and reversing controller. This old-style elevator is now public property and the substitution of an electric motor for a steam engine is not a patentable idea. There remains then scarcely more than the controlling devices upon which patents can be granted. Upon these much ingenuity has been expended and in these is found the chief differences in the electric elevators now on the market.

The variety of ways in which an electric elevator can be controlled is so great that in the present state of the art it is impossible to control them all.

The trust, realizing this and also the formidable competition resulting from the new agency, resorted to the following methods:

The A. B. See Manufacturing Company shortly after they began to manufacture electric elevators heard that the Otis Company was secretly warning inquirers after elevators against buying from them as they *were going to sue* them for an infringement of patent. This disreputable business method was continued for some time with customers, but the fact of alleged infringement was never made known to the See Manufacturing Company. Mr. See finally demanded of Mr. Norton P. Otis, president of the Otis Company, to know upon what they based their charge of infringement. Mr. Otis, although still using this threat of suit for infringement as a club to force customers his way, declined to give Mr. See any satisfaction in regard to his inquiry. Not long after this incident the Otis Company served notice of a suit on one of See's customers—and this without notice to the See Manufacturing Company. The customer not being familiar with the law paid little attention to the notice of suit and the Otis Company would have taken judgment by default had not the A. B. See Company gotten wind of the matter just in time to assume the defense. Here was a very clear case of attempting to get judgment by stealth, but it was happily foiled. The patent upon which suit was brought was one granted to S. S. Wheeler, which covered devices which the A. B. See Company did not use at all. The features covered by the patent were well known ten years before the date of the patent, and no one who has looked into the matter believes that the patent would hold if tested before the courts. However, since the A. B. See Company did not use the device or ideas of Mr. Wheeler's patent it matters not whether that patent is valid or not.

Prof. Anthony in discussing this suit in 1894, concludes that there could be but one issue, and that in Mr. See's favor, on the following grounds:

1st. The elements of the combination claimed in the patent are all old, and combining them involved no invention.

2d. The combination claimed is itself old.

3d. The A. B. See Company does not use the combination.

In other words, the Otis Company had endeavored to break up a competitor's business, first by warning purchasers not to purchase his goods because of an alleged infringement; second, when confronted by the competitor himself, the Otis Company refused to state wherein he infringed; third as a pretext for carrying out a threat the Otis Company did bring suit—not against the infringer as it would have done had its desire been to establish infringement, but unbeknown to the real infringer, against one of his customers whose interests in the alleged infringement were so slight that he could not be expected to make any fight. The object of this becomes doubly clear when we study the patent on which the Otis Company sued. It was clearly to produce a moral effect upon the trade—to bulldoze it into buying trust elevators and to break up an honest competitor's business.

When Mr. Otis took the necessary oath to begin this suit he was either mentally irresponsible for what he did or he was lamentably ignorant of the responsibilities involved. There is no escape from one or the other of these conclusions.. This is not an isolated case of the dirty work of the Otis Company. Against another firm that has been in business in New York City for 25 years—a firm that is justly respected for high class work and business integrity—it brought three suits for infringement, in pursuance of its tactics.

Nothing came of these suits either, nor could anything have been expected to result from them as a result of trial. The intention evidently was to frighten the competitor out. Fortunately this competitor had too much backbone to be frightened out—it contested the suits and won.

Those unfamiliar with the elevator business cannot well understand how such a policy can hope to succeed. It will be clearer, however, when it is understood that for years the Otis Company has been considered so strong financially that it was thought to be almost suicidal in a smaller concern to measure strength with it in lawsuits. It was generally conceded that the Otis Company in pursuance of its rule or ruin policy would exhaust the resources of any smaller concern daring to come into open rebellion to its sway by overwhelming it with lawsuits which it would be unable to defend.

Other companies besides the A. B. See Company—in fact, almost every competitor in the market, whether manufacturers of hydraulic or electric elevators, or both—have found that in almost every instance where they have presented estimates for elevators the intended purchasers had been warned by the Otis Company not to purchase lest they be seriously troubled by a suit for infringement. In the case of the A. B. See Company, it appears that the only ground for suit by the Otis Company was their claim that they possessed the exclusive right to use a shunt wound electric motor in connection with an elevator. But this company has not confined its peculiar business methods to electrical competitors. They have treated nearly all competitors alike—their general method being first to threaten the customers of their competitors with suit, and then having exhausted the moral effect of this, to actually bring suit, usually upon some untenable ground, and keep this pending suit hanging over them as long as it was possible to do so without bringing it to trial, using it in the meantime as a most effective weapon against those who dared to enter the field which the Otis Company seem to think has been preempted entirely for their benefit.

While the favorite method employed by the Otis Company and the Elevator Trust has been the disreputable one to threaten intending customers of their competitors with suit for infringement, this has not been their only method. They have in some cases endeavored to steal the contract from a competitor even after it had been awarded. One of the most noteworthy illustrations of this occurred at Minneapolis recently. Bids for the equipment of the Minneapolis City Hall and Court House with elevators were opened on Feb. 19, 1895. There were fourteen altogether and the award was finally made to the Sprague Company for its electric elevators for the first section on a vote of 8 to 1.

Pending settlement of the details of the contract an injunction was issued against the commission, nominally on the application of a "taxpayer," but really at the instigation of the Crane Co., to prevent the signing of the contract with the Sprague Co.

In support of the application for the injunction, affidavits from the following people were submitted:

Norton P. Otis, president of the Otis Elevator Company.

Wm. E. Hale, former president of the Hale Elevator Co.

Thomas E. Brown, consulting engineer of the Otis Co.

George K. Reynolds, chief engineer of the Crane Elevator Co.

Thomas M. McGuire, consulting engineer of the commission and agent for supplies of the Crane Co.

Frank Elmer Herdman, electrical engineer of the Crane Co.

Frederick H. Prince, president of the Eaton & Prince Elevator Co.

Charles N. Coen, former general manager of the Hale Elevator Co., now salesman of the Crane Co.

Wm. H. Coen, vice-president and general manager of the Crane Elevator Co.

S. G. Cook, who is operating Crane elevators.

J. C. Freeman, J. Hutchinson and Albert Stevenson, all three being represented as chief engineers of the Owings Building, Chicago, likewise using Crane elevators.

In spite of this array of hydraulic interests the injunction was dissolved, although four days were granted for additional affidavits. The filing of such additional affidavits was abandoned, but the Crane Co. presented instead another bid for which they requested consideration, making the most astounding claims.

These latter statements of the Crane Co. were submitted to Mr. Wm. De La Barre, hydraulic engineer of the Minneapolis Milling Co., for an independent expression, and a copy of his reply is given below:

William De La Barre, Engineer of the Minneapolis Milling Company.

Dear Sir: The Construction Committee of the Court House and City Hall Commission has instructed me to ask you for a written opinion concerning the proposition of the Crane Elevator Company to run an elevator with 7½ horse-power to an altitude of 96 feet 8 inches on a one-minute schedule, the machine being adjusted to carry 3,600 pounds live load. Is the test they propose such a one as you would recommend as a basis to compute the cost of operating expenses in actual service, or is it a mere trick intended to hide the exact truth? In addition to this, will you kindly answer the following questions:

First—Can a hydraulic elevator in actual everyday service do as much work with 7½ horse-power of energy as an electric elevator can with 40 horse-power, the efficiency of the electric machines being as great or greater than hydraulic?

Second—How much more could the county afford to pay for six Winslow elevators with Reidler pumps than for six Crane elevators with pumps listed in their bid at $16,780, computations of running expenses in each case to be based on pounds of steam per horse-power given in their schedules, the machines being adjusted to carry 3,600 pounds live load, with 300 pounds underbalanced car and sixty per cent. efficiency, making the round trip of ninety-six feet in one minute, ten hours per day and 315 days in the year, eight pounds of water to one pound of Youghiogheny coal at $4 per ton of 2,000 pounds, and interest for the investment at 4½ per cent.?

Third—How much more could the county afford to pay for electric elevators than for the six Crane elevators in question, using same figures, excepting to take into consideration the fact that electric elevators use power only in proportion to the load carried, on an average six passengers a trip, and using thirty-five pounds of steam per horse-power?

To these queries Mr. De La Barre responded in writing as follows:

Oliver T. Erickson.

Dear Sir: In reply to your written request of March 22, 1895, with reference to the proposition of the Crane Elevator Company and others, permit me to state that I have examined the papers submitted to me, and, assuming the figures and facts given therein to be correct, I would say that I should not regard the test proposed by the Crane Elevator Company convincing or conclusive with regard to the operating expenses during actual service.

The answer to your second question is $13,555 for each elevator, or $81,318.66 for six elevators, assuming each of them to work under identical conditions.

The answer to your third question is $14,454.66 for each elevator, or $98,722.96 for six elevators, assuming each to work under identical conditions. This is on the basis of seventy per cent. efficiency for the electric motors.

The Hydraulic Elevator Trust, it seems, has a strong ally in the Henry R. Worthington Co., manufacturers of hydraulic pumps used in elevator service. In the fight against the Sprague Electric Elevator Co. at Minneapolis, the Trust called upon this ally for assistance, and it was rendered by an agent of the Worthington Co., who, in behalf of the Crane Co., stated among other things that an electric system would require eight times the coal of a hydraulic system.

This was communicated in a letter signed "Henry R. Worthington Co., by B. F. Slocum." Upon this becoming known to the Sprague Co., the following correspondence ensued:

New York, November 27, 1894.

Henry R. Worthington Co., 86 Liberty street, City.

Gentlemen: We beg to enclose you a copy of a letter signed "Henry R. Worthington Co., by B. F. Slocum," presented to the Board of County Commissioners, Court, House and City Hall Building, Minneapolis, Minn., at the recent opening of the bids for elevators. In view of the remarkable statements made in this report, not alone with regard to the Worthington apparatus, but relating to the electric elevator as manufactured by this company, we beg to inquire whether the statements therein contained are endorsed by you, or are made on the responsibility of Mr. Slocum. Very truly yours,

SPRAGUE ELECTRIC ELEVATOR COMPANY,
(Signed) By Frank J. Sprague, Vice-President.

They replied as follows:

Brooklyn, N. Y., November 30, 1894.

Sprague Electric Elevator Company, 253 Broadway, New York City.

Gentlemen: We have read the communication sent us under cover of your favor of the 27th inst., and fail to see on what grounds you assume to cross-question us concerning its contents. In the absence of any direct statement in it, your assumption that your elevator is the one referred to by our salesman may or may not be correct.

It seems to us that, if there is any question as to the correctness of the calculations, it should properly be raised by the County Commissioners, to whom the communication is addressed, and that no good can come to any of the parties interested in this particular case by transferring the discussion from Minneapolis here. Yours truly

HENRY R. WORTHINGTON,
(Signed) Charles C. Worthington, President.

This letter so palpably begged the question that Mr. Sprague wrote as follows:

December 1, 1894.

Charles C. Worthington, Esq.,
President Henry R. Worthington Co., Brooklyn, N. Y.

Dear Sir: We have your letter of November 30, in reply to ours of the 27th ultimo. We regret that you should evade the issue raised in our letter. Under the circumstances we have every ground "to assume to cross-question you." The copy of the communication sent to you, signed by your Mr. Slocum, purported to present two sides of the elevator question—one the advantages of the hydraulic depending upon Worthington apparatus, the other the disadvantages of the electric

You must be well aware that the questions which have arisen at Minneapolis are not between the Sprague-Pratt and any other electric elevator, but directly and simply between two typical systems, with one of which you are somewhat closely identified, and of the other of which we happen to be the representatives.

We shall not discuss here the correctness of the statements made so far as they relate to hydraulic elevators in general, or the Worthington pump in particular—that we shall take up in due time; but, so far as the statements made relate directly or by inference to the electric elevator built by this company, they are in a large measure untrue and misleading, and we have every right to require the principal either to indorse the statements of a subordinate or correct them.

It may be, as you say, "that no good can come to any of the parties interested in this particular case by transferring the discussion from Minneapolis here," if by "any of the parties" you mean the hydraulic interests. We quite coincide with this view.

In spite of your diffidence we are still constrained to ask, without entering into any discussion of your representative's communication, whether the Sprague-Pratt electric elevator was the one referred to in that communication. That question, at least, is simple enough.

Yours truly,
SPRAGUE ELECTRIC ELEVATOR COMPANY,
(Signed) By Frank J. Sprague, Vice-President.

No reply has been received as yet to this last letter.

Mr. George K. Reynolds, the engineer of the Crane Company, had also been making a number of remarkable statements calculated to injure the Sprague Company, and to him Mr. Sprague addressed the following:

New York, November 28, 1894.

George K. Reynolds, Esq., Consulting Engineer, Crane Elevator Co., Chicago, Ill.

Dear Sir: We understand that at a meeting before the Commissioners of the Court House and City Hall Building, Minneapolis, Minn., you recently made the statement that the screws of the Postal Telegraph elevators had worn out and had been replaced, and that we carried spare screws to replace such as were liable to give out.

We wish to know if this version of your statements is correct, and if you, over your signature as the representative of the Crane Elevator Company, will put those statements in writing. Very truly yours,

SPRAGUE ELECTRIC ELEVATOR COMPANY,
(Signed) By Frank J. Sprague, Vice-President.

To this also no reply was received.

Later, when the commission visited New York, the statements of Norton P. Otis, the president of the Otis Elevator Company, and his agents were of such a character that the Sprague Company was constrained to send another registered letter as follows:

January 24, 1845.

Norton P. Otis, Esq., Otis Elevator Company, New York City.

Dear Sir: You have recently made a statement to the effect that the screws of the Postal Telegraph elevators have been several times worn out and replaced. I believe it is my right to ask if that statement is made on hearsay, and, if so, your authority; or if it is made on your personal responsibility.

If the former is the case, it is not your privilege to repeat it without your personal knowledge; and if the latter, then I have to ask if you will state in writing, over your signature, either personally or as an officer of the Otis Elevator Company, that any screw in the Postal Telegraph plant has ever worn out, or that any screw for that purpose has ever been replaced. Frankly, I wish to place the responsibility for that sort of statement where it belongs. Yours truly,

(Signed) FRANK J. SPRAGUE, Vice-President.

The above merely shows one phase of the methods employed by the Trust to defeat honorable competition. The particular animus which led to the employment of these methods exists still and is indicated by the fact that the Sprague and the Crane companies had had a somewhat important contest and the latter had been defeated in the award of a contract for fifteen elevators in the Parrot Building, San Francisco, so that it came to be commonly reported in Minneapolis that the Sprague Company must be defeated there, no matter what it cost, for the Crane Company realized that, should the San Francisco decision be followed by another similar one, their power in the Northwest would be broken, and they could well afford to put elevators in the Court House for nothing to prevent such a blow to their prestige.

But notwithstanding these underhand methods the award was made to the Sprague Company by a vote of 8 to 1 of the commissioners. The dissenting commissioner was Mr. John De Laittre, and he in defence of his position made the following written statement:

That the first cost of an electric plant for the entire building would be at least $40,000 more than a hydraulic.

That it is easy of demonstration that the operating expenses and fuel bills would be more than doubled by the use of the electric system.

That he is fully aware of the powerful influence of the "Sprague-Pratt" Company in Minneapolis and of their intimate relations with the Postal and North American Telegraph Companies.

That the amount of the Sprague Company's bid for electric elevators, covering electric generators and engines, using a total of 160-horse power for the four elevators, is $29,875.

That the bid of the Crane Company for the highest type of hydraulic elevators, using triple-expansion pumps and using 30-horse power for the four elevators, is $17,480.

That the power required by the four Sprague elevators is five and a third times that of the four Crane elevators.

That the total cost of 12 elevators of the "Sprague-Pratt" type, including generators and engines, would be $85,125, and it would require two 250-horse power engines to operate the dynamos required by the "Sprague-Pratt" machines.

That the total cost of a like number of the best type of Crane elevators would be $33,760, and that it would require 90-horse power to operate them.

That the excess of the cost of the Sprague electric elevators over the Crane elevators would be $51,365.

That twelve "Sprague-Pratt" elevators will require an average of 480 electric horse power at an annual cost of $11,520, whereas twelve hydraulic elevators will require an average of 90-horse power at an actual cost of $3,240.

Each and every statement thus epitomized is false. There is absolutely not one single exception. The statements are not only false, but there is not in the bids which were presented to the commission any excuse for the presentation of them.

Mr. Sprague in replying to these statements says:

In my letter of transmittal of February 14th, which was certainly open for Mr. De Laittre's inspection, and from which he had no business to make a garbled extract, I stated that the generating plant should consist of two dynamos of 80 kilowatts capacity each, one of which would be ample for the operation of the four elevators under actually normal conditions; that two would enable six loaded cars to be simultaneously hoisted under the full load, a condition, however, which under normal practice would never occur; and that these same two units would supply the current necessary for operating the entire plant of twelve elevators under their normal conditions of service.

It should be further borne in mind that the dynamo and engine plant proposed was not merely to take care of the average load, but to provide for those extreme conditions which arise by the combination of movements of elevators, and that the average demand would not exceed one-half the capacity of the dynamo plant.

The maximum engine power provided, instead of being two 250-horse power engines, would be two 120-horse power engines.

The average electrical power used would be 4-horse power hours per car mile of travel.

With twelve elevators on a regular service of forty round trips per hour, the loads which will obtain in practice are such that the average electrical horse power delivered to the entire battery will be about 72-horse power instead of 480; that is, less than one-sixth of "Expert" De Laittre's estimate.

Instead of 90-horse power delivered to the water column of the hydraulic elevators, there would be about 150-horse power required under exactly equal mileage and service.

There is a radical difference between hydraulic and electric elevators in that hydraulic elevators are pressured for the maximum load which they must be able to carry, and use for every foot of travel the same amount of water independent of the load, while the electric elevator takes advantage of the falling off of actual duty and uses power in proportion to the actual combined friction and live loads.

Instead of $17,480 being the Crane bid, including triple-expansion pumps for high pressure service, the bid taken from the list published in the *Times* of February 19, was $26,261, $8,781 more than was stated by Mr. De Laittre, and the total cost of the Crane high pressure service with triple-expansion pumps would be $42,541 instead of $33,760.

It must be borne in mind, however, that, while the electric plant has the street for reserve in case of the failure of an engine or dynamo (and under conditions of very slack service, as at night or on Sundays and holidays, such street reserve can be most advantageously used, saving both in power-operating expenses and in attendance), there is no need to put in an additional dynamo and engine. It would be absolute folly, however, to put in a hydraulic plant without a reserve pump.

If any Crane bid had been accepted it would probably have been for the highest-priced apparatus, and it should have included a reserve pump, so that the cost, to say nothing of those extras which the installation of hydraulic elevators at some distant future could have easily added, would have been about $46,525.

The Sprague Company's bid for the four elevators, excluding engines and dynamos, was $19,925.

Its lowest bid, under which they have stood ready all along to equip the plant, including the necessary dynamo, was $22,180, and, with the necessary compound engine of the highest type, would be $24,100, instead of $29,875.

The company's bid for the four elevators, including the necessary dynamos to operate the twelve elevators under the conditions of actual service, was $24,485, and, with the best type of compound engines to operate them, $28,275, instead of $29,875.

The total bid of the Sprague Company for the twelve elevators, with engines and dynamos, is $67,875, instead of $85,125, or a difference of $17,250.

Again, deducting from the De Laittre statement the cost of our eight extra machines, our first cost, according to De Laittre, for the four elevators with engines and dynamos, would have been $45,525, instead of the actual bid of $28,275.

According to this same expert estimate of the cost per horse power per month for the generation of electric or hydraulic power—which I am perfectly frank to say is low--since we will use an average of 72-horse power, as absolutely metered, against 480-horse power, the cost per year would be $1,728, instead of $11,520, a difference of $9,792, while the hydraulic cost would be $5,400 as against $3,240.

These statements, so far as absolute costs are concerned, are both absurd, the cost of power being under the truth in either case, but the ratios which I have given are correct, and will affect both plants alike.

Referring now to the bids of the Sprague and the Crane and the Winslow companies for apparatus as it would necessarily have to be completed, there is an actual difference between the Sprague and the Crane companies of $21,350, instead of $51,365, or $30,015 less than stated by Mr. De Laittre, and there is an excess of the Sprague Company over the Winslow Brothers' bid of about $7,875, the difference between the Crane and the Winslow estimate fairly representing the amount which the Crane Company were willing to sink to carry this contract in their favor as against the Sprague Company.

In order to make the preceding statements clear we have arranged them in tabulated, form giving the facts, the De Laittre statements, and the differences, as follows:

Cost of 4 Sprague-Pratt electric elevators, with necessary dynamo to operate them	$22,180
De Laittre's statement	25,575
Difference	$3,395
Cost of same with best type compound engine	$24,100
De Laittre's statement	29,875
Difference	$5,775
Cost of 4 Sprague-Pratt electric elevators, with compound engines and dynamos necessary to operate the 12 elevators in regular service	$28,275
De Laittre's statement, being his total of $85,125 less the cost of the 8 machines	45,525
Difference	$17,250
Total cost of 12 Sprague-Pratt electric elevators, with multipolar generators and compound engines	$67,875
De Laittre's statement	85,125
Difference	$17,250
Cost of 4 Crane high-pressure elevators, with piping and pumps for operating 12 elevators, but without reserve	$26,261
De Laittre's statement	17,480
Difference	$8,781
Total cost of Crane high-pressure plant, with best pumps, without reserve	$42,541
De Laittre's statement	33,760
Difference	$8,781
Total cost of Crane plant, including reserve pump, about	$46,525
De Laittre's statement	33,760
Difference	$12,765
Cost of 4 Winslow Brothers elevators, with piping for high-duty machines, without reserve	$34,160
Total cost for 12 Winslow elevators, no reserve	56,160
Total cost Winslow elevators, with reserve, about	60,000
Average electrical h. p. to operate 4 Sprague-Pratt electric elevators on actual service	18 h. p.
De Laittre's statement	160 "
Difference	142 h. p.
Average power in water column required to operate 4 Crane hydraulic elevators	50 h. p.
De Laittre's statement	30 "
Difference	20 h. p.
Maximum engine-rated h. p. provided to operate the complete Sprague plant	240 h. p.
De Laittre's statement	500 "
Difference	260 h. p.
Average electrical h. p. required to operate the complete Sprague plant on normal service, as metered	72 h. p.
De Laittre's statement	480 "
Difference	408 h. p.
Average steam h. p. required to operate the Sprague plant	125 h. p.
De Laittre's statement	500 "
Difference	375 h. p.
Average power in water column required to operate 12 Crane hydraulic elevators, like duty	150 h. p.
De Laittre's statement	90 "
Difference	60 h. p.
Equivalent steam h. p. if used in an engine for same water evaporation, at least	250 h. p.
Excess cost of Sprague-Pratt plant over Winslow Brothers	$7,875
Excess cost of Sprague.Pratt over Crane high-duty	$21,350
De Laittre's statement	51,365
Difference	$30,015

We could go on multiplying instances of similar methods of business encountered by every one not in the Trust, but the above will doubtless be sufficient to indicate the dishonorable methods which have for years characterized the Otis Co. and its allies, the other members of the Elevator Trust. These methods have been employed against those not building electric elevators as well as against those who do. We are only specially concerned because of the attempts to drive one of the most promising branches of electrical development from the field, but we have the interest that all honorable people have in seeing dirty and dishonest methods banished, and are among those who believe that the Otis Co. and its allies have put themselves without the pale of association with honorable business men whether electrical or non-electrical.

An Application of Electricity to the Bleaching of Oils and Fats.

It has recently been claimed that oils and fats may not only be bleached but sweetened and purified generally by treating them with an electric current. The system upon which this is effected is as follows: There is a tank divided into two parts by means of a porous partition; in one of the compartments thus formed is placed a solution of common salt at 8° Twaddell strength, and immersed in this solution is a carbon electrode. In the other compartment there is a mixture of the oil or fat with a similar salt solution, and immersed in the mixture is a copper electrode. A continuous electric current is then generated by means of a dynamo, the oil and salt solution being agitated by mechanical means at the same time.

A. I. E. E.

NIAGARA FALLS MEETING.

Preliminary Programme.

The General Meeting of the American Institute of Electrical Engineers will be held at the Cataract House, Niagara Falls, N. Y., beginning on Tuesday, June 25, at 10 A. M. and continuing four days. The following papers will be presented:

1. "The Substitution of Electricity for Steam in Railway Practice" (inaugural address), by the President, Dr. Louis Duncan, of Baltimore.
2. "Properties of Fuse Metals When Subjected to Short Circuits," by Walter E. Harrington, of Camden, N. J.
3. "Location of Grounds in Armatures, Fields, etc.," by Clarence E. Gifford, of Jamestown, N. Y.
4. "Some Features of Alternating Current Systems," by Chas. P. Steinmetz, of Schenectady, N. Y.
5. "Theory of General Alternating Current Transformer," by Chas. P. Steinmetz, of Schenectady, N. Y.
6. "Compounding Dynamos by Armature Reaction," by Elihu Thomson, of Lynn, Mass.
7. "Existing Commercial Applications of Electrical Power from Niagara Falls," by W. L. R. Emmet, of Schenectady, N. Y.
8. "Alternating Current Curves," by Dr. C. E. Emery, of New York.
9. "Electric Power in Factories," by Prof. Francis B. Crocker, Messrs. Benedikt and Ormsbee, of New York.
10. "Some Observations on a Direct Connected 300-Kilowatt Monocyclic Alternator," by Profs. Dugald C. Jackson and S. B. Fortenbaugh, of Madison, Wis.
11. "On Mechanical Models of the Electric Current," by Prof. Brown Ayres, of New Orleans, La.
12. "On the Cause of Death in Electric Shock," by Albert M. Bleile, M. D., of Columbus, O.
13. "Long-Distance Power Transmission at 10,000 Volts" (the Pomona plant), by George Herbert Winslow, of Pittsburg.
14. "Notes on the Reconstruction of a Small Central Station Plant," by Franklin Leonard Pope, of Great Barrington, Mass.
15. "On Rating the Performance of Electric Power Plants and Transmission of Varying Loads," by Prof. Wm. S. Aldrich, of Morgantown, W Va.
16. "Work of the Westinghouse Electric and Manufacturing Company for the Cataract Construction Company of New York," by L. B. Stillwell, of Pittsburg.

Among the objects of engineering interest which it is proposed to visit are the new works of the Niagara Falls Power Company, the Niagara Falls Park and River Railway on the Canadian side, the aluminum plant of the Pittsburg Reduction Company, the plant of the Carborundum Company, the central station of the Niagara Falls and Buffalo Electric Light and Power Company.

TRANSPORTATION.

The Convention rate of one and one-third fare for the trip has been granted by the Trunk Line Association, conditional upon an attendance of 100 members and guests.

Wherever the number warrants arrangements will be made for a special car. From New York City the following trains and routes are suggested:

New York Central, 1 P. M., June 24, single fare....	$9.25
West Shore, 6 P. M., June 24, single fare............	8.00
Lehigh Valley, 6 or 9 P. M., June 24, single fare....	8.00

Personal.

Mr. Stanley S. Stout, attorney for the Western Telephone Construction Company, Chicago, was in New York last week, returning home via Washington.

Mr. W. C. McKinlock, the genial secretary of the Metropolitan Electric Company, Chicago, has just returned from a Southern trip. He has secured some profitable orders and reports a decided improvement in business.

Recent Experiments on the Electric Discharge by Lord Armstrong.*

At the last conversazione of the Royal Society, Lord Armstrong exhibited on the lantern screen a remarkable series of photographs and dust figures produced by the action of very powerful electric discharges. Most of the effects were obtained by the use of a large multiple Wimshurst machine, having sixteen plates of 34 inches diameter, made by Newton & Company, and capable of giving a spark of about 17½ inches. The machine was fitted with two 10-gallon Leyden jars as condensers, and was found perfectly adapted for the purpose of the experiments. The photographs were mostly obtained by the well-known method of causing the discharge to pass over the surface of a photographic plate with which the electrodes had been placed in contact. The dust figures were produced by discharging on glass or metal plates over which had been sifted various more or less non-conducting powders, such as calcined magnesia mixed with carbon in the form of lampblack, tripoli powder and hard carbon reduced to a fine powder. We are able this week, by the courtesy of Lord Armstrong, to reproduce what appears to us some of the most suggestive figures. Many of the results obtained appear to be quite inexplicable; they are, therefore, all the more interesting to the electrical theorist, and no doubt when the true explanation is arrived at we shall have made a great advance in our knowledge of molecular physics and of the true nature of electricity.

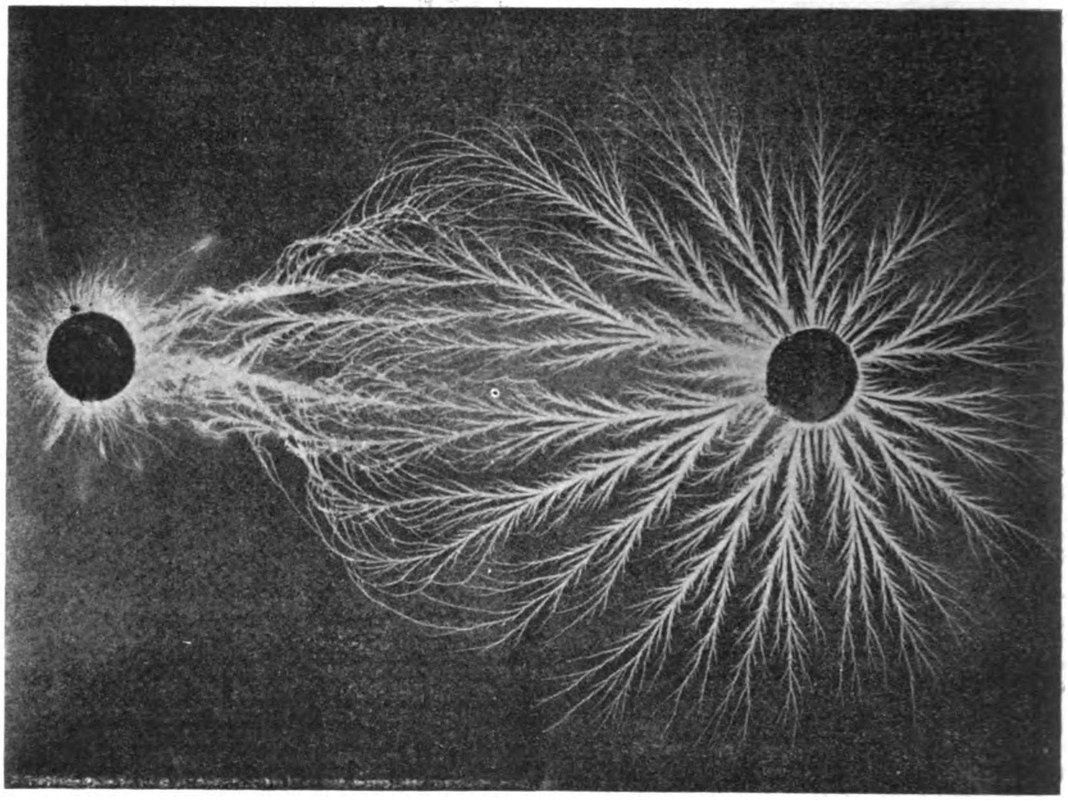

FIG. 1.

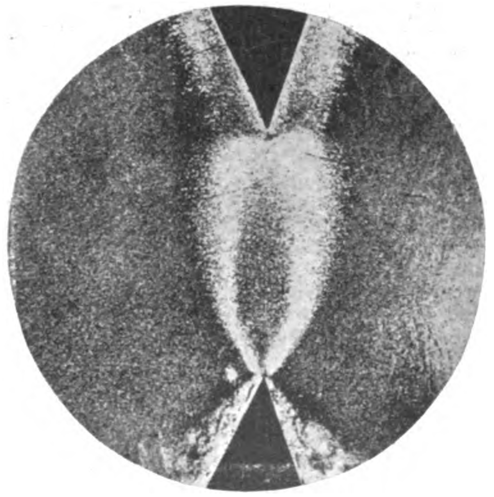

FIG. 2.

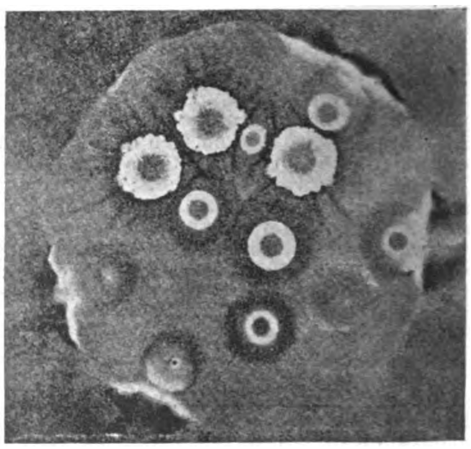

FIG. 3.

An exceedingly interesting experiment performed by Lord Armstrong in 1843, and repeated in an improved form before the Literary and Philosophical Society of Newcastle in 1893, appears to throw a good deal of light on some of the results shown in these figures. In the experiment as originally performed, two wine glasses were filled to the brim with chemically pure water, and the two glasses were connected by a cotton thread coiled up in one glass, and having its shorter end dipped into the other glass. On causing a strong current to pass across the moist thread from one glass to the other in the right direction, the coiled thread was rapidly drawn out of the vessel containing it and deposited wholly in the other, a rope of water being left suspended for a few seconds between the lips. In the improved form of the experiment shown in 1893, a glass bulb was used having a long neck on one side and a short nozzle on the other, the nozzle having an aperture of $\frac{1}{10}$th of an inch in diameter. Through this aperture a string composed of spongy cotton thread was passed. The string was barely sufficiently thick to fill the aperture, and was secured by a knot or otherwise to a conducting wire which entered the bulb through a cork at the top of the neck. The bulb was plunged into a glass cistern filled with distilled water, which was also allowed to fill the bulb. When a positive current was sent into the bulb, the water in the cistern being connected with the negative pole, the cotton was seen to climb up into the bulb, while a current of water could be seen flowing downwards out of the bulb all round the cotton. On reversing the current the movement of the cotton was reversed; the cotton always moved opposite to the conventional direction of the electric current, i. e , towards the positive pole.

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* From the *Electrical Review* (London.)

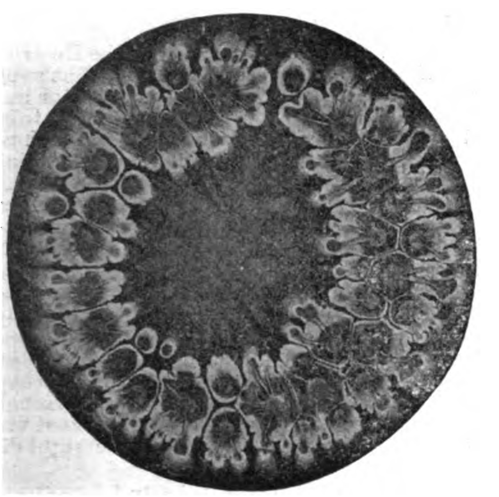

FIG. 4.

In many of the figures this tendency of the discharge from the positive pole to flow outside and encircle the discharge from the negative pole is shown in a remarkable manner. In the photograph Fig. 1, the branching discharge which radiates in all directions from the positive pole is seen to encircle the compact bundle of sparks proceeding from the negative pole. The way in which the terminations of the positive sparks bend towards the central negative current of sparks is especially noteworthy. The two currents acting together appear to be striving to form a kind of vortex ring. Lehmann has actually produced vortex rings by discharging from a pointed electrode in certain liquids. The dust figure (Fig. 2) shows very distinctly what appears to be a vortex ring or tube circulation between pointed electrodes. Fig. 3, which is produced, like the Kundt figures, by discharging upon a negative terminal coated with a film of dust, appears to show a section of the vortex tube circulation. As Lord Armstrong describes it, the effect resembles that which would be produced by sucking up a tube and blowing down the annular space surrounding it. The general shrinkage of the dust film and the breach of continuity at the margins is noteworthy; also the tendency to form separate craters representing the sections of the hypothetical vortex tubes. This tendency of the small craters to preserve their individuality is still more remarkably shown in Fig. 4, which represents a dust figure produced by a shower of negative lines discharged from a ring. The dust craters are crushed out of their natural circular form by overcrowding, but show no tendency to coalesce. Fig. 5, which is a dust figure formed by a spark, shows again the central circulation of the dust [from the negative to the positive pole, and the outer return current. Fig. 6 is a dust figure produced by the passage of a very powerful electric spark. The loose dust is swept off or thrown into confusion by the violence of the spark, but the finer particles adhere to the glass and retain the markings impressed upon them.

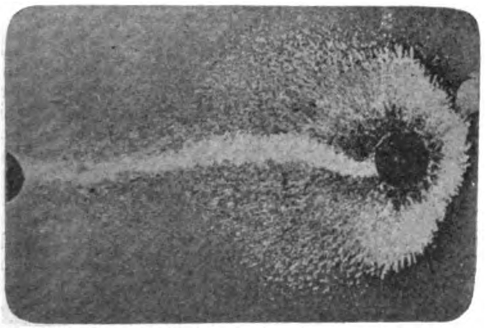

FIG. 5.

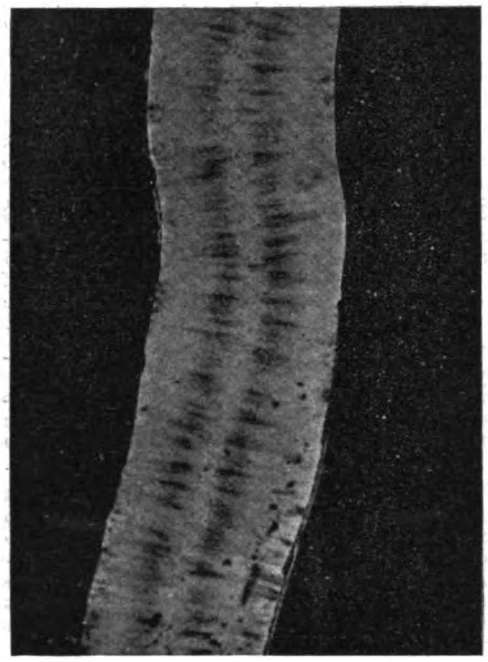

FIG. 6.

(*To be continued.*)

London Notes.

(From our Special London Correspondent.)

TELEGRAPHY BY INDUCTION.

Mr. W. H. Preece, C. B., F. R. S., has been lecturing in London on this subject. He said that the first induction experiments were made in 1884 by himself and Mr. Lindsay, on the astonishing fact that a message transmitted from the General Post Office, London, to Bradford by an overhead wire could be read through an underground wire by an operator in the telephone company's exchange room, also in London, although the two parallel wires were nowhere nearer together than eighty feet apart. This was the origin of the practical inquiries which, during the past ten years, had been carried out by the Post Office electrical department, and by which it had been fully proved that where parallel wires of considerable length can be isolated, messages can be carried across between them by the ether of space independent of weather. After referring to various successes secured, he dealt with the final practical success which was obtained in March of this year. The cable connecting the Isle of Mull with the mainland at Oban was broken, and before the cable ship came round to make repairs communication by induction was interpolated. The width of the channel at the points selected for inductive circuits varies from 1¼ to 2 miles. The distance between the overhead wire and the mainland is almost uniformly two miles. As there were no existing wires on the mainland parallel with the overhead wire, a gutta-percha insulated wire was laid along the ground from Morven in a northwesterly direction for about a mile and a half. It was earthed at Morven in a running stream a mile away from the sea, and at the other end it was earthed in the sea itself. The wire joined up for the inductive circuit was at first 12 miles, but the resistance of the circuit was too great, and a division was made at the point exactly opposite the termination of the Morven gutta-percha wire. Until this was done satisfactorily, communications could not be established. The traffic actually dealt with by this arrangement between March 30 and April 3 was 110 ordinary messages and one press message of 120 words. By this time the repairs of the cable were completed.

LEGAL NOTES.

Mr. J. H. Vail has been appointed receiver for the Electrical and Mechanical Engineering Company at 41 Cortlandt street. The liabilities are $26,441, and the nominal assets are $22,000, consisting of book accounts, accounts payable from contracts in process of completion, furniture and fixtures.

Ridsdale & Lewis, dealers in electrical apparatus at No. 59 Cortlandt street, have assigned to Edward Swann.

General News.

What is Going on in the Electrical World.

Rockwell City, Iowa.—There is talk here of getting electric lights.

Hamilton, Ont.—Tenders for lighting the city will be asked for at once.

Hull, Mass.—This city has voted to issue $60,000 five per cent. sinking fund electric light bonds.

Clyde, N. Y.—The Clyde Electric Light Works was damaged by fire on the 4th inst. to the extent of $1,000.

Lansing, Mich. —The Senate has passed a bill appropriating $25,000 for an electric light plant for the State University.

Sioux City, Iowa.—The big warehouse of the Sioux City Electric Light Company was entirely destroyed by fire a few days ago.

Union Springs, Ala.—The city council is considering a proposition from an electric light company to put in a system of arc lights.

Norwalk, O.—A proposition to have the city put in an electric light plant costing $25,000 is to be submitted to a vote of the people.

Clarksville, Tenn.—The Clarksville City Railway Company will purchase electrical equipments. Wm. Daniels president.

Gainesville, Ga.—D. E. Evans is interested in a company being organized to build an electric line in this city and suburbs.

Butte, Neb.—A project is on foot to secure the necessary capital for the construction of a trolley line between this place and Stuart.

Lake City, Minn.—Electric light bonds issued by this city to the amount of $6,000 have been sold to the Lake City Bank of Minnesota.

Woonsocket, R. I.—The machinery in the shoe factory to be erected here by Assemblyman Dulude will be operated by electric power.

Pottsville, Pa.—The county commissioners will visit the alms-house to arrange for the erection of a boiler-house and electric light plant.

Willmar, Minn.—The people of this place have voted to empower the city council to erect an electric light plant at a cost not to exceed $5,000.

Fort Madison, Ia.—J. C. Hubinger has petitioned the council for a franchise to operate an electric street railway on certain streets of this city.

Crockett, Tex.—The city council has granted to F. Lockfield, of Waco, Tex., a franchise to put in an electric lighting plant, to be in operation October 1.

Chicago.—The new electric elevated railroad is rendering satisfactory service. The Logan Square branch has been added to the portion already in operation.

Logansport, Ind.—Influential citizens of Burlington are trying to interest our capitalists in the projected electric railway to connect Burlington with Logansport.

Allegheny, Pa.—The Western Electric Company secured the lion's share in the awards for electrical supplies for the city, bids for which were opened a few days ago.

New Orleans, La.—The Canal and Claiborne Street Railway Company is preparing plans to change its line into an electric system. It has 18 miles of road.

Guthrie, Okla.—The Woodward Water, Heat and Power Company has been chartered here to put in a waterworks and electric light plant at Woodward. Capital stock, $25,000.

Fort Wayne, Ind.—A. B. White, of Fort Wayne, is interested in the project of building an electric railway in Fort Wayne, and in the town of New Haven, six miles distant.

North Hempstead, N. Y.—H. R. Newkirk, Benjamin Hicks and others have applied for a franchise to construct and operate an electric street railway at Great Neck, L. I.

Clarksville, Tenn.—The Clarksville Street Railway Company is prepared to receive proposals for machinery, cars, etc., for an electric railway. Wm. N. Daniel, president.

South Amboy, N. J.—Representatives of the proposed electric railway will apply to the mayor and council of South Amboy for a franchise to run the road through certain streets of the borough.

Spartanburg, S. C.—A scheme is being developed to connect this city with five or six contiguous factory towns by an electric railway. The leading business men are all favorable to the project.

Bellefontaine, O.—The city council has ordered that the clerk advertise for contracts to build the electric light plant, according to plans prepared by Mr. Roberts and adopted by the electric light committee.

Boston.—The change from steam to electricity on the Nantasket branch of the N. Y., N. H. and Hartford Railroad will be fully accomplished by the middle of June, when tests will be made of the new system.

Crisfield, Md.—Thomas H. Bock, of the firm of Cohn & Bock, flour and lumber manufacturers at Princess Anne, Md., proposes to construct an electric railway from Princess Anne to Deals Island, a distance of sixteen miles.

Newark, O.—The Citizens' Electric Light and Power Company has awarded the contract for the electrical apparatus to be used in the new plant here to the Westinghouse Electric and Manufacturing Company of Pittsburg.

Syracuse, N. Y.—The Syracuse Street Railroad Company has asked the highway commissioners for a franchise for a double track electric road from the southern limits of the village of Elmwood to Card's hotel at Onondaga Valley.

Montpelier, Ind.—The matter of building an electric railway to connect Hartford City, Ind., and Montpelier is being agitated. The line, if built, will be nine miles long. J. P. McGeath, of Hartford City, is one of the promoters.

Riverton, N. J.—The scheme for bonding the borough of Riverton for an electric light plant was revived at a meeting of council the other night, and a resolution adopted to carry the matter through the Supreme Court.

Hingham, Mass.—The franchise for the proposed electric street railroad through Hingham to the Hull line has been secured by Deacon Josiah Reed, of South Weymouth, and it is said that work will be commenced at once.

Pueblo, Col.—The Pueblo City Railroad is to be sold to satisfy a mortgage of $500,000, on an order made by Judge Halleck in the Federal Court. The property it is thought will be bid in by the General Electric Company.

Laporte, Ind.—The Michigan City and Laporte Electric Railway Company intends, if possible, to complete the building of their road this summer. Russell Harrison is supposed to have a controlling interest in the new company.

Greenbush, N. Y.—The trustees have deferred action on the application for a franchise of the Albany Railway until June 18. The railway company asked consent to construct and operate an electric street railroad on certain streets in Greenbush.

Macon, Ga.—The Consolidated Street Railway Company has asked the council for permission to erect poles on which to string wires for electric light and power circuits. The Macon Gas, Light and Water Company also intends to put in a power circuit.

Stoneham, Mass.—The plan for an electric street railway between Stoneham, Winchester and Arlington, which was agitated about a year ago, is being revived. Onslo Gilmor, of Stoneham, and A. D. Coehran, of Winchester, will be on the board of directors.

Tacoma, Wash.—The purchase of the Steilacoom electric line by the Tacoma Railway and Motor Company, of which Paul Schulze, now dead, was president, is being investigated, and the probability is that a separation of the two systems will result.

San Diego, Cal.—An electrical expert has been here figuring on the establishment of a plant to supply this city with electric power, which is to be secured from a waterfall on the flume line, about twenty miles from the city. About two thousand horse-power will be generated.

Richmond, Va.—The committee on light of the common council has been instructed to secure plans and specifications for the erection of an electric plant of a capacity of 600 arc lights of 1,200 candle-power each, and to inquire into the cost of maintaining the same.

Jacksonville, Fla.—T. J. Appleyard, secretary of the Senate, who is interested in the Jacksonville and Tampa Bay Improved Railway Company, has been invited to meet his associates in Cincinnati to arrange plans for the construction of the road. It is to be operated by electricity.

Buffalo, N. Y.—Mayor Jewett has given his consent to the project of Alonzo C. Mather to put up an experimental plant of his invention to develop electric power from a system of turbines in the Niagara River. The Legislature granted Mr. Mather this privilege at its last session.

Brooklyn, N. Y.—A route for an electric railway to connect Brooklyn with Far Rockaway has been surveyed and the directors have decided to go ahead with the work of buying the right of way. The road will be a one-track one in which the Boynton bicycle car with several improvements will be run.

Montgomery, Ala.—Judge Arrington of the city court has rendered a decree ordering the foreclosure of the mortgage on the West End and Riverside Electric Street Railway Company in favor of the State Trust Company of New York, which is trustee for most of the $100,000 bonds.

St. Louis.—The work of surveying the proposed route for the electric railway from Carondelet through St. Louis County to Morse's Mills, in Jefferson County, a distance of 40 miles, has begun. It is to be an extension of the Southern Electric, and will be known as the St. Louis and Fenton Railway Company.

Los Angeles, Cal.—A new electric light plant is proposed for the city hall and jail. About 500 lights are necessary.—The Board of Works recommends that the city clerk advertise an ordinance for the construction and operation of an electric road running from Eighth to Hill, to Sixteenth, to Figueroa streets.

Youngstown, O.—Harold & Co., of Pittsburg, have been awarded the contract for an electric road between Youngstown and Lauterman's Falls. Grant Hamilton and Henry Hamilton are arranging to build an electric railway from Youngstown to Poland, O., and through the coal fields of North Lima.

Peoria, Ill.—J. Frank Aldrich has asked the city council for a thirty-year franchise for electric lighting. The Peoria General Electric Company, now supplying the city with light, has been conducting its business since the expiration of the Jenney Electric Light and Power Company's franchise, without any tangible authority from the city.

Mauch Chunk, Pa.—The Inter County Electric Railway Company, which built six or seven miles of track without having properly secured the right of way, has gone into the hands of a receiver, and the court has ordered a sale of the property and franchise of the company at Tamaqua on the 18th inst.

Niagara Falls.—At a recent meeting of the directors of the Niagara Falls Power Company the following officers were elected: President and chief-engineer, D. Coleman Sellers; first vice-president, Benjamin Flagler; second vice-president, Charles Sweet; treasurer, Edmund S. Wheeler; secretary, J. S. Milner.

Rochester, N. Y.—The Rochester Trust and Safe Deposit Company has commenced action to foreclose the $60,000 first mortgage bonds on the Glen Haven Railroad. The attempt at the reorganization of the road by the holders of the second mortgage bonds was a failure, and no effort will probably be made to resist the present action.

Milwaukee, Wis.—The election for officers of the Milwaukee and Waukesha Railroad Company resulted as follows: President, J. W. Bingham; vice-president, C. Pittelkow; treasurer, Jacob Wellauer; secretary, A. B. Myers. The directors are the above-named officers and James Petley, Max Rosenthal, S. I. Henderson, A. Schneider and J. J. Considine, the latter two being from Waukesha.

Beatrice, Neb.—The property of the Beatrice Rapid Transit and Power Company, consisting of the electric light plant, six miles of motor line in operation, etc., all appraised at $37,000, is to be sold at public auction by order of the U. S. Circuit Court, on July 8, in this city. Pending the action of the court the property has been controlled and operated by M. C Steele as receiver, and has earned sufficient to pay all running expenses.

Quebec, Can.—Mayor Parent declined to entertain the protest of a delegation of carriage-makers, blacksmiths and hackmen of this city against the construction of the proposed electric railway; they objected that it would ruin their business. The mayor pointed out that the ancient capital had already suffered enough through its reputation for backwardness, and that it was time to take a new departure in the right direction.

Forestville, Conn.—The Liberty Light Company has bought the Laporte-Hubbell shop in this place and will manufacture the electric light head cap invented by E. D. Rockwell. This is a cap with an electric light on it which is run by batteries carried in the wearer's pocket. With Mr. Rockwell will be associated Mr. Rodrigues, of New York, who will look after the electrical department, and C. A. Treadwell, who will have charge of the machine shop.

Keokuk, Iowa.—The council has been authorized by a vote of the people to establish a municipal electric lighting plant in this city and to make a contract with the Des Moines Rapid Power Company to aid in the development of the great natural water power of the Mississippi at this point. By this contract the power company must develop within a year not less than 15,000 electrical horse power. The probable capacity of the plant will be double that figure. The lowest estimate for the cost of developing this power is $500,000.

Charleston, S. C.—There seems to be no doubt now that this city is to have an electric railway system, as the $5,000 forfeit has been deposited by the men who have been negotiating for the purchase of the City Railway with the intention of changing its motive power to electricity. The men named in connection with the purchase are John B. Hoelgen and Edgar C. Maxham, of Brooklyn, N. Y. The property will be transferrred to the new owners about the middle of July.

Newark, N. J.—The People's Light and Power Company has purchased a controlling interest in the Newark Electric Light and Power Company, and intends to engage in the electric lighting business throughout the State by transmitting current from a great central plant which will be established probably in this city. The authorized capital of the People's Company is $2,000,000.—The first trolley-car from Newark to Elizabeth and over the track of the Consolidated Traction Company in Elizabeth was run on the 3d inst.

Brazil, Ind.—The Brazil Block Coal Company have placed the Jeffreys electric mining machines in their No. 1 mine. They have purchased a dynamo, and besides mining coal by electricity will illuminate the entire mine in this manner. It is presumed that one of these machines, operated by two men, will mine thirty-five tons of coal a day, which would represent the work of twelve skilled miners by the old process. It is the company's intention, should this experiment prove successful, to replace pick mining in all their mines with electric machines.

Little Rock, Ark.—Judge Williams, of the Federal Court, has confirmed the sale of the Capital and City Electric Street Railways to Henry C. Haarstick, of St. Louis, who is trustee. The sale took place last month; $630,000 was the purchase price. The syndicate for which Mr. Haarstick acted in the matter is said to be composed principally of the United Electric Securities Company of Boston and the General Electric Company of New York, and some other capitalists. A new company has been organized to operate the roads under the name of the Little Rock Traction and Electric Company.

Pittsburg, Pa—The Braddock Street Electric Company expects to have its line in operation early in August after a suspension of several years.—The Coraopolis, Sewickley and Economy Electric Road has been organized and will at once start to build a road to Beaver. The officers of the new road are as follows: C. I. McDonald, of Pittsburg, president; Simon Harold, Beaver Falls, vice-president; Geo. A. Lashell, secretary; W. T. Treadway, solicitor; C. I. McDonald, J. C. Whitla, Simon Harrold, John S. Duss, J. A. Ferguson, George A. Lashell and J. W. Arras, directors. The capital stock is $150,000.

San Francisco, Cal.—An electric belt railway system is being urged by leading men of Sonoma and Napa, by which those valleys would be brought within easy reach of San Francisco. Starting at Santa Rosa an electric line will run down the two valleys—one going by Petaluma and Lakeville to the mouth of Petaluma Creek, the other running down Sonoma avenue to Kenwood, Glen Ellen, Sonoma and Shellville. At the latter point the road will connect with an electric road from Calistoga, St. Helena and Napa; thence running along the foothills to a junction with the Santa Rosa and Petaluma electric road, and so on to the mouth of Petaluma creek, to connect with the fast ferry service from San Francisco.

Camden, N. J.—The Pennsylvania Railroad officials have been prosecuting investigations along their lines centering in Camden, looking for the possible equipment of some of them with electricity.—An experimental run on the new electric road built by the Pennsylvania Railroad Company between Mount Holly and Burlington was made last week and the results attained were highly satisfactory to the president and other officials of the company. With the machinery new the trial run lacked some of the elements necessary for furnishing reliable data, but sufficient is gleaned to show that the days of steam on railroads are looked upon as numbered. The road is finished for five of the seven miles between the two cities.

Baltimore, Md.—Gen. Joseph B. Seth, Chas. Dorsey and Dr. J. C. Monmonnier, as a committee of the recently incorporated Gwynn's Falls Electric Railway Co., will make an examination of the various routes suggested for the line between Wetheredsville, Powhatan and Baltimore, and report the one best adapted. The directors of the company have decided that the proposed bicycle system would not be practicable and a regular trolley line will be constructed.—Sealed proposals will be received by the "Construction Committee of the Underground System of the Police and Fire-Alarm Telegraph and Police Patrol" until 12 o'clock noon Thursday, June 20, 1895, for the construction of about 45,000 feet of electrical subway conduits, in accordance with drawings and specifications prepared by the engineer, Nicholas S. Hull, Jr., 508 Equitable Building, Baltimore.

New York.—For the proposed underground railway systems for rapid transit in this city Chief Engineer William B. Parsons has suggested to the Rapid Transit Commissioners the running of trains of not more than three light, roomy cars, running at half minute intervals, with stations at about every four blocks for general service, and for express trains he recommends trains of five or six cars, stopping not oftener than once every mile and a half, the motive power to be electricity. The electrical system suggested is the use of electric motors placed under the regular cars, these being at the head of each train, in the same manner as that employed by the Intramural Railway at Chicago, the Liverpool overhead road and the West Side elevated system in Chicago.—The Kings, Queens and Suffolk Company, 106 and 108 Fulton street, New York, organized to build the new electric railroad on Long Island, calls attention of contractors to the enterprise and requests those who may be interested or would like information concerning it to apply at the company's office for particulars necessary to a thorough understanding of the contemplated work preparatory to the making of bids.—The Edison Electric Illuminating Company of New York has mortgaged to the State Trust Company as trustee all its property rights and franchises for a period of 100 years in the sum of $15,000,000.

Telephone and Telegraph.

B. M. Wilson, of Dawson, Ga., has begun the erection of a telephone system in Union Springs, Ala.

Manager George Durant of the Bell Telephone Company at St. Louis says the company is going to improve its system there at once and will replace the old instruments with telephones used on the metallic wire system.

The Hudson River Telephone Company and the Capital District Telegraph Company, at Albany, N. Y., are to consolidate.

The Telephone and Electric Specialty Company, Memphis, Tenn., doing a general electric business in the Southern States, has recently completed several large telephone installations. Exchanges have been established at Jonesboro and Arkadelphia, Ark.; Water Valley, Miss., and Tallahassee, Fla., all of which are in successful operation. The patrons are highly pleased with the new service as are also those for whom this company has installed a large number of private telephone lines.

The St. Louis Telephone Company, which has asked for a franchise for a single wire telephone system, promises strong competition for the Bell Telephone Company in St. Louis. The new company was organized early in April and has among its stockholders J. A. J. Schultz of the Schultz Belting Company, August H. Busch and E. W. Stamm of the Anheuser-Busch Brewing Association, Moses Greenwood, Jr., Col. Jos. M. O'Shea, Andrew Haley, Thos. J. Ward, Chas. F. Joy, T. J. Hennessy, Clark H. Sampson, Selden Spencer and others. The ordinance granting the new company the right to lay conduits underground has passed a second reading in the council.

The Southwestern Telegraph and Telephone Company at Austin, Tex., has completed its system to Waco, Corsicana, Fort Worth, Dallas, Sherman, Denison, Paris and other north Texas points.

If the Lansing Telephone Company can get a franchise a new telephone exchange will be in operation at the capital of Michigan shortly after July 1. D. A. Reynolds is at the head of the enterprise and has contracts for 310 telephones.

The Railway Telegraphers at their late convention did not decide the question of a location for the headquarters of the organization, but referred the matter to W. V. Powell, the grand chief; J. R. T. Austin, the grand secretary, and the executive committee of the order. This is presumed to be a favorable disposition of the matter for Peoria, Ill.

The common council of Binghamton, N. Y., has received the committee report favoring the granting of a telephone franchise to C. F. Hotchkiss provided he accepts the conditions.

The Oshkosh Northwestern Telephone Company, capitalized at $20,000, is going to put in an exchange at Oshkosh, Wis., without reference to the Berliner decision. J. H. Jenkins and Chas. Schriber are leading stockholders.

V. J. Mayo, an electrical engineer from New York, has arrived in Sacramento, Cal., whither he went for the purpose of putting into operation the works of the Columbia Telephone Company, recently formed by citizens. The engineer says that Sacramento will have complete metallic circuit 'phones which will insure the very best service.

C. J. Willow, the president of the recently organized Wizard Telephone Company at Council Bluffs, Iowa, has got himself into trouble by purchasing material on promises that he could not fulfil. He is now in jail, has tendered his resignation and releases all his interests to Eli Brown, who will pay off all attachments, and put the company on its feet. Whether the company will continue operations yet remains to be seen.

The Schuylkill Telephone Company of Ashland, Pa., has been granted a charter. Its capital is $25,000.

A dispatch from Mitchell, S. D., says: "The largest local telephone enterprise now under consideration in South Dakota is for a line from here to Sioux City. A company has been organized to construct a line connecting Mitchell with Sioux Falls and Sioux City, Iowa, together with all points en route. The right of way will be secured at once and the construction begun on the first telephone line of any importance in South Dakota. Should the investment prove successful, the line will be extended through to the Black Hills. The instruments to be used are of the latest long distance pattern."

The Plymouth Rock Telephone Company (capital $75,000) of Plymouth, Massachusetts, has secured a franchise covering Plymouth, Middleboro, Eddyville, Kingston, Carver, North Carver, South Carver, Rock, South Middleboro and North Middleboro. The company will start in with 523 subscribers at $24 per year for places of business, $18 per year for residences and $12 per year on three party line contracts. Mr. John Boyle O'Brien, attorney, 53 State street, Boston, promoted the enterprise.

A universal cipher code for use in cable messages has just been completed by experts at Berne, Switzerland, who have labored nearly five years on its compilation. The work was authorized by the Paris Convention of telegraphers in 1890. The new code comprises 250,000 words distinctly different from each other and none containing more than ten letters. It will be adopted by all European countries as soon as arrangements are completed for its use, and in a few years will probably become the cable language of the entire world.

The Delaware Telephone Company has been organized at Wilmington. Capital stock, $100,000. Directors: J. Wilson Gooch, Anson A. Maher, Mark M. Cleaver and others.

The Central New York Telephone Company is having subways laid in Utica for its wires. Engineer Wyman of Boston has charge of the work.

Burlington, Iowa, promises to be as great a center for telephone as it is for telegraph lines. The *Hawk-Eye* predicts that "before the year expires Burlingtonians can talk with Chicagoans and New Yorkers in their native jungles."

A new telephone company is being organized at Melrose, Mass., and it has asked the selectmen for permission to erect poles and string wires through the town. It agrees, if it can obtain 100 subscribers, to establish a local exchange, and will cut the prices to about half the present rates. A number of business men are interested in the new company.

Alexander T. Brown, of Syracuse, N. Y., has received letters patent on a new system of electrical exchanges for telephone and telegraph service. Telephone subscribers, instead of calling up the central office, may by this system call each other direct.

Some late telephone devices patented by Daniel Drawbaugh will be controlled by C. W. Ream, of Reading, Pa., and G. Milton Bair, of Hanover, who, if sufficient inducement is offered, intend to establish a large telephone factory at Reading. There is to be a capitalization of $1,000,000, under the name of "The Drawbaugh Telephone and Electrical Company."

Aberdeen, Miss., will soon be supplied with a telephone system by the Aberdeen Telephone Company. Hugh Campbell, superintendent of the Hope Compress, is the owner of the system. He has secured a franchise from the town for a period of twenty-five years.

The construction of the Interstate Telephone Company's line in Frederick City, Md., is being rapidly completed. The exchange will soon be in working order. Long-distance telephones will be placed at the service of the business houses. The company are extending their lines to many cities of the South.

The Home Telephone Company of Baltimore has closed contracts with 3,2[illegible]0 subscribers in that city. The Chesapeake and Potomac Telephone Company, the local Bell concern, has less than 2,400 subscribers, and has charged $125 per year. The new company is making three-year contracts at $36 and $48 per year.

The Erie County Pharmaceutical Association at a recent meeting in Buffalo, N. Y., adopted the following resolution: "That this association go on record as favoring the new Automatic Telephone Company and also urge its members to subscribe for their service."

The Hogan National Telephone Company, of Chicago, has submitted a proposition to business men of Spring Valley, Minn., that if 50 subscribers can be obtained and a franchise is granted it will put in a system.

The Topeka Telephone and Electrical Company, successors to the Harrison Telephone Company at Topeka, Kan., has filed its charter. The capital stock is increased from $25,000 to $100,000 and the directors of the new organization are as follows: A. K. Rodgers, S. J. Bear, C. E. Tomlinson, A. P. Jetmore, E. H. Crosby and Simon Greenspan. The new company starts out with a bona fide list of over 400 telephones now in active operation and has orders for over 150 more which will be put in during the next thirty days. It is organized as a Topeka company and the capital stock is all owned in that city.

COMMERCIAL PARAGRAPHS.

The Cincinnati Edison Company have just placed an order for four more 80-light Standard arc dynamos and Standard lamps. After the severe tests given the thirty-two 50-light Standard arc machines previously purchased, and the remarkable record made by the machines in the matter of no repairs to speak of, it must certainly be gratifying to the Standard Electric Company to receive so plain a proof of the advisability of using only Standard apparatus.

The C. W. Hunt Company, 45 Broadway, N. Y., has issued a booklet on "Industrial Railways" which every street railway and electric light manager needs to have on his desk.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Atlantic City, N. J.—An ordinance introduced in council providing for city hall to cost not over $100,000.

Atchison, Kan.—Plans preparing for a court house.

Dover, Del.—Architect Frank R. Carswell has been engaged to make plans for a new State Library to be erected here.

Erie, Pa.—The new Schlosser block is to contain a public hall.

Leadville, Col.—A residence to cost $100,000, by John F. Campion of the gold mine "Little Johnnie."

Malden, Mass.—Y. M. C. A. building, cornerstone laid. Information of ex-Alderman Jesse Cadworth.

New Castle, Pa.—Architect Cyrus T. Dean, Erie, Pa., is preparing plans for a theater to be built here at a cost of $40,000.

New York City.—Ten story building for offices and lofts at 11 West 28th st., Architects Barrey and Chapman.—Flats and Apartments: 7 five story, 7th ave. between 146th and 147th sts., Architect G. A. Schellenger, 120 Broadway; 6 five story, 114th st. west of 8th ave., Architects A. B. Ogden & Son, 1031 Madison ave; seven story, south side of 34th st., west of Lexington ave., Architects Hogan, Slattery & Co., 105th st. and West End ave.; 4 five story, northwest cor. Madison ave. and 101st st., Architect John C. Burne, 201 East 86th st.; 4 five story, north side of 84th st., east of Amsterdam ave., Architect John De Hart; 4 four story, north side of 148th st., east of Bergen ave., Architects Neville & Bagge; 4 five story, south side of 63d st., east of 11th ave., Architect Frederick H. Kurtz; six story flat, southeast cor. of Stanton and Willett sts., by Fay & Stacom, 387 Pleasant ave.; five story, cor. Water and Scammell sts., by Joseph Fisher, 26 Scammell st.; five story, 80th st., east of Amsterdam ave., by Adler & Co.; six story, north side of 11th st., by John B. Cole, of the Hotel Majestic; 5 five story, north side of 112th st., west of Amsterdam ave.; 4 five story, Amsterdam ave and 108th st., by Judson S. Todd, 28 East 28th st.; 2 five story, 329 West 53d st., by Fisher & Peck, 66 East 66th st.; 2 seven story, northeast cor. Madison ave. and 87th st., Architect Thos. Graham, 309 East 43d st.; five story, 852 1st ave., Architect Thos. Graham; five story, east side of 3d ave., north of Grove st., Architect Henry Anderson; five story, northeast cor. Amsterdam ave. and 123d st., Architect W. J. Fryer; 5 five story, south side of 112th st., east of 5th ave., Architects Neville & Bagge, 227 West 127th st.; 4 four story, 108th st., east of Bergen ave., by Elizabeth M. Barry, 1669 Boston ave.; four story, 170th st. and Vanderbilt ave., by Thomas Faning; 4 three story, 119th st., west of Lenox ave., by Wm. H Jacob, 16 East 43d st.; 3 five story and basement, north side of 83d st., west of Lexington ave., by F. L. Kurtz; seven story flat, southeast cor. of 5th ave. and 118th st., also 2 five story south side of 118th st. and 5th ave., by Byrdie M. Spence, 442 Central Park West; 2 five story, south side of 65th st., west of Central Park, by Mary M. Stewart, 131 Columbus ave.; four story, south side of 151st st., west of Cortland ave., by Henry Ewald, East 151st st.; five story and basement, south side of 75th st., east of Park ave., by Henry O. Havemeyer, of Greenwich, Conn.; seven story, west side of Amsterdam ave., south of 103d st., by Henry G. Marshall, 101 West 81st st.; 4 five story, 286 Willis ave., by G. S. and H. S. Boehm; 3 five story, north side of 80th st., west of Columbus ave., by Wm. Drought; 4 five story and basement, south side of 63d st., west of 11th ave., by James D. Putnam; ten story and basement, at 75th st. and Columbus ave., by C. H. Merriman, of Oakdale Station, Long Island; five story, southwest cor. Madison ave. and 118th st., by Schreiver & Fennell 110 West 131st st.; seven story, northwest cor. 69th st. and Central Park West, Architect George Keister, 1286 Broadway; 14 five story, north side 2d ave., east of Ave. A, by Timothy Donovan, 322 West 40th st.—The Pierrepont residence at 103 5th ave., has been sold by Jacob Hirsch to a builder, who will erect a high office building on the site.

Pittsburg, Pa.—Architects Barthberger & Guss have prepared plans for a club house to be erected in Oakmont Square.—John C. Holmes has had plans prepared for a high-class residence on Braddock Terrace.—A five story annex to the structure occupied by Cruikshank Bros. & Co., to be equipped with suitable machinery.

Quincy, Mass—New court house for the County of Norfolk, to cost $70,000.

Richmond, Va.—Plans have been drawn by Capt. M. J. Dimmick for a building for the R. E. Lee Camp Confederate Veterans, to be heated by steam and lighted by gas and electricity.

St. Paul, Minn.—Plans have been prepared for the Senate Lodge, to contain lodge room, bowling alley, gymnasium, billiard room, hall, etc.; building committee: E. L. Tryer, R. C. Hine, R. B. Ware.

Titusville, Pa.—State Hospital for the insane.

Washington, D. C.—The Senate Committee on Rules has been called to meet for the purpose of considering various questions affecting the Senate, the most important of which are the proper ventilation of the Senate Chamber and the lighting of the Senate wing of the Capitol.

INCORPORATIONS.

The Batesville and Oldenburg Railroad and Electric Company, Batesville, Ind. Capital stock, $50,000. Promoters: Kendal M. Hord, Bellamy S. Sitton, Ed. K. Adams, Jonas Joseph, Shelbyville, Ind.; John Hilderbrand, Batesville.

The Battle Mountain Heat, Light and Power Company, Victor, Col.—to manufacture and furnish gas and electric light to town of Victor and vicinity. Capital stock, $500,000. Promoters: James F. Burns, James Doyle, F. M. Reardon, J. B. Cunningham, Victor, Col.

The Negley Street Railway Company, Pittsburg, Pa.—to build an electric street railway in the City of Pittsburg. Capital stock, $6,000. Promoters: W. B. Rhodes and Joshua Rhodes, Allegheny; Wm. H. Latshaw, Pittsburg.

The Gross Street Railway Company, Pittsburg, Pa.—to build an electric street railway in the City of Pittsburg. Capital stock, $6,000 Promoters: W. B. Rhodes and Joshua Rhodes, Allegheny; Wm. H. Latshaw, Pittsburg.

The Milwaukee Electric Manufacturing Company, Milwaukee, Wis.—to manufacture and deal in electrical supplies and machinery. Capital stock, $8,000. Promoters: J. E. McKivitt, M. Weisser, J. C. Schmitt, Milwaukee.

The Ives Land Company, Seattle, Wash.—to plat lands and town sites and deal in same; operate railways, water works, electric and gas works, mills, etc. Capital stock, $40,000. Promoters: A. H. Gamel, W. G. Tanner, J. G. McFee, E. F. Sweeney, H. C. Henry.

The Oakley and Cincinnati Street Railroad Company, Cincinnati, Ohio—to construct, maintain and operate a street railroad line from Oakley into Cincinnati. Capital stock, $10,000. Promoters: R. J. H. Archiable, John Rempe, H. P. Sabbert, Edwin E. Schneider.

The Canales Trolley Company, Springfield, Ill.—to obtain from Frank Wm. Canales, of Portland, all the patent rights for the United States for trolleys and all improvements thereof; own, manufacture, buy and operate inventions relating to trolleys and all machinery. Capital stock, $100,000. Promoters: Adam M. Ross, Frank W. Canales, T. Henry Pearse.

The Globe Electrical Company, Detroit, Mich.—to manufacture and sell electric dynamos, motors, etc. Capital stock, $10,000. Promoters: Will H. Palmer, Scott H. Morris, Friend Palmer, Detroit.

The Charleston Electric Company, Charleston, Ill.—to manufacture and deal in telephone, light, heat and power and street railway apparatus and supplies, and construct light, heat and power plants. Capital stock, $5,000. Promoters: Richard Cadle, Frank C. Brooks, Wm. A. Highland.

The Dallas City Street Railway Company, Dallas, Tex.—to construct and maintain street railways in Dallas to be operated either by horse, electric or cable power. Capital stock, $500,000. Promoters: Frank Clark, Baltimore, Md.; G. L. Blackford, Denison, Tex.; J. L. Sale, Dallas, Tex

The Phœnix City Railway Company, Phœnix City, Ala. Capital stock, $30,000. Directors: J. F. Flourney, J. Wainright, L. F. Garrard, H. F. Effing and others.

The West End Electric Light and Power Company, West Hazleton, Pa. Capital stock, $10,000.

The East Lorain Street Railroad Company, Lorain, Ohio—to construct, own and operate street railroads in village and county of Lorain, and in Cuyahoga County, electricity or other motive power to be used in operation; to supply electric light, heat and power. Capital stock, $25,000. Promoters: William J. Garone, Wm. McReynolds, John W. McReynolds, John A. Park, Lorain; Edward S. Meyer, Cleveland, O.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JUNE, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.50 P. M.	2	3.30 A. M.
2	......	..	......
3	1.00 A. M.	3	3.40 A. M.
4	1.10 "	4	3.40 "
5	1.40 "	5	3.40 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	8.00 P. M.	9	11.00 P. M.
10	8.00 "	10	11.30 "
11	8.00 "	11	11.50 "
12	8.00 "	13	12.20 A. M.
13	8.00 "	14	12.40 "
14	8.00 "	15	1.00 "
15	8.00 "	16	1.20 "
16	8.00 "	17	1.30 "
17	8.00 "	18	2.00 "
18	8.00 "	19	2.30 "
19	8.00 "	20	3.00 "
20	8.00 "	21	3.40 "
21	8.00 "	22	3.40 "
22	8.00 "	23	3.40 "
23	8.00 "	24	3.40 "
24	8.00 "	25	3.40 "
25	9.00 "	26	3.40 "
26	9.30 "	27	3.40 "
27	10.00 "	28	3.40 "
28	10.30 "	29	3.40 "
29	11.00 "	30	3.40 "
30	11.30 "	July 1	3.40 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JUNE 4, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

540,305. Closed-Conduit Electric Railway. Michael F. Flynn, Stamford, Conn. Filed July 28, 1894.

540,340. Trolley-Pole With Locking-Wheels. Thomas Thompson, Newark, N. J. Filed Oct. 29, 1894.

540,486. Trolley for Electric Railways. Theophile Euphrat, Darien, Conn. Filed March 5, 1895.

540,487. Ice-Detaching Trolley for Electric Railways. Theophile Euphrat, Darien, Conn. Filed March 22, 1895.

540,569. Conduit Electric-Railway System. Charles M. Allen, San Francisco, Cal. Filed Oct. 3, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

540,333. Electric-Arc Lamp and Carbon. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed Oct. 13, 1894.

540,404. Electric-Arc Lamp. Henry Radcliffe, Milwaukee, Wis., assignor of three-fourths to Thomas K. Creighton and John C. Sundin, same place. Filed March 19, 1895.

DYNAMO ELECTRIC MACHINERY.

540,351. Dynamo-Electric Machine. George De Camp, St. Louis, Mo., assignor to the Atwood Electric Company, same place. Filed Sept. 24, 1894.

540,456. Electric Motor. Frederick Pearce, New York, N. Y. Filed Dec. 3, 1890.

TELEPHONE AND TELEGRAPH APPARATUS.

540,239. Telephone System. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Feb. 21, 1895.

540,477. Telegraphy. Cyprien R. J. Willot, Paris, France. Filed April 24, 1894.

MISCELLANEOUS.

540,244. Electric Heater. Edward E. Gold, New York, N. Y. Filed Jan. 29, 1895.

540,323. Electromagnetic Winding. Osborn P. Loomis, Bound Brook, N. J., and Charles A. Pierce, Lynn, Mass. Filed March 9, 1895.

540,325. Electric Trolley for Canal-Boats. Alonzo C. Mather, Chicago, Ill. Filed Dec. 1, 1893. Renewed May 3, 1895.

540,341. Electric Burglar-Alarm. James Tomney, New York, N. Y. Filed May 2, 1892.

540,358. Electric Switch. John O. Heinze, Jr., Lynn, Mass. Filed Dec. 4, 1894.

540,366. Can-Heading Machine. Henry Schaake, San Francisco, Cal. Filed April 24, 1894.

540,398. Electric Heater. John E. Meek, Denver, Col., assignor to the H. W. Johns Manufacturing Company, New York, N. Y. Filed Feb. 5, 1894.

540,422. Signal-Transmitting Apparatus and System. Henry A. Chase, Boston, Mass., assignor by mesne assignments, to the Metropolitan Duplex Fire and Police Signal Company, Portland, Me. Filed Sept. 1 1892.

540,463. Electric Gas-Lighter. George W. Shepherd, Philadelphia, Pa. Filed March 13, 1895.

540,480. Apparatus for Use with Electrically-Illuminated Signs or Advertisements. Ernest L. Berry and Frederick Harrison, London, England. Filed Nov. 21, 1894.

540,529. Electrically-Controlled Speaking-Tube. George S. Williamson, McKeesport, Pa. Filed Feb. 18, 1895.

540,540. Underground Electrical Conductor and Method of Manufacturing Same. John H. Croskey and Joseph Locke, Pittsburg, Pa. Filed Jan. 17, 1895.

540,557. Electric Regulator. James McKim, Weir, Kans. Filed Sept. 12, 1892.

540,606. Apparatus for Electrically Purifying Water. George M. Collier and Richard T. Detlefs, Cleveland, Ohio. Filed Nov. 10, 1894.

RE-ISSUE.

11,498. Electrical Signaling System. Bradley A. Fiske, U. S. Navy. Filed Feb. 16, 1895. Original No. 527,958, dated Oct. 23, 1894.

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There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

EDITORIAL NOTES.

The Duty and Responsibility of a Trade Paper.

In our issue of June 5 we endeavored to awaken some of our contemporaries to a sense of their duty to the trade at large, and to stir the consciences of some of their managers and editors by reminding them of their responsibility to the general public. We hoped by calling attention in a somewhat forcible manner to their failure to do their duty to the very large number of independent concerns counted among their advertising clients, and also by pointing out that they, recognized as mediums for the circulation of reliable electrical news among the general public, had never uttered a word of caution, or even remotely suggested that much of the electrical business of the country was in the hands of a class of people not only utterly indifferent to the true interests of the investor, but actually engaged in deliberately fleecing investors on a scale the like of which has never been equalled in the history of the world.

When the present management of ELECTRICITY first entered the field of electrical journalism, three years ago, we were led to believe that the electrical industry of this country rested upon an adamantine foundation, and that those companies which were fortunate enough to have at their disposal the inventive genius, constructive ability and high technical knowledge needed to invent and develop the machinery, apparatus and appliances used in the industry, and possessed of sufficient capital to carry on its manufacture on the scale demanded in the new and rapidly developing art, were indeed to be envied, because had the business management been such as to have properly protected the investors in the stocks of the corporations engaged in the business, the legitimate returns from the business would have been greater than in any other business that we know of.

We confess that when we first entered the field of electrical journalism we had no special training or previous experience fitting us specially to speak authoritatively on the many complex questions met with in the development of the machinery and apparatus used in the art, but in this respect we believe we can safely lay claim to having been on a par with any of our contemporaries when they first entered the same field, which was but a few years before the date of our entry.

Our interest, however, had long before been raised, and our imagination and expectations been excited to pretty much the same pitch as that of the general public by the novelty and utility of the results achieved by the electric light and power transmission branches of the business, and the many sensational stories which had appeared from time to time in the technical and daily press concerning the future possible developments of the art had borne our hopes and expectations upward to a very great extent, but not beyond that which we felt was already justified by the apparently successful and important work and the results already achieved.

The future seemed indeed most bright and promising, and no matter how sanguine our hopes may have been, it nevertheless seemed incredible that they could exceed the bounds of the possible, and it seemed almost foolhardy for anyone to fix any limits to the development of the useful and beneficial applications of that truly wonderful and most mysterious power, Electricity.

With closer contact with the electrical field, however, we began to hear rumors of a kind which seriously disturbed the roseate views we shared in common with most of the public. These rumors were so startling and discordant that at first we were disposed to credit them to that class of persons who might properly be called pessimists and cranks, and to believe that the ideas embodied in the rumors were the product of diseased imaginations or disordered stomachs, and at first we were disposed to pay but little attention to them.

Constant and widening contact with the trade, however, gradually convinced us that there was much of truth in these rumors, and as our knowledge of the trade increased we were reluctantly compelled to believe that the worst rumors we had heard were nothing but slight reverberations from the outer boundaries of a field the interior of which was carefully concealed from the public view, but which little by little was exposed to our vision. The glimpses we first caught of this interior were of a kind which raised in us a feeling of discouragement and disgust, but closer study of the situation induced us to still more thoroughly explore this carefully concealed region, known only to and fully understood by comparatively few people, but which certainly should and must have been understood by our older contemporaries, whether their journalistic methods were infantile or archaic. With the knowledge accumulated during our investigations there was developed in us a strong spirit of revolt against the barefaced rascality discovered, and we became thoroughly convinced that we could not be true to ourselves, honest to the trade or to the general public, by pretending not to perceive the forces acting to bring the industry to ruin and disgrace.

We believe that we now fully understand the condition of the electrical trade as it exists in this country to-day, and moreover we have at present such a complete knowledge of the history of the art and of the doings of the managers of the various corporations formerly and now engaged in it as to fully qualify us to deal with the subject in an authoritative manner, and to entitle our opinions in the matter to the consideration and respect of the trade and the general public.

It was this complete knowledge of the history of the art and the doings of the managers of the corporations engaged in it that led us to clearly comprehend the fact that the solid foundation upon which we had at first supposed the industry to rest did not exist at all, and to perceive that in place thereof there did exist a condition of affairs most sad to behold and fraught with the greatest danger to the best interests of the trade and of the public; and we believe that our contemporaries had sufficient knowledge of the matter to enable them to see the situation from the same standpoint as we did. Instead of a solid industry resting upon a sure foundation, we found a most unstable one, the foundations of which were honeycombed in every direction by fraud, misrepresentation and mismanagement.

And an industry which should have been a benefit and a blessing to the country, and a source of immense profit to all those engaged in it and to investors, has been converted into an injury and a curse to nearly all except a few unprincipled people at the head of the affairs of most of the larger corporations engaged in it.

We are not of those who believe that the industry cannot be rescued from its present perilous position, nor are we to be counted among those who believe that by a policy of shutting our eyes to the facts, sealing our mouths against the utterance of the truth for the purposes of temporary gain or profit, these conditions will remedy themselves. Indeed, common honesty demanded that every paper supported by the trade should long ago have vigorously attacked the management of the corporations doing business by the methods too commonly practised in the electrical field, and done all in their power to assist in eradicating the evils existing in it.

Throughout the length and breadth of this land there is abundant evidence almost daily presented to the technical electrical press to give an idea of the immense losses inflicted upon confiding investors in electrical enterprises and convince any reasonable person that the shameful financiering schemes of some of the unprincipled men engaged in this business have been the bane of the trade. For scarcely a day passes but that one or more of the corporations, the stocks and bonds of which have been to a greater or lesser extent foisted upon the investing public, goes into the hands of a receiver, and a reorganization and scaling down of the capital of the wrecked concerns become necessary.

In the columns of this journal during the past three years we have repeatedly in a general way called attention to the financial methods employed by the managers of the Thomson-Houston Company and the General Electric Company, and in our last issue we presented a specific instance, accompanied with documentary proof of the correctness of our charges.

The Milwaukee Street Railway system, which some time ago defaulted in paying the interest upon its bonds, and has recently passed into the hands of a receiver, is another instance. In next week's paper we shall give a list of street railway companies, the stock or bonds, or both, of which are included in the assets of the General Electric Company in its recent annual report, which shows that out of 40 companies financed by the T.-H. method 25 are in the hands of receivers. In view of these facts, can there longer be any doubt about the correctness of our views and opinions as expressed from time to time in the columns of this journal? If so we shall soon present to our readers such an exposé of the rascally financiering methods employed in this business, accompanied by documentary proof, as will convince even the most sceptical of our readers that we are right.

We know that our policy of vigorously attacking and showing up these methods has not been publicly approved by any of our contemporaries; and many engaged in the industry, whose interests *appeared* to be injuriously affected, have not only disapproved of our course, but have roundly abused us and charged us with improper motives, and some few persons have even gone so far as to call us blackmailers. But all this must come to every newspaper that tells the truth.

Reforms are at first generally unpopular, and reformers must be prepared to stand more than ordinary abuse. We did not enter upon this campaign without an appreciation of what it meant in contumely, misrepresentation, abuse and danger to ourselves. We knew that we must sacrifice the support of many engaged in the trade and the aid of some of those writers who have been of material service to our contemporaries like the *Electrical World*, the *Electrical Engineer*, the *Western Electrician*, and in earlier days to the *Electrical Review*.

We think we may justly claim that we have not lacked the courage to express our convictions, and we are sure that our course was justified by the circumstances.

For we believed that even a trade paper owed certain duties to the trade and had responsibilities to the general public which it ought not to shirk for reasons based solely upon temporary gain or sentiment.

But our campaign is not yet finished, and will not be until we have accomplished our purpose.

We reprint elsewhere from our contemporary, the *Electrical Review*, of June 12, some comments on our campaign which need a wider circulation than they can have in that paper.

It seems scarcely credible that any person engaged in the field of electrical journalism, possessing even a modicum of common sense or honor, could descend to such a depth of dishonor and pettifoggery as to pen such lines. But since it has been done we propose to analyze the misstatements made and to expose the attempt to dodge the issues presented in the editorial on page 1 of our issue of June 5.

If any contradiction of the first statement of the *Electrical Review* concerning our flagging of vigor in this campaign is needed, we point to our article on the Tacoma Street Railway swindle in our last issue.

The efforts we have made to regulate the electrical universe, or more truthfully that part of it in the United States, are on record, as are also the results of those efforts, and those who think at all admit that ELECTRICITY has been a stronger force since 1892 than all other electrical journals combined.

We have no lack of appreciation to complain of. On the contrary, ELECTRICITY has constantly grown in strength and influence, is a paying property, and is recognized in this country and in Europe as the representative of all that is best in the trade on this side of the Atlantic.

We did not start out to kill any company. We did start out to kill corrupt and dishonest methods in the management of corporate affairs in our trade, and to assist the honest stockholders in protecting their own rights. We shall succeed fully. The signs are already in evidence.

We are not chagrined to find the G. E Company "growing in strength," but we *are chagrined* to find any newspaper in the world indulging in such reckless untruth as to suggest that this company *is* "growing in strength." According to the G. E. Company's own reports, parts of which the *Review* has printed, a surplus of $9,300,000 on June 1, 1892, has changed into a deficit of $14,300,000 on January 31, 1895, the stock has fallen from 119⅞ to about 33, the preferred stock and bonds are both selling twenty points below their former quotations. Is this growing in strength?

We never aimed to drive any of our contemporaries off the face of the earth. We have use for them all, and will yet compel them to play a part in our campaign for truth and justice. From their decrease in business, however, averaging from 8 to 20 pages, we fear they are driving themselves off the earth by not protecting their own clients.

If the *Review* honestly regrets that the electro-medical frauds still thrive, why does it not make an effort to expose them?

Infantile disappointments are as nothing compared with those of old age. The former, easily forgotten in the brighter and more engaging hopes for the future, may be buried any hour under the realization of noble deeds achieved with advancing strength. But the journal which arrives at its zenith, passes it, declines and is confronted with actual dissolution, with the terrible knowledge that it has not for one single issue been true to its mission, that its death is not an accident but a deserved fate—this journal, we hold, must feel disappointment bitterly.

There is no doubt that Mr. Price and our other contemporaries would miss us, would chortle in their joy if we were gone. But we are not going. Oh, no.

We have no intention of retiring "from a cruel and unappreciative field." From the record of failures in the past three years it looks very much as though the field were "retiring" faster than ELECTRICITY.

As to our "own reform" we do not see how perfection itself can be reformed. Seriously, if there are any specific faults in the policy pursued by this paper, we would esteem it a favor to have them pointed out in detail by any or all of our contemporaries. We welcome criticism even from weak-minded journals like the *Electrical Review*.

It is not at all strange that the *Electrical Review* should be the first to writhe and squirm at the presentation of facts which it cannot deny and which are particularly well understood in its own office, for the *Review* itself has been from the start conducted in almost the same manner as the larger electrical companies. It has been a veritable graveyard for invested capital.

When the paper was first started there were four companies struggling for supremacy, each one of them trying to kill the rest—the Brush, Edison, United States and Weston companies. From these concerns the paper extracted large amounts of money without any equivalent return. The publisher was the intermediary, going from one company to the other and working "deals" for consolidations and for other purposes. His idea was to *get money*, no matter whether it was earned or not. The "entertainment" idea, which was the stock in trade of the electric light boomers from Boston, was worked to its full limit by the publisher of the *Review*, and some of his bills for these extravagancies are yet unpaid. Stock in the enterprise was sold without regard to the chances of the investor for getting any return. Mr. A. J. Dam put $12,000 into it, none of which ever came back. The entire career of the paper has been stained by exactly the same methods, the same peculiar theories of business, which have made the general electrical business what it is to day.

Most of the offences and derelictions charged against the *Review* can be laid with equal justice at the doors of all the other journals. They have never risen to the height demanded of them by the untoward conditions developing even in 1880. They have never tried to educate the public, to give correct information. They have never dared to criticise any concern who had advertising patronage to bestow. Holding out their hands to beg patronage and support from the independent element, they used all the abilities possessed by them, every week, to strengthen those corporations which were endeavoring by every means, honest or dishonest, to drive the legitimate workers out. The only object of these papers has been to draw from the plunderers as large a share of the plunder as possible. Their share of this plunder has been the consideration received for concealing the truth, even for printing directly misleading statements.

We have now heard from one of our contemporaries in "answer" to our strictures upon them for their total lack of honor, the utter absence of any endeavor to do their duty by the trade which gave them birth. We would now like to hear from the rest.

The best answer they can make is not to deny the truth or indulge in vaporings like those of the *Review*, but to mend their ways, and turn in now, though late, to do their duty by their constituents and drive out the rascals and their accursed methods from this trade.

At present these papers are as far from what trade papers ought to be as the poles are from the equator.

* * *

Electrical Transmission of Power.

Under date of May 28th one of our subscribers makes the following inquiry, the answer to which we believe will be of such general interest that we publish the letter in full, omitting only the post office and name of our correspondent:

To the Editor of ELECTRICITY.

Dear Sir: As one of your subscribers I wish to inquire in regard to the transmission of power. We are in negotiation for a water power on the Susquehanna River, six miles distant, as our coal bills up here are excessive. We note in your paper of May 22d, in regard to the Niagara enterprise, that there is a great loss of power in transmission. As we have only six miles to overcome, can you give us an approximation of percentage of loss by the best of the present methods, and much oblige

Yours very respectfully,

B.

As regards the question of whether or not it would pay to transmit power from a distant waterfall to compete with locally generated steam power, the local conditions are so controlling that it is impossible, without knowing them all, to give in any case a categorical answer, even when the distances involved are given as in this case. Water powers as sources of energy for electrical transmission are often held out as enticing investments, and on the assumption that they cost nothing to develop are placed in a false light which has led many to regret their connection with schemes of this kind. On the other hand, well considered projects of this kind offer abundant opportunities for safe and profitable investment, and there are doubtless hundreds of legitimate enterprises of this kind already under way or projected, and it is to these that we point in pride as we do to many others with chagrin.

In the first place, assuming that the water power is ample and constant, it must be borne in mind that the interest on the investment required to develop that power, plus the interest on the transmission plant, plus the cost of maintenance of the water power and transmission plant, must be *less* than the cost of coal required to generate the same power locally. That is to say, the fixed charges on the improvement which renders the water power available stand in lieu of the fuel bill which the new undertaking is intended to replace. This brings into the question the cost of locally generated steam power. It will be perfectly evident that with coal at $2 a ton we could not afford to invest as much money in a water power development as we could if the latter were to compete with coal that cost $10 or $20 per ton. It might easily be that the interest on the cost of developing a water power at our very doors would equal or exceed the cost of steam-generated power at the same place, and this would be so if coal, labor and other local supplies were exceedingly cheap. It would be folly in such a case to go to a distant waterfall unless the cost for development of the latter were so much less than the cost for development of the local water power that with the added cost of transmission the power could still be delivered more cheaply than it could be produced for locally by steam or other means. On the other hand, in localities such as many of our Western mining districts, where coal is very dear, labor high, and where all supplies are hard to get, either on account of the distance from the railroad or difficulties of transportation, a large investment in water power, even at a very great distance, would be fully warranted and pay handsomely. Thus it will appear that mere distance, or mere cost of coal, or mere cost of developing and transmitting the power does not settle the question so often asked.

If locally produced power is cheap, then the transmitted power must be cheaper to compete with it, and this means that the investment required to render the distant source of energy available must be such that the fixed charges will not exceed the cost of coal locally delivered, in lieu of which they stand.

In estimating the fixed charges on a hydraulic plant, great care should be taken not to underestimate them, and it is just here where so many promising enterprises of this kind are wrecked. In a hydraulic plant it is usually necessary to plan on a much larger scale than needed for present requirements. That is to say, if you have a fall capable of developing say 10,000 H. P. and the present demand is only for 1,000 H. P. it is seldom feasible to develop the water power for the smaller amount and then add to it as the market for power increases. The dam required for the smaller demand would cost nearly or quite as much as that required for the full 10,000 H. P., and the result is that an investment is made at once which is nearly or quite adequate to the development of the larger amount. The fixed charges on this investment must be distributed among 1,000 H. P. instead of 10,000 H. P. as usually calculated. When divided among the full capacity of the plant these fixed charges may be very small, and seem to indicate a judicious investment, whereas if divided among one-tenth the amount, or the amount actually used, they may be prohibitive.

Then again, the load factor at the consuming end of the line is an equally important factor often not considered. Supposing the consumer uses the 1,000 H. P. but half or one-third the time, then the fixed charges, which seemed small when divided among the total capacity of the plant, become multiplied again by 2 or 3. These are features of the situation which must all be considered, but which, in embryo undertakings, are most apt to be entirely overlooked or given insufficient weight.

Our correspondent refers to our remarks in a previous issue on the Niagara Falls transmission scheme. This in our opinion forms a most noteworthy illustration of the features above referred to.

In order to get power at all the Niagara engineers felt compelled to dig a long tunnel capable of acting as a raceway for 100,000 H. P. The cost of the tunnel, the wheelpits and other structures already completed has already mounted up into the millions. We have heard it estimated as high as $10,000,000. Suppose it is only half of this, the interest on this investment at 6 per cent. will be $300,000—these are the fixed charges for the *undeveloped* power. Dividing this by the total capacity of the tunnel makes the very reasonable fixed charge per annual H. P. of $3. But the company have not yet sold 25,000 H. P. If they had, then the $3 would become $12. Coal at $2 per ton would be cheaper. Supposing the customer has to pay a fixed charge of $12 per H. P. and is entitled to use it twenty-four hours a day 365 days in the year, but uses it only on an average of 9.6 hours per day, which is better than most of our electric light stations are doing to-day, the fixed charges at once become $30 by reason of a 40 per cent. load factor.

There are two conditions surrounding the Niagara project which are exceedingly unfavorable to its success as a business enterprise. The first is that its product must compete in one of the very cheapest steam power markets in the world, and second, that by the plan of development adopted the investment is so enormous that the fixed charges per H. P. must be exorbitant until the sale of power is large enough to bring it down to reasonable figures.

In regard to our correspondent's last inquiry as to the loss of power in transmission, the reply is that that can be made anything we choose. By simply increasing the electromotive force sufficiently high we may reduce the line losses to a negligible figure. Where very high potentials are involved there will be a saving in copper or in line losses, but there will be some additional charges for insulation against these higher voltages, and if step-up and step-down transformers are used additional losses will be introduced, but in a given case where the voltage is fixed there will be one permissible loss in transmission which will give the best results, and that is determined by the cost of energy produced and the cost of copper. According to Sir William Thompson's law the most economical loss in transmission is that in which the value of the H. P. lost annually is just equal to the interest on the investment in the copper in the line.

We give below the available data of several of the most important American transmission schemes:

Concord.—Two 250 K. W., 3-phase; 2,500 volts step-down transformation to 110 volts; distance of transmission, 4 miles; steam coal at point of delivery, $4.25 to $4.50 per ton.

Sacramento.—Four 750 K. W., 3-phase; 11,000 volts step-up and step-down; distance of transmission, 20 miles; competes with steam coal at $8 per ton.

Redlands.—Two 250 K. W., 3-phase; 2,500 volts step-down to 110 volts; 1st circuit, 4½ miles, 150 K. W.; 2d circuit, 7½ miles, 100 K. W.; competes with coal from Sydney, Australia, costing delivered $8 to $9 per ton.

Telluride.—3,000 volts; transmission, 8 miles; competes with soft lump coal costing in Telluride $10 to $12, hard coal about $2.50 more; no data as to cost of coal delivered at the Virginius mine; longest transmission (Ophir loop to Tomboy mine), about 16 miles; E. M. F. at motor terminals, 3,000 volts; competes with coal at Tomboy mine costing prices quoted above at Telluride plus cost of delivery at mine, which is $10 to $12 additional.

Niagara to Buffalo.—Distance about 20 miles; competes with coal at $1.50 to $2 per ton.

It may be well at this point for us to define distinctly our position in regard to water power electric transmissions, since we have been accused in some quarters of hostility to enterprises of this kind. The electrical industry has been crippled by the repeated failures of dishonest or ill-judged schemes in the past. So called friends of the electrical industry, as well as dishonest schemers, have foisted upon the public so many commercially impossible projects that electrical investments have become generally regarded with suspicion. No class of schemes are more enticing than water power schemes, and none lend themselves to deception so readily as these. The idea that water power costs nothing is the seed from which a harvest is expected, but from which disappointment is sure. It is part of our province to spread an early frost on these budding schemes. On the other hand, there are already many well-planned and successful installations of this kind in operation, and there will be and should be many more if we can ward off the blight which the ill-judged or dishonest schemes, if matured, are sure to bring upon the industry. To all legitimate engineering enterprises of this kind ELECTRICITY will lend its most efficient aid and encouragement. To those which are bound to be failures before they are born, we pledge, in the interests of the industry, our most active opposition.

* * *

IT IS with some regret, but less surprise, we learn that in the recent contest between Paris and Bordeaux for carriages without horses, irrespective of other power used, the electrical carriages were defeated. A gasoline motor won, not only the first prize, but the second, third and fourth, making the distance of 750 miles in 48 hours.

* * *

Cause and Effect. The fact that speculators and schemers, without any praiseworthy intentions as to the building up of a solid industry, have taken all but complete possession of this trade from the beginning is on record. It is an important part of ELECTRICITY's mission to point out just as many of the causes for this condition as possible in order that sooner or later the evil features may be eliminated as fully as possible.

One of the most potent reasons for the success of the schemers has been the lack of knowledge on the part of the public—even the intelligent public—in regard to electrical matters generally; and the prime cause of this ignorance, almost as evident to-day as in 1882, has been the misinformation given out in the daily press, tacitly submitted to if not directly inspired by men of considerable ability and knowledge—conspicuously by Edison himself.

The early New York *Herald* articles, in which it was claimed that Edison had "solved the problem," that "gas was to be driven out," that "a 16 C. P. lamp can be maintained at a cost of not over 16 cents per annum," did almost as much to injure the honest manufacturing industry as Edison's splendid inventive work did to promote it.

The same causes are working to-day. In a recent issue of the New York *Herald* was a half-column article on the work of Mr. D. McFarlan Moore with startling headlines as follows:

TO MAKE LIGHT WITHOUT HEAT.

D. McFarlan Moore Claims to Have Made a Discovery that Will Revolutionize Illumination.

WILL BE SOLD IN STICKS.

These Can Be Carried Around by the Owner, Who Can Press a Button and Get a Light.

JUST LIKE A GLOWWORM.

The same week the New York *Recorder* had a two-column article headed as follows:

IS HE A SECOND EDISON?

Herbert E. Rider's Electrical Inventions Are Attracting the Attention of Scientists.

HE EXPLAINS HIS EARTH-MAGNETO.

A Talk About His Underground Trolley, Steam and Heating Inventions, and His Plan for Harnessing the Power of the Ocean—A Brother of Maud May Rider.

Mr. Moore is a reputable electrical worker of some standing. He is endeavoring to produce something useful. We think his actual work is on the wrong lines, but give him full credit for attempting to do something for the public good.

Mr. Rider is a bald swindler, and the earth-magneto has been sufficiently exposed in these columns.

Yet how closely similar are the advertising methods employed by both.

The evil effects of the nonsense in regard to Moore's work in the *Herald* are made particularly evident by the way the *Herald* matter has been copied all over the country. A few days later a New Haven paper said editorially:

> A New York company is arranging to bring bottled lightning to everybody's door. Stored electricity will be delivered fresh every morning just as the milkman delivers the milk. This will supply electricity for cooking, for lighting where only a few lights are desired, for running sewing machines, and the like.
>
> There is nothing chimerical in this. The company will generate the electricity, fill the jars and deliver them as easily as the electric fluid is delivered by wires.

Thousands of people have been led to believe that this scheme is *practical.* Pennock and other miracle claimers are thus helped to sell more stock, and doubtless within a few months stock in this "bottled electricity" company will be offered for sale and find purchasers.

Does this sort of thing benefit the art? Does it benefit the public? Does it benefit those engaged in it? We think not.

Under the Searchlight.

Views and Opinions on Timely Topics.

Professor John Poo-Bah Barrett and His "Electrical Journal."

We closed an article on John P. Barrett's new newspaper enterprise in our issue of June 5th by saying that if there were anything in his past history to denote that it would have any effect on him we might make a few remarks upon the propriety of J. P. Barrett, holding the official position he does, engaging in the newspaper business. It might interest our readers, however, to know that Prof. John Poo-Bah's energies are directed in many lines, which will probably explain also the amount of the snug sum which the enterprising Professor has saved out of a small yearly salary.

In Feburary, 1892, Banks Cregier and S. H. Hayden brought suit against J. P. Barrett, alleging crookedness. This matter was fully ventilated at that time in the Chicago newspapers, but the suit was finally dropped, as we understand, for the reason that the two parties came to an amicable settlement.

We quote from an article published in the Chicago *Tribune* February, 24th, 1892, the following:

> In defiance of the rules and law governing such cases, said Barrett has for years been employed and engaged in other occupations and business requiring his personal attention. Some of these are "The Police Telephone and Signal Company," "The Chicago and Proviso Electric Railway Company," "The Cobb Vulcanite Wire Company," "The Electrical Reminder Company" and the "World's Columbian Exposition Company," from which latter corporation alone he receives a salary of $5,000, and from the others considerable amounts, all of which are exclusive of the sum of $4,000 which he draws from the city of Chicago for his services as superintendent of city telegraph.
>
> It is claimed that for this reason Mr. Barrett must be considered as having resigned his office and that his salary from the city ought to be withheld.

Our readers will probably think that this should be enough for a man who holds the responsible position of City Electrician for the city of Chicago, but John showed his fine commercial instinct and fine Italian hand by fortifying his position for many years in a rather ingenious way.

About ten years ago, when electrical installations were very few and far between, John saw a chance for his life. A city ordinance was passed organizing what is known to-day as the Electrical Inspection Department of the city of Chicago, each consumer to pay the trifling sum of $1.00 per electrical horse power for the plant inspected.

This money, of course, was paid to the city of Chicago, but the more income the more inspectors, which latter of course were appointed by John; hence, the more inspectors the more political friends to give a job to and the more pull.

John, of course, with his usual generosity, discriminated a little in favor of some of the larger corporations and his particular friends; in one case, for instance, a company paid $150 a month as inspection fees no matter what electrical horse-power was involved.

As a matter of fact, there is to-day in the city of Chicago a very efficient inspecting department organized and operated by the Board of Fire Underwriters which does not charge anything for inspection. The underwriters, of course, are the parties mainly interested as to fire risks, and the inspection of City Inspector has dwindled down to a farce. The city's inspection department is kept up by John for the income derived therefrom and for his own political friends.

As a matter of fact, if one compares the rules and requirements of the Chicago Fire Underwriters' Association, adopted September 14, 1893, and the rules and requirements of the Chicago Fire Department, adopted January 15, 1894, he will find one almost a verbatim copy of the other.

Another new departure was John's organization of the fake which is now known as the National School of Electricity and which was made the subject of a good many of our editorials.

But the Professor is very inventive and ingenious, and after having the school fake fairly started, a city ordinance was passed by which electrical workers in Chicago had to go to John for a license. The license could be obtained by anyone who could show his former experience or education, and the diploma of any certain high-grade schools (of course including the National School of Electricity) was sufficient to obtain this license.

So it will be seen that in the natural progress of evolution John had finally to have his own electrical organ to more fully and comprehensively teach his well-known business methods and electrical systems, and generally convey his talents to the large number of so-called students in the National School of Electricity and, incidentally, of course, get from the (not any more unsuspecting) public a few advertisements at the cheapest rates—no ad., no business—"Dr." Hornsby, of course, keeping up the supply of suckers—excuse us, we meant students—by paying to his "agents" $5 a head for every new acquisition.

We understand that the new Mayor of the city of Chicago, with the aid of the Civic Federation, has been trying to clean the city of Chicago, both literally and otherwise. Might we draw the attention of W. F. Baker, the president of the Civic Federation of Chicago, to the above subject. We think the investigations he might set on foot would keep him busy for a few months to come.

(*To be continued.*)

* * *

The Brush Works.

The Cleveland papers are somewhat inclined to doubt the correctness of the late news published in these columns in regard to the closing of the Brush works. They have no trouble in bolstering up the perfectly proper hope of Cleveland people that the works will not be moved by printing interviews with various people who "think they would know if any such plan were on foot." We don't think; we just know. The *Plaindealer* says:

> The matter was investigated by the Cleveland papers, and Mr. S. M. Hamilton, one of the officers of the company said that if the Brush works were to be closed he had not heard of it.
>
> The renewal of the assertion by ELECTRICITY that the works were to be removed practically gainsays the sincerity of Mr. Hamilton's declaration that the works were not to be closed. Mr. Hamilton was out of the city yesterday and Mr. C. F. Brush was shown the clipping from ELECTRICITY.
>
> "The man who wrote this," said Mr. Brush, "must be a sorehead. Although I am not connected with the company at present, it is hardly probable that the works would be closed and removed to Schenectady, N. Y., without my knowing something about the change. As far as I know the works are not going to be moved or closed, and as I said, if they were I would probably have received some intimation of the change."

Mr. Brush *is* out of the company, and has no knowledge whatever of what goes on at 44 Broad street. Mr. Smedberg would lose his job if he told the truth, and Mr. S. M. Hamill is an artist in the use of words. By the by, how strange it is that a man of Sam Hamill's abilities and attainments should be referred to by a reporter in his own town as Mr. S. M. Hamilton. Until the Cleveland papers know the name of their own leading citizens they had better not pretend to know much about matters happening 500 miles from home.

* * *

No Change in G. E. Officers.

The G. E. directors met on May 14 and re-elected the previous officers, adding the name of E. W. Rice, Jr., as third vice-president. The Coffinesque method of building railroads in the wilderness and in towns of 50 inhabitants, taking the bonds at 60 and selling them in Boston at 70 or 80, seems to be satisfactory to H. L. Higginson, J. P. Morgan and the rest of the board.

* * *

Congratulations Are in Order and Extended.

The following handsomely engraved card contains an announcement that will please a host of electrical men both in and out of electrical journalism:

> Mr. and Mrs. Samuel Faulkner invite you to be present at the marriage of their daughter Lucretia to Mr. Frank Loney Perry, Thursday evening, June 27th, at 8 o'clock, First Presbyterian Church, Chicago.

Mr. Perry has long been connected in an editorial and business capacity with the *Western Electrician*, and has in this way and through his many brilliant and venturesome reportorial exploits become widely known in electrical circles. One of his most thrilling experiences was in the maiden trip of a submarine boat in the Detroit River which he described most graphically in his own paper and elsewhere. A man who will voluntarily incur the unknown dangers of such a trip is not the one to flinch at a matrimonial venture, and we are only surprised that he has deferred the step so long.

This announcement is only another illustration of the force of good example. The head of the paper which Mr. Perry has served so long set the example but a short time ago, and the contagion has been spreading ever since until all his associates, with (we are sorry to say) one exception which shall be nameless, have been afflicted in like manner. The *Western Electrician* has been improved with each addition to the lady members of its staff, and we look for another improvement immediately after June 27th.

ELECTRICITY extends congratulations to Mr. Perry upon this his latest evidence of enterprise.

TWO VIEWS.

"ELECTRICITY'S" EFFORTS TO PURIFY THE TRADE SEEN FROM DIFFERENT STANDPOINTS.

Mr. C. W. Price, Editor of a Subsidized and Guilty Contemporary, Sees One Side.

(From the Electrical Review, June 12.)

Our spurty little contemporary, ELECTRICITY, is evidently tired. Its efforts to regulate the universe have wofully failed. It has commenced to scold and whine over lack of appreciation. It started out to kill the General Electric Co., the American Bell Telephone Co. and a few other companies (non-patrons), and is sorely chagrined to find them alive and growing in strength; besides, a few of its slow-going contemporaries were to be driven off of the face of the earth, and numerous individuals were ground to pieces by its disjointed pen (in its mind). Several electro-medical schemers and quacks were "exposed"—and are doing a bigger business now than before, which we all regret. These little disappointments often happen to infantile journalism. We shall miss our erratic and ill-advised, but seldom dull, little half-brother, if it is going to give up the fight and retire from a cruel and unappreciative field. Perhaps, however, its cries of disappointment mean the beginning of its own reform—although this thought requires an unparalleled stretch of the imagination.

A Reputable Manufacturer, Who Has Experienced the Injustice We Inveigh Against, Sees the Other.

To the Editor of ELECTRICITY.

DEAR SIR: Permit me to congratulate you on the articles contained in your last issue under date of June 5, particularly the editorial entitled "Where the Responsibility Lies" and your analysis of the "Pennock Electric System."

Your editorial analysis of the financial condition of the electrical trade is correct, as many others beside myself can well testify. Having been for several years secretary and treasurer of the —— Company, I was compelled to meet the very difficulties you enumerate, namely, the problem of either manufacturing and selling electrical apparatus at less than cost, closing down the works and waiting for trade conditions to improve, or obtaining sufficient capital to enable our company to at least control the market.

The policy of selling apparatus at less than the cost of manufacture is suicidal to any concern, and the second proposition of remaining idle until times improved was impracticable, as there seems to be no tendency on the part of the larger manufacturers to permit improvement in the electrical trade itself. The third alternative, of interesting a large amount of additional capital, was also impracticable, as your article demonstrates. There was therefore no option except of going into voluntary liquidation while still solvent and placing the assets in the hands of an assignee that they might be disposed of as a whole or in fragments as circumstances would dictate. I have no doubt you could find dozens of manufacturing concerns whose experience has been practically identical with the above.

I sincerely trust you will continue your present policy of placing the blame for existing conditions in the electrical field where it properly belongs and will further continue to expose electrical fakes, which are now, as they always have been, very much in evidence, and which have assisted in discouraging capital from investments in legitimate enterprise. Continue to publish a paper edited by the editors and not by the advertisers and you will be rendering the electrical fraternity the best possible service. I remain very truly yours, S.

Philadelphia, June 10, 1895.

* * *

DR. ADAMS'S AIR LINE.

Who Are the Bankers?

They May Pay Their Forfeits Out of the $9,000,000 On Hand.

Dr. Wellington Adams, head of the electric railway to be run from St. Louis to Chicago, says: "We have been detained in the construction of our road by the panic of the last two years and were hitherto unable to place bonds. We hear from our bankers in Chicago, who were to place the bonds, that they now have $9,000,000 raised, leaving only $1,000,000 to be raised. These are under a constant monthly forfeiture and this will cause them to expedite matters as much as possible. I am very confident that we will soon resume work."

* * *

The Backers are Responsible.

(From the Financial News.)

That is, in accordance with the known principle of equity, we must advise our readers to let that General Electric stock severely alone. Neither buy it, nor sell it short until the company makes a "sworn" statement of its affairs. It has *robbed hundreds of men, and its backers should be held responsible.*

DESERVING OF SUPPORT.

To the Editor of ELECTRICITY.

DEAR SIR: I have read the copies of your paper with much interest, but none so much as the issue of June 5. Your editorial in this number on "The Telephone Situation" is from the shoulder. For speaking out against such powerful corporations you deserve the support of all fair-minded and unbiased people.

JAS. D. RANDALL, Mgr.,
Telephone and Electric Specialty Company.
Memphis, Tenn., June 8, 1895.

* * *

We shall welcome Messrs. Armington & Sims into full-fledged membership in the electrical manufacturing industry. If they make as good dynamos as they have engines they will find a place to sell them at a good profit. There are still purchasers who want the best.

* * *

The controversy between our contemporaries as to which is the oldest may have its serious side. The oldest one is the guiltiest one, and upon it may be first laid the heavy hand of vengeance.

Personal.

Mr. John Starr, one of the leading men in the trade in Canada, was in New York last week. Mr. Starr sold the first T.-H. apparatus in France, and is now a general dealer in supplies at Halifax.

Mr. Hugh H. Harrison has joined Mr. R. B. Corey in the selling agency of Bergmann and Knight arc lamps. Mr. Harrison is one of the most popular young men in the business and will be welcomed back to the commercial line. He became connected first with Leonard & Izard in Chicago, was afterward in the Edison General railroad supply department and has since been with J. G. White and White-Crosby Company.

The Three-Wire System.

The State of the Art is Such that it is No Longer Necessary—Improved Methods of Distribution Described.

(Special from our London Correspondent.)

When new systems or improvements in existing systems are invented which revolutionize a particular branch of trade by effecting economies or increased efficiencies in the working, thus rendering the employment of any other method out of date, unreasonable or unsuitable, it is but natural that those desiring or finding it necessary to avoid the new invention should seek to perfect, or at any rate to devise, some means of their own whereby they may be enabled to take advantage of the purposes of the invention in question without actually infringing the patentee's rights. It may be some slight alteration which in itself is of comparative insignificance, yet coupled to the idea which it is sought to avoid alters the whole and enables the thing to be worked in such a manner as to ensure freedom from royalty impositions. In this way inventors have occasionally been the means, unwittingly, of indirectly bringing into the world certain improvements not attained by themselves.

A system of such importance as the three-wire system of electrical distribution was therefore bound to have about it both avoiders and infringers. That system, it will be remembered, was invented almost contemporaneously by Dr. John Hopkinson in England and Mr. Edison in America. Dr. Hopkinson's letters patent in England were dated July 27, 1882, and expire in 1896.

The many advantages of this system are known to your readers. The economy effected in copper used in the conductors for distribution by the introduction of the middle wire by Dr. Hopkinson enabled it to revolutionize the then existing system of electrical distribution. In the London Courts of Justice on November 4, 1892 (over ten years subsequent to the date of the patent), an action was heard against certain London electricity supply companies for infringement of the patent, and after a very lengthy hearing, in which most eminent counsel and expert witnesses were engaged, judgment was, on January 14, 1893, given in favor of the plaintiff, who secured damages, costs on the higher scale and the delivery over to him of all infringing apparatus. This decision was recorded in Electricity at the time. There were really several companies defendants in the action, though only one name was put forward. The result, of course, led the alleged infringers to seek means for effecting the distribution in some other way, and among the officials of the principal defendant company—the St. James's and Pall Mall Electric Light Company—there was some talk of disconnecting the middle wire from the point midway between the two generators and supplying any want of balance by motor transformers or separate balance machines, or by batteries. As a matter of fact a balancing transformer was fitted which fulfilled its object well and was presumably outside the patent, but the St. James's Company were advised that it would not do to fight the patent on those grounds, and in consequence they decided to abandon any appeal and forthwith paid the royalty. It is, however, thought in a responsible quarter that the patent could not be sustained against such objections.

Mr. R. E. Crompton (the president of the Institution of Electrical Engineers) was the first to use a three-wire system with secondary batteries. In a paper read before the Institution of Electrical Engineers some few years ago,* Mr. Crompton gave a description of a system which was first put down by him at Vienna in 1886, and all the subsequent stations designed and equipped by him in Great Britain have been on the same principle.

At the present date it is stated that the Vienna system is still working satisfactorily. As to whether this arrangement enables the avoidance of Dr. Hopkinson's systems without any possibility of infringement, Mr. Crompton's own opinion has always been that Dr. Hopkinson's patent is quite clear on this point, i. e., that under the term "generators of electricity" he does *not* include accumulators, and that consequently every one who bridges from outside to outside wire with the dynamo and compensates the other wires by means of accumulators *does not infringe*. Mr. Crompton says that the only reason why the London companies using this system did not fight Dr. Hopkinson was that that gentleman's people made such a satisfactory offer that it was not worth while fighting the matter, which was complicated by the fact that most of these companies then using Mr. Crompton's system with accumulators had at one time or other used Hopkinson's plan of two dynamos in series, and therefore would at any rate have been liable to back royalties for these periods which might have been levied at an exorbitant rate.

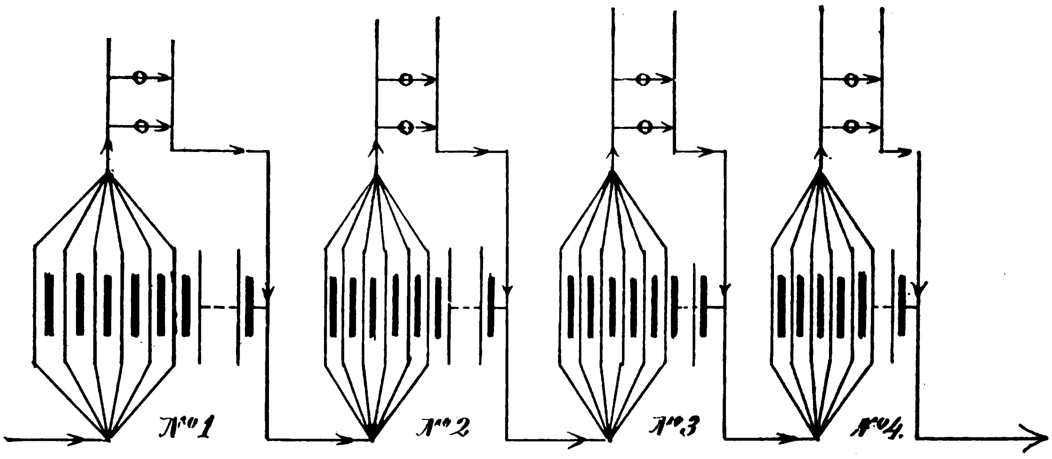

Diagram No. 1.

In Mr. Crompton's opinion the working of multiple wiring systems by accumulators or by equalizing machines is more economical than working them by Dr. Hopkinson's patent, as the latter contemplates always running two machines in a three-wire system or four machines in a five-wire system. This reduces the size of the machines, makes them less economical, and also prevents the machines being run at a good load factor, which is also very detrimental to economy.

It is not out of place to refer to the Vienna system more in detail as stated in the paper already referred to. The arrangement consists of charging accumulators from central groups of batteries of accumulators arranged in series. Each group of accumulators consisted of 52 cells giving the 100 volts required for the lamps with a comfortable margin. The total electromotive force required to charge the four groups of batteries in series varied from 430 volts at the time the batteries are giving off work to 480 volts for the short time during which the charge is being completed. This includes the loss of current in the mains, the generating stations being situated 1,400 yards from the distributing station. On the subject of the regulation of groups of batteries placed in series, the author said his was a simple matter and had been carried out at Vienna and elsewhere in the following manner:

The diagram No. 1 represents four battery stations arranged in series. Supposing that the current enters at the left hand lower corner, passes through the first battery with the lamps parallel to it, passes from the end of that battery to the commencement of the second, and so on to the third and the fourth, and that this current is kept constant or varied at will at the central station by means of adjustable electrical current governors, we have to see how we can keep the potential constant in each of the four groups of lamps shown. In each accumulator one terminal is permanently connected to one of the discharge mains and to one of the charging mains. The other terminal attached to the other mains can be shifted from cell to cell according to the electromotive force required in the corresponding lamp circuit by a movable contact forced through a series of contact rings. The bunch of lines shown in the diagram at the extremity of each of the accumulators represents the movable terminal. As a rule the terminal for charge and discharge at this the regulating end of the battery neither receives nor gives off current, so that there is no loss of energy in the shape of electromotive force. The ring contacts are arranged in line in such a manner that a circular ring contact made of thin sheets of copper can be forced through them in turn by a central screw spindle. The double form of contact regulations was found to be more convenient, because when it became necessary to fill up the end cells they could charge into a larger number of cells than were discharged from; at such times only was there any loss of electromotive force in the regulating apparatus. The arrangement for coupling up to the apparatus is very simple; the mains for charge and discharge are attached to the fixed disk contacts on the central screws; the regulating cells of the battery are coupled to their respective contact rings by sockets. The large central station at Vienna is worked by E. P. S. accumulators.

Mr. Crompton has found that the percentage of accumulators which he has always added to complete the three-wire system has been invariably found sufficient to provide the extra output required during short periods of maximum load.

In Mr. Stuart A. Russell's book on "Electric Light Cables" there is a lucid description of a modification of the three wire system, which is as follows:

"A modification of this (the Hopkinson three-wire system) is sometimes employed which dispenses with the third wire in the feeding mains and permits of the use of one dynamo supplying current at 200 volts, instead of two dynamos supplying current at 100 volts. Fig. 2 shows the arrangement of the apparatus, in which D is the dynamo supplying current at 100 volts, which is conveyed by a two-wire feeder main to the distributing point A, at which is placed a battery of accumulators; and to the two outside terminals and the middle terminal of this battery the

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[*] Proceedings of Inst. of Electrical Engineers, Vol. XVII, Nos. 72 and 73. Paper by Mr. Crompton on "Central Station Lighting; Transformers vs. Accumulators."

three distributing wires are connected. The accumulators here play the same part as their namesakes do in a system of hydraulic supply; the half battery connected to the circuit which requires most current discharges into that circuit, and so helps the dynamo machine; and the half battery connected to the circuit in which the demand is smaller is charged by the surplus current."

While there is no economy in an installing by this method over the other—the accumulators costing as much as the extra wire and second dynamo—an economy in operation is attained. During the hours of light load the batteries may supply all the current required, permitting the shutting down entirely of the central station during those hours.

Still another method has been proposed for simplifying the three-wire system. This consists in using a single dynamo giving 200 to 220 volts. To the brushes of this are connected the two outside wires. The neutral wire is connected to the center of the armature coils, and thus carries at potential midway between that of the two outside wires. This method is evidently quite adapted to the alternating current.

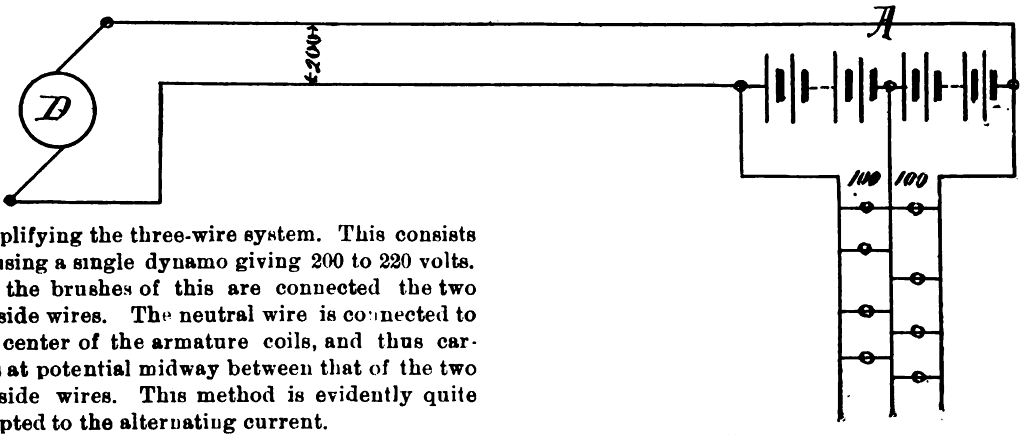

FIG. 2.

With so many methods at hand which seem to be as good if not better than the regulation three wire system, it would seem clear that the threats of the G. E. Company by which they hope to control should fall flat.

Electric Haulage at the Berwind-White Company's Eureka No. 22 Colliery.*

"A mine turning out over 11,000 tons of bituminous coal per month and not a mule about the place." Such is the statement of Mr. A. S. R. Richards, general superintendent of the Berwind-White Coal Mining Company at Osceola Mills, Pa., in speaking of the recently opened Eureka Colliery No. 22, which comes under his management. While there are one or two other instances of coal mines where mules are unknown, this Eureka No. 22 stands alone probably in never having been worked by mules for a single day.

Last fall Mr. W. A. Crist, the general manager of the Berwind-White Company, and General Superintendent Richards decided to give electric haulage a test and selected No. 22 to make the trial. The installation was made and within two hours of the placing of the electric locomotive on the mine tracks it was hauling coal and has so continued with no interruptions, except a short shut-down one day when an oiling device in the steam engine demanded some attention.

Through the kindness of Mr. Richards the writer is enabled to present a description of the plant.

Anticipating an increase in the number of locomotives used, if the trial proved satisfactory, the power plant was installed much larger than at first needed. The installation work began in the fall. A boiler house 33 ft. long × 17 ft. wide was first erected. It is built of wood placed on stone foundations. In it is set a 66-in. × 16-ft. return tubular boiler, with 54.4-in. tubes, made by the Harrisburg Foundry and Machine Company. The boiler is set with full arch front, entirely in stone, lined with fire-brick. It is provided with a 70-ft. stack, 30 in. diameter, and is fed by a Garfield double-jet injector, no feed pump being used. The water supply is obtained from an artificial reservoir 1,200 ft. away, which is fed by springs above the level of mine drainage. The water flows to the power house through a 3 in. wrought iron pipe laid 3 ft. underground.

The engine house is of wood with stone foundations, and contains a comfortable office for the electrician. The locomotive shed immediately adjoins it. It is 46 ft. long × 20 ft. wide, and the shed forms an L 16 ft. × 24.

The engine and generator are set with about 20 ft. belt centers, on cut stone foundations laid with Portland cement, from 6 to 8 ft. deep. The engine, automatic high speed, is an "Ideal," made by the Harrisburg Foundry and Machine Company. It is 13 in. × 12 in., with a speed of 300 revolutions per minute. The normal steam pressure is 80 lbs. per square inch, at which pressure, with $\frac{1}{4}$-cut-off, the engine develops from 97 to 100 H. P. A Schieren double leather perforated electric belt, 12 in. wide, drives the generator from a 52-in. flywheel.

The General Electric Company furnished the generator and electrical equipment. The generator is set in a wooden cap-piece over the stone foundation and is of the multipolar type, 90 K.W. capacity and wound for 500 volts with an over-compounding to allow for a 10% loss in the line when under full load. The machine runs at a speed of 700 revolutions per minute, the pulley being 21 in. in diameter.

The switchboard is of oak, made in the skeleton type, and carries an automatic circuit breaker, a current indicator, a Weston round pattern voltmeter, a double pole main switch and a field rheostat. Insulated wires carry the current to the locomotive shed, where connections are made to the trolley wire and to the ground return. A lightning arrester is connected in just at the point where the trolley connection is made.

The trolley system used is the single trolley, rail return, which was used by the Thomson-Houston Company in its first underground plants. The trolley wire is the same size as is used in street railway practice, No. 0, and at present it is unnecessary to use any auxiliary feed wires, the trolley itself carrying sufficient current to operate the locomotive at any point on the line, under full load.

In the outside construction work the line is supported by wooden poles carrying cheap but effective brackets, made of 2-in. and $1\frac{1}{4}$-in. iron pipe. The brackets support the mining insulators and clamp ears, of the General Electric type. The clamp ear, doing away with the soldering of the trolley to the ear, is of great advantage in first cost of construction work and also in quick construction and repairs and in keeping the line taut and in good shape. Underground the same insulators and ears are used, the insulators being carried generally on short wooden strips held to the roof by special expansion bolts.

The track is laid on 6 in. ties, with an excellent roadbed. A 30-lb. rail is used for 5,680 ft. of main haulage track and 20-lb. rail is laid for the remaining 3,450 ft. of track now in use. Heavy fish plates are everywhere used at rail joints.

The rail return is supplemented by bonding wires connecting from rail to rail. No. 0 bare copper wire, turned, is used for bonds, connected to the rails by channel pins $\frac{9}{16}$ in. in diameter.

The locomotive now doing all the gathering, hauling and distributing, is a two motor mining locomotive, with 1,500 lbs. draw-bar pull capacity, at a speed of 8 miles per hour. Its horse-power rating is therefore about 33. For a starting pull much more than 1,500 lbs. is shown, and the rating in every way seems conservative. As an evidence of this the writer noted at one time an ammeter reading of 110 amperes at 560 volts, which, making allowances for small amount of current used in lighting, losses in the line, etc., meant an exertion of about 70 H. P. by the locomotive. This excessive demand was only temporary. The locomotive is of the low sloping back type made by the General Electric Company, which has come to be called the "turtle back." It carries a motor geared to each axle, and is equipped with the latest improvements in controlling and operating apparatus. Its construction makes it practically waterproof and the heavy iron frame and covering offer a substantial protection from damage by falling roof or in wrecks. The latter are of very infrequent occurrence, however. It is a little over 10 ft. long over all, 5 ft. wide, and its height allows its operation where the trolley wire is not less than 36 in. from the top of the rail. The gauge is 36 in., the wheel base 44 in., and the machine weighs about 6 tons. Its heavy double bumpers are made to coincide with the car bumpers. The cars in use, made by Pie & Co., of Osceola Mills, are of excellent design for low veins, weigh about 980 lbs. empty and carry about 2,400 lbs. of run of mines coal. They have a wheel base of 22 in., and self-oiling 14 in. wheels. For couplings the old chain and hook have been replaced by a link and pin, as better adapted to electric haulage. At the present time 200 of these cars are in use.

An inspection of the map will show the method of opening up the mine which has been employed, and the distance over which the one locomotive does the hauling. As stated above, the output during April was 11,242 tons. The largest single day's work was 452 cars of coal and 20 cars of rock. Handling the latter, owing to their weight and the time taken in switching them to the gob track, is equivalent to hauling about twice the number of coal cars. The amount of coal hauled that day was 472 gross tons. The average output is 450 net tons per day of 10 hours, but this is being raised constantly. Of this output, 49% comes from Drift No. 1, 27% from Drift No. 2, and 24% from Drift No. 3. The maximum grade against load is 3% up the west track at the tipple. It was when the locomotive was pushing a trip of 19 loaded cars and 6 empties up this grade that the ampere reading above noted was taken. The maximum grade in favor of the loads is $2\frac{1}{2}$% in No. 2 drift, about 800 ft. from the bank mouth. A comparatively small tonnage goes over the 3% grade mentioned above, so that with the exception of a very short 3% grade 300 ft. from the mouth of No. 3, the grade against the loads average well under 2%. The average grade of all the entries now wired, taking into account al distances, is a little in favor of the loaded trips.

The minimum radius of track curve is 36 ft., on the small spur leading into the motor shed.

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*Written by Timothy W. Sprague for the *Engineering and Mining Journal*, and by kind permission of the latter reproduced, with map, in ELECTRICITY.

The minimum radius inside the mine is 51 ft.

Not taking into account the distance covered in switching, gathering trips, etc., the locomotive is now making about 20 miles per day. The maximum number of cars hauled from each drift to the tipple is as follows: From No. 1, 42; from No. 2, 25; from No. 3, 32. No. 4, has but just been wired and is little used as yet. A record has been kept of the amount of fuel used by the plant. Naturally there is little attempt at getting this down to a minimum under the circumstances, although run of mine coal is used. The record shows 26 gross tons used per month, or about one gross ton per day.

The locomotive arrived on January 8th of this year, and, as stated, has been working constantly and without causing a moment's delay since. That the test is satisfactory to the Berwind-White Company is evidenced by their having recently ordered of the General Electric Company three more locomotives, each of 800 lbs. draw-bar pull capacity, for this same mine, and a complete equipment for electric haulage at Eureka No. 26. The construction work of the latter plant is already well under way.

The smaller locomotives at No. 22 are to do the gathering of loaded trips inside for the larger machine to haul to the tipple from several main gathering points and the distributing of empty cars from the same points to the rooms. They will be put at work, one at a time, during the summer, as required by increased distances and tonnage.

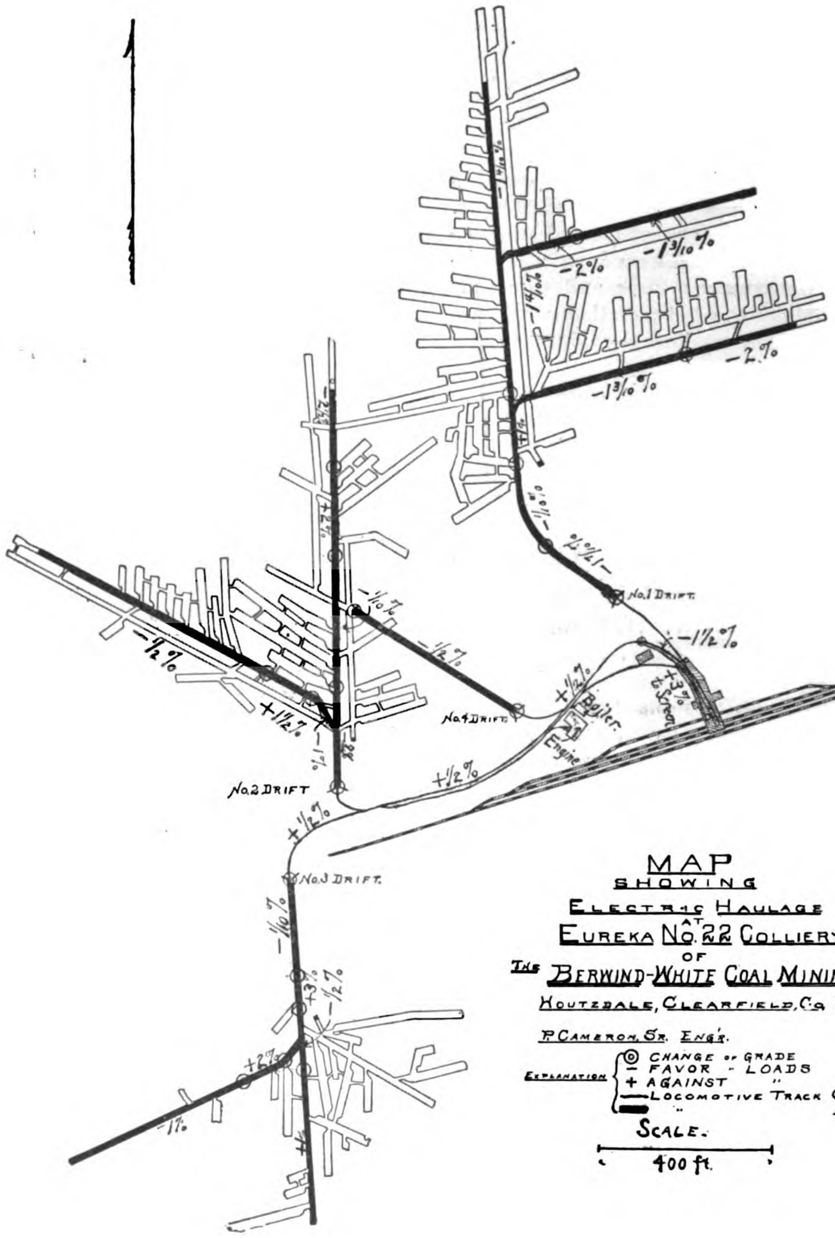
For the operation of the entire haulage plant there are required but three men. One man does the firing and looks after the engine and dynamo. The motor man, or locomotive driver, does all the rest, assisted by a coupler, or trip man. The time of Mr. Wells, the electrician, is not properly chargeable to this plant, as he is now putting in the plant at No. 26. and as other installations are made the proportioned amount chargeable to each plant will be small. Allowing a liberal percentage for interest and depreciation and putting in the coal at 75 cents per ton, the cost of haulage comes inside of 2 cents per ton. The addition of more locomotives will not add materially to the cost of operating the power plant, and the additional charge for interest and depreciation will be slight. Each locomotive will require its own motorman, with perhaps one or two couplers, for the three new machines. The increased output will more than offset these charges, however, and bring the cost per ton lower than at present, probably.

Some observations made during a trip (not for exhibition purposes) into No. 1 drift from the tipple, straight into the face of the entry, may be of interest. The locomotive started in, pulling 24 empty cars, against a grade of from 1½% to 1.7%, at 11:12 A. M. At 11:17 all the empties had been dropped along the heading, being taken by the miners directly into their rooms. The last empty was dropped at a point about 1,800 ft. from the tipple. In the meantime, however, we had picked up 12 loaded cars, which had been placed in the main track by the miners, and were pushing those ahead of us in addition to pulling what remained of the empties.

At 11:23 the return trip was started. We were then pulling the 12 loaded cars and on the way out picked up 16 more loaded cars, with which we arrived at the tipple at 11:30. The actual running time was therefore five minutes going in and seven minutes coming out, a total of twelve minutes, during which time 24 empty cars were distributed at entrances to rooms at distances varying from 1,000 ft. to 1,800 ft. from the tipple, and 28 loaded cars picked up along the same distance and delivered at the tipple.

The wait outside was longer than necessary, owing to a delay in making some couplings. In considering the operation of the plant it must be borne in mind that it is so new and work is advancing so rapidly that the haulage arrangements have each day to be modified. When the smaller locomotives are at work doing the gathering, the main haulage work will be greatly simplified and expedited.

The accompanying map shows the relative positions of the drifts, power plant and tipple, and as noted the grades are shown in percentages, the sign "+" signifying a grade against the loaded trips; the sign "—" a grade in favor of the loaded trips, and the small circle or dot on the haulage lines denotes a change of grade. The illustrations show a general view of the engine and boiler houses and tipple, with a loaded trip of 21 cars attached to the locomotive, and the inside of the engine room.



The plant is situated at Windcrist, Clearfield County, Pa., and is visited by a large number of operators as well as curiosity seekers, all of whom find a hearty welcome from the Berwind-White officials. It is intended later on to operate ventilating apparatus by electricity, and the current is now used for what lighting is necessary.

The writer is indebted to General Manager Crist and General Superintendent Richards for many courtesies extended, and also to Peter Cameron, Jr., mine boss, and Harry J. Wells, electrician, for information furnished. The maps and some general data were kindly supplied by Peter Cameron, mine superintendent, and William Cameron, his assistant.

The Telephone Case.

U. S. Circuit Court of Appeals' Ruling Upon the Berliner Patent.

Charges of Fraud Not Proven.

The opinion of the United States Circuit Court of Appeals has at last been handed down. It is a voluminous document of about 40 pages, written by Judge Putnam, which opens with the following statement of the case:

This is a bill in equity filed February 9, 1893. touching a patent issued November 17, 1891, to the American Bell Telephone Company, as assignee of Berliner. The alternative prayer is that the patent be in all things recalled, repealed and decreed absolutely null, but that, if the patent is not deserving to be wholly repealed, but is repealable in part, a decree be made repealing only such part as the court shall deem to be repealable. As to the latter part of this alternative prayer for relief, the Court has heard nothing and there is no occasion to consider it.

Berliner's original application was filed June 4, 1877, and Patent 463,569 was issued more than fourteen years thereafter. In a general way it covers the microphone.

The pith of the case, as stated briefly for the counsel for the United States, is:

1. That Patent 463,569 is void for illegal delay in its issue, and
2. That it is also void on the ground that the prior patent 233,969, was granted upon the same application, to the same applicant, for the same invention.

The substance of the opinion is by no means as far-reaching and so decisively in favor of the Bell Company as the first reports led the public to suppose, for, as will be seen from the parts quoted below, it merely reinstates the patent in the position where it was before Judge Carpenter's decision declaring it null and void. In other words, the Berliner patent is now in the same position as any other patent granted by the United States Patent Office, viz., possessed of prima facie evidence of validity, which validity may be attacked and must be defended before the courts in the same way as other patents upon which adjudication has not yet been had. The only point that has been settled in this case is that the patent is not void by reason of illegal delay in its issue.

The second claim of the United States, "that it is also void on the ground that the prior patent, 233,969, was granted upon the same application to the same applicant, for the same invention," is met by the statement that the examiner and the Board had before them all the facts bearing on this branch of the case which are now known, and understood the law, so that the patent was issued under no mistake of either law or fact, the Court adding that "the most that can be claimed by the United States is that the officials of the Patent Office, having all the law and facts before them, erred in the exercise of their free judgment in the determination that the earlier patent did cover the invention described and claimed in the later one. Even were this so, the result was not a mistake in the sense of the law in its application to the principles of cancellation of deeds and other instruments; but it was merely an erroneous judgment and determination of the ultimate fact deduced from the primary facts, all of which were known."

"As we are clear," says the Court, "that this proposition of the United States cannot be sustained on the law, even admitting the facts to be as claimed, *we will not undertake to determine the question of the substantial identity of the respective claims of the two patents, or any of them. We prefer to leave that without prejudice, in the event it hereafter involves other individual or corporate rights.*"

The question in regard to the effect of the first patent (by date of issue) upon the patent in suit is therefore still open.

As regards the illegality of the delay in the Patent Office, the appellants claim that "the duty of the Bell Company was to get its patents with the least possible delay by the exercise of all its legal rights. Its submission in silence to delay directed by the Commissioner in violation of his duty was a failure in the discharge of its duty." The Court in reply to this enumerates a number of things that the Bell Company had the *right* to do, and then says: "The imagination can hardly put a limit to the things it had a right to do. To say, therefore, that it was bound to do in the public interest all that it had a right to do in its own, and that if it did not do this it should pay the penalty of a forfeiture of an invention said to be extremely valuable, is a proposition so unreasonable that the mere statement of it by the United States seems to confess the weakness of their case."

To the claim that although the officials of the Patent Office were guilty of gross dereliction of duty in their treatment of the Berliner application, all that was needed to bring matters to a focus was greater diligence on the part of the Bell Company, the reply is:

"Whether, however, the law's measure is that of reasonable diligence or the highest, the courts have no standard by which they can determine what amount of informal solicitation would have been proper.

"It must be admitted that it is not only necessary for the United States to prove that there was a lack in this direction but that the lack contributed to the result... There is no proof which enables us to form proper judicial conclusions on this point. If the record showed that the American Bell Telephone Company had failed to make the usual communications, whether oral or written, there might be something which the law could take hold of; *but as the proofs stand the fact is otherwise.*"

After referring to the claim of the appellants that the Solicitor General and the Commissioner had been derelict, the opinion goes on to say:

"The United States seem to assume that the Solicitor General, as well as the Commissioner, failed to appreciate the grave consequences, as now described, likely to arise from delay in acting on the application touching the Berliner microphone, and that it was the special duty of the defendant corporation to set him right. But however this may seem, and looking at the matter from the position of those accustomed to engage in large and important litigation, we cannot doubt that the counsel for the United States would be forced on reconsideration to agree with the Court that at the crisis to which we refer (viz., the Drawbaugh interference) any approaches by the American Bell Telephone Company to the Solicitor General, having regard to anything which would weaken or hamper the prosecution of the then suit, would have been regarded with suspicion, and would have been entirely beyond and outside of the efforts reasonably expected from solicitors and counsel with reference to any pending hostile proceedings. *Like every other proposition in the case having in view an explanation of the practical methods in which the American Bell Telephone Company could have exercised at various stages the extreme degree of diligence asked of it by the United States, this one fails to bear out any test whatsoever.*"

But it is said by the United States that the Patent Office could easily have disposed of Drawbaugh, because at that time the law was well settled that under the statute of 1870 two years public use, even without his consent, was fatal to him, and Manning vs. The Cape Ann Isinglass and Glue Company is referred to as settling this point. The Court says: "*This case was not* decided until May 7, 1888. It did not involve this question, and what was said therein touching it was a *dictum* and was never acquiesced in by Drawbaugh's solicitors. . . The Bell Company was compelled, with reference to this application, to meet the practical condition of things, and we must put our course ve in t at position. Therefore whatever may now be said as to the theoretical side of the law, it is more appropriate to the purposes of this case to observe that Drawbaugh's solicitor did succeed in practically retaining his application under adjudication by the Patent Office until near the close of October, 1891."

The Court next pointed out a clear inconsistency on the part of the United States. Referring again to the Drawbaugh case, it says: "It was claimed by the United States at one point that this litigation did not involve the microphone, but with a clear inconsistency the United States, at another point in its argument at bar, rested one of its propositions as to the alleged duty of the Commissioner at a certain crisis on the distinct ground that the Circuit Court had decided that Drawbaugh did not invent the microphone." "The fact is," said the Court, "that the entire dispute as between Drawbaugh on one side and Bell, Edison and Berliner on the other turned on one and the same question, viz., the truth or falsity of Drawbaugh's story; so that, as testified to by the president of the American Bell Telephone Company, if Drawbaugh's story was substantially true it cut up by the roots all that Edison and Berliner had done."

The Court expresses its opinion of the suggestions made by the United States as to what the Bell Company *should* have done to avoid the delay in the following words:

"The practical summing up of all these various suggestions is that the American Bell Telephone Company is, in effect, censured for not reforming both the practice and the officials of the Patent Office. We think this demand is without parallel or precedent, that the case may justly be stated in this form, and that, when thus put, it shows itself so revolutionary as to require the legal mind to reject it on mere statement," and it further claims that the United States "have failed to meet the burden resting on them, of proving that the lack of compliance with what they claim should have been done had any practical result in producing the delays complained of." That the Bell Company with all its resources could have found some way to break the deadlock if it had earnestly desired so to do, *may* be true, "but the courts have never yet been vested with authority to deprive any person or corporation of property or rights on the strength of any such mere assertion, nor without allegations and proofs in a definite form.

"We think this is the first instance in which either the people or the king, wherever the common law prevails, has sought to revoke by legal proceedings, on the ground of imputed or merely legal fraud, a grant of this character, issued to a subject after full official knowledge of all the facts, where there has been no deceit, collusion or corruption, and where the subject duly complied with all statutory and departmental requirements, *merely because the officers in charge have been dilatory and the subject failed to use zeal in spurring them on.*" . . "*We do not determine that any degree of laches whatever will forfeit a patent once granted*, reserving, of course, cases of abandonment, and other cases where, through laches, the equities of strangers have become established, neither of which classes are involved in the suit at bar.

"*The United States asks us to establish a period of limitations other than fixed by statute,* and we do not decide that under any circumstances we have any authority so to do. *We merely determine that the case of extreme diligence, as made by the United States, cannot be maintained.*"

The Court then goes on to show that while the delay in this case was unusual, it was not unprecedented, and it is stated that during the two years 1893 and 1894 forty-nine patents issued with an average of ten years after the applications were filed—ten of them ten years or over, and several of them fourteen years or over.

"*The decree of the Circuit Court is reversed, and the case remanded to that court with directions to dismiss the bill.*"

A NEW CONTACT SYSTEM OF ELECTRIC RAILWAYS.

The Westinghouse Electric and Manufacturing Company have acquired the recent Wheless patents of electric railways, and are exhibiting a working model of the same on the fourth floor of the Equitable Building, on Broadway, New York. In this system a metallic return is used, and the roadbed is provided at intervals of less distance than the length of a car, with sets of three metallic plates extending slightly above the street paving. These connect by means of insulated wires with electromagnetic switching devices located beside the track. Underneath the car are three metal contact bars which make contact with these metal plates as the car proceeds. Within the car is located a small storage battery, and this by means of the contact bars and surface contacts actuates the electromagnetic switches by which the line current is thrown into connection with the motors. When the car is not over the contacts the metal plates are not in circuit, so that there is no chance for leakage by this cause, but as the car proceeds over successive plates it first picks up the current, and then as it passes off drops it again, leaving the track connections entirely dead.

The model forms a most interesting working exhibit, and is well worthy of a visit of inspection.

LOUISIANA LIGHT COMPANY'S AFFAIRS.

Efforts to Displace R. T. McDonald and Maurice Hart.

In the application for a receiver for the Louisiana Electric Light Company, filed two weeks ago by the United Electric Securities Company, charges of fraud and gross mismanagement are made against Messrs. R. T. McDonald and Maurice Hart, two of the leading directors. Among other things it is charged that—

In the year 1889 the president and directors entered into a contract with the Fort Wayne Electric Company of Fort Wayne, Ind., whereby the Louisiana Electric Light Company agreed to give to the Fort Wayne Electric Company $425,000 of the stock of the Louisiana company for the purchase of certain patent rights which had no value to the knowledge of the directors of the defendant corporation, and that the stock was delivered by them knowingly for no substantial consideration.

That on or about January, 1891, R. T. McDonald and Maurice J. Hart were the owners or controllers of the stock of a certain bankrupt or worthless corporation, known as the New Orleans Tower Company, and were at the same time directors of the Louisiana Electric Light Company, and that the president and directors of the latter company, with full knowledge of the aforesaid facts, entered into a contract with two of its members, viz., R. T. McDonald and Maurice J. Hart, whereby in consideration of a transfer to the Louisiana Electric Light Company of $480,000 of the stock of the said New Orleans Tower Company it agreed to assume and did assume the debts of said company, amounting to $155,000.

That on or about September, 1892, and prior thereto, the Fort Wayne Electric Company of Fort Wayne, Ind., bought out the Edison Electric Company, a corporation doing business in the city of New Orleans, and that on the 29th of September, 1892, the president and directors of the Louisiana Electric Company voted a sum of $50,000 as a credit to the Fort Wayne Company, without any lawful consideration, but under the pretence that the said company had benefited the Louisiana Electric Light Company by purchasing the Edison Electric Light Company.

That after said purchase of the Edison Electric Light Company by the Fort Wayne Electric Light Company, the president and directors of the Louisiana Electric Light Company passed a resolution offered by R. T. McDonald by which, in consideration of $200,000 of stock of the Edison Electric Light Company, the president of the Louisiana Electric Light Company was authorized and directed, in behalf of said company to guarantee the payment of the principal and interest of $500,000 of the bonds of said Edison Electric Company, and that the said bonds have actually been indorsed and guaranteed by said Louisiana Electric Light Company, but that the consideration of said guarantee, viz., the $200,000 of stock of the Edison Electric Campany, has never been delivered to or received by the Louisiana Electric Light Company, which company has thus assumed a liability of $500,000 without receiving any consideration whatever therefor, and that the said stock was actually received and is now held by R. T. McDonald and Maurice J. Hart, individually.

That the affairs of the Louisiana Electric Light Company have in divers and sundry ways been grossly mismanaged by the president and directors thereof: that by reason of said mismanagement the corporation has become utterly insolvent; that in addition to the $700,000 of first mortgage bonds the company has outstanding about $800,000 of second mortgage bonds, the coupons on all of which mature semi-annually on the first days of June and December of each year; that the coupons maturing June 1, 1895, have not been paid, and your orator is informed that a large part of previously maturing coupons had not been paid and canceled by the company, but were taken up by others without being canceled; that the company is unable to meet its other current obligations and, as your orator is informed, went to protest in bank, the 6th day of June, 1895; that its most valuable source of revenue is from its contract for lighting the city of New Orleans, and your orator believes that its prospective revenues from that and other sources have been hypothecated in advance to creditors up to and including March, 1896, and that amongst said creditors who have received such hypothecation for a large amount is the Fort Wayne Electric Company.

When the case came up on an order to show cause why a receiver should not be appointed, on June 13 last, all the parties interested appeared in court. Fenner & Denegre represented the petitioners and Judge T. J. Semmes appeared as counsel for the president and board of directors of the Louisiana Electric Light Company. Judge Semmes stated that the interested parties were hopeful of an adjustment of the affairs of the Louisiana Company and asked that the hearing of the application for a receiver be postponed until June 28, which the court granted.

This action at New Orleans is merely another move in the fight of Coffin *vs.* McDonald, and it is no credit to the perspicacity of the latter if he fails to see it and to strike back.

The United Electric Securities Company is the one on which Mr. Coffin floated into apparent success. To those who are posted in the affairs of this corporation, as ELECTRICITY is, it seems strange indeed that they dare come into any court charging fraud upon any one else; that they have the effrontery to invoke the aid of any court in carrying out their schemes; that they dare above all things take the chances of provoking a fight with R. T. McDonald, who knows all their methods.

Notwithstanding all that has happened in the last two years, it is evident that Mr. McDonald has hesitated to open the warfare upon the G. E. Company which was expected. After the plainly evident sufferings of the Ft. Wayne interests from their few years of subserviency to Mr. Coffin, keeping them back from the development of new lines of apparatus—from keeping up with the times, as it were—it has been a surprise to those who know Mr. McDonald best that he has not made stronger efforts to re-establish his position, even at the expense of an irreparable break between him and Mr. Coffin.

Why should there be any more trades and deals? Why should any company keep out of any line of manufacture to accommodate a rival, even for a consideration?

We have always maintained that Mr. McDonald is a shrewder and abler man than C. A. Coffin. Why does he not assert himself?

After this attack upon his honor and business methods, half believed to be an honest one in New Orleans, according to the press of that city, can Mr. McDonald hesitate any longer? Can he longer suppose for one moment that Mr. Coffin has any other object than he had in August, 1893, to wit, to drive Mr. McDonald entirely out of the field?

We have no doubt that this matter will be secretly settled between the Securities Company, Coffin and Mr. McDonald. But what credit is there in this mode of procedure?

The Electropoise.

(From the Electrical Review, London.)

The Electropoise, notwithstanding what has been said of it in our own columns, and more particularly in *Science Siftings*, seems to flourish, judging by a full page advertisement of this appliance, "which polarizes the entire body," appearing in the *Gentleman's Journal* for May 15. In America our contemporary, ELECTRICITY, has been waging a war of extermination against this "home cure without medicine" with, we believe, considerable success, and we thought its pretensions had been completely exposed in the old country. However, it was evidently only scotched, not killed, so we would suggest that the poor foolish dupes whose testimonials are printed in the aforesaid advertisement should read *Science Siftings* to learn what the Electropoise consists of.

The Telephone Situation.

It is expected that the National Association of independent telephone manufacturers will meet in Pittsburg on Monday next to perfect their organization.

Recent Experiments on the Electric Discharge by Lord Armstrong[*]—II.

This peculiar quasi circulation in the electrostatic field which Lord Armstrong's experiments appear to indicate is of the greatest theoretical interest. Several experimenters have obtained analogous results, and attempts have been made to explain them which, however, do not appear altogether satisfactory. Faraday, in 1838, observed the movement of dust particles, and silk fibers in non-conducting liquids, in the opposite direction to the current, and also a convective movement of the liquids themselves in the same direction as the current; and many other experimenters have made similar observations with a variety of other powders. Electric convection is considered to be due to layers of the dielectric liquid in contact with the electrodes getting surcharged with electricity, owing to the fact discovered by Quincke, that conduction in such liquids does not follow Ohm's law, the current increasing faster than the E. M. F. Near the electrodes the fall of potential is more rapid than in intermediate parts of the field, and consequently electricity will flow more rapidly into the liquid from the electrodes than it is drawn off by the field beyond. The surcharged layers of the liquid are repelled, and thereby produce a convective movement. The movement of suspended particles in the opposite direction to this convective current in the liquid is considered by Quincke and Helmholtz to be explained by supposing that the contact of the liquid and the particles gives them opposite charges. This explanation, however, appears to be incompatible with Lord Armstrong's experiment, where the cotton thread is connected to the positive electrode, and therefore must have the same kind of charge as the convective liquid current moving away from the positive pole.

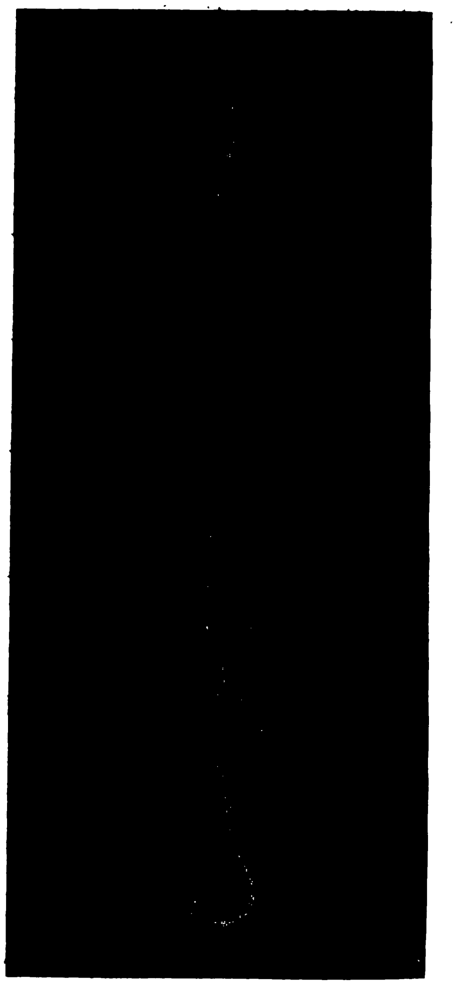


FIG. 7.

Another group of Lord Armstrong's figures show some peculiar photographic actions of the discharges. It has long been known that under certain circumstances the lightning flash produces a reversed image or "dark flash" on the photographic plate. This subject has been investigated by Clayden*, who came to the conclusion that the reversal of the image of the lightning flash was due to the superposition of light reflected from white clouds striking the photographic plate before or after the flash. He found the "dark flash" had frequently a white core, and this he found he could reproduce in photographs of sparks from an influence machine, when these sparks were produced by large Leyden jars, but not when the fainter sparks from smaller Leyden jars were used. In the latter case there was no white core, the whole of the spark image was reversed.

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[*] From the *Electrical Review* (London.)

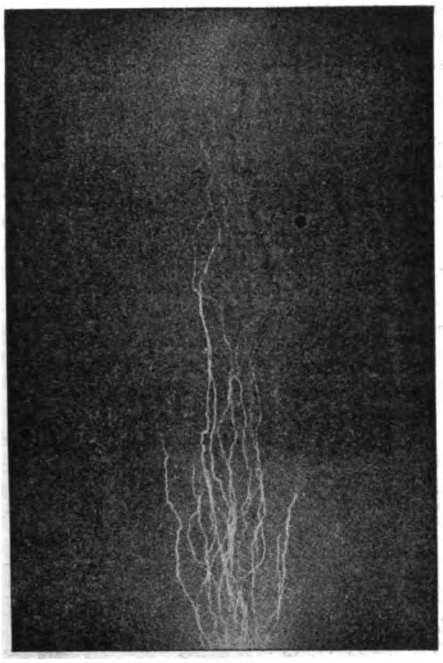

FIG. 8.

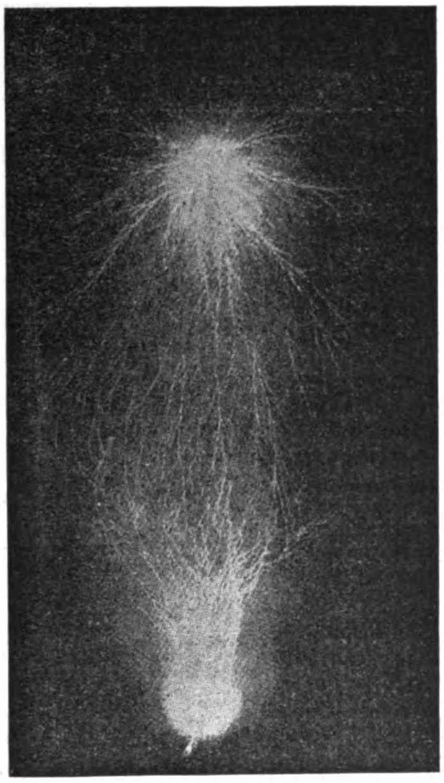

FIG. 10.

The existence of the white core, therefore, may plausibly be attributed to concentration of the current on the surface of the spark, a well-known property of alternating or rapidly varying currents such as we have in the electric spark. The more intense light produced by this stronger surface current may produce reversal of the photograph image, while the less dense current at the center does not reach the reversal point. Fig. 7 shows a discharge containing a dark spark with a white core, which can be seen much better in the enlarged view of the same (Fig. 8). Figs. 9 and 10, however, show how incomplete this explanation of the dark spark is. Fig. 9 is an enlarged view of the horns of part of a brush discharge. The branches of these horns can be seen to overlap or coalesce at several points. The image at these points is brighter, though according to the theory just explained these points ought to be dark owing to photographic reversal. In Fig. 10 we have an effect which as far as we know is quite novel, namely dark points upon white sparks. These dark points occur apparently where the branches terminate in air before they reach the negative pole. This peculiar effect, if photographic, would imply that the points of these sparks were much more luminous than the rest of the spark. But the effect may be electrolytic, as there is always a probability of some electrolytic action when the discharge is made over the surface of the sensitive film of a photographic plate. At the positive end of a spark, oxygen or halogen compounds would be produced by electrolysis, and it is well known that the presence of such compounds in the sensitive film favors reversal of the image. Here, however, they appear at the negative end, and therefore if this theory be correct the dark points must have been produced by a reflected wave of current which temporarily converted the end of the spark into a positive electrode. Fig. 11 represents the effect produced by a discharge from the air upon a negative point. The shape of the horns is said to bear a

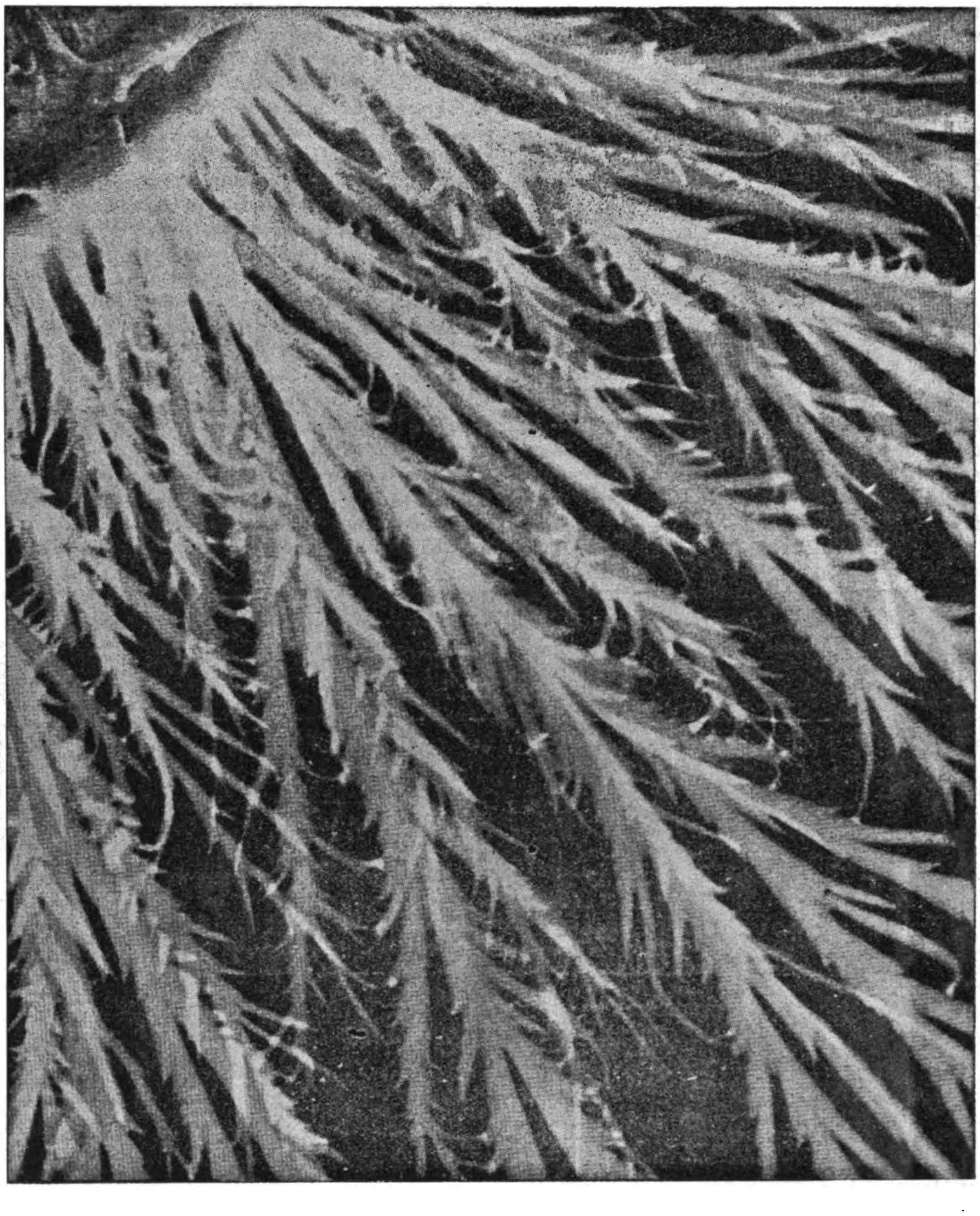

FIG. 9.

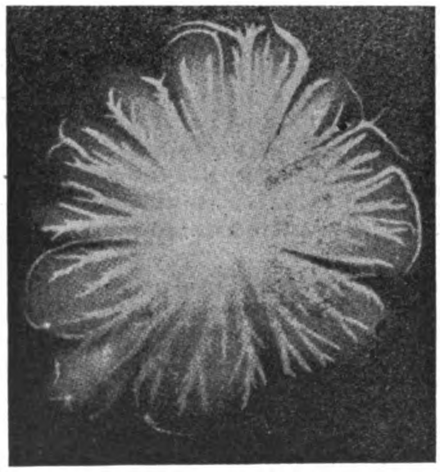

FIG. 11.

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*Phil. Mag., Vol. XXVIII., page 92, 1889.

very close resemblance to those seen in solar eclipses.

These beautiful figures obtained by Lord Armstrong will, we do not doubt, be of the greatest interest to students of electrical theory, and as a distinguished physicist has remarked, they would be very instructive if we only knew what they meant.

PULL THE STRING.

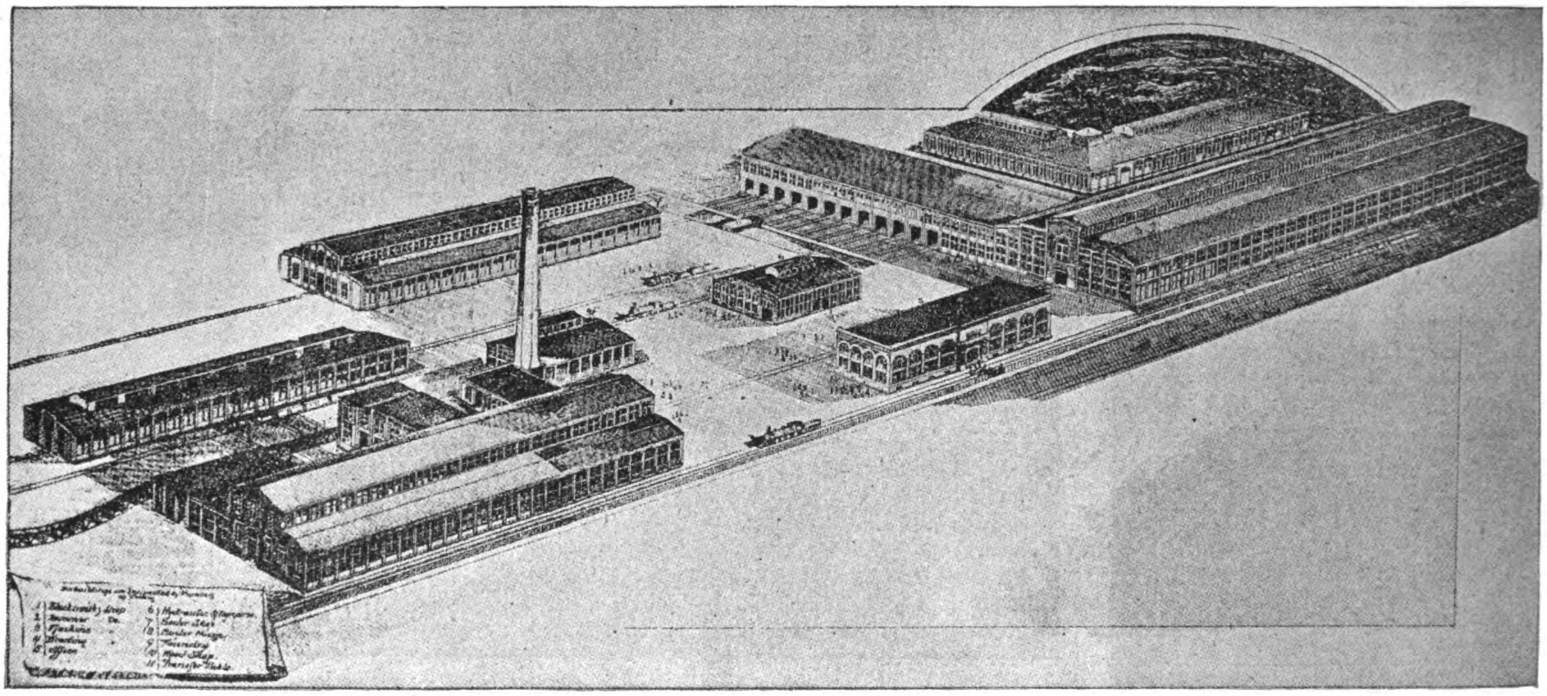
It is too late this time, but hereafter when you get your copy of ELECTRICITY don't break your finger nails or tear the cover of the paper by trying to get the wrapper off in the wrong way. Find a little notch in the wrapper on the right end, pull the string, and you have no trouble.

The Siemens & Halske Co.

Increased Capital—Ready to Extend Their Lines of Manufacture.

The Siemens & Halske Electric Company of America have completed the arrangements which have been under way for several months, and are now finally settled at the old Grant Locomotive Works, Chicago, the purchase of that property having been completed.

The capital stock has been increased from $1,000,000 to $2,000,000, of which $700,000 is preferred and $1,300,000 is common stock. The greater part of the new issue was taken by C. T. Yerkes and his associates. The new issue was oversubscribed by $500,000. In payment for the property the Grant Locomotive Works receive $500,000 in the common stock of the company and 200,000 in the preferred. There is at the present time a mortgage of $217,000 against the property, which, according to the agreement entered into, is to be paid off, the property going to the purchasing corporation free from all indebtedness.



THE SIEMENS & HALSKE ELECTRIC COMPANY'S CHICAGO WORKS.

Sixty two acres of land are comprised in the site of the Grant Locomotive Works, the plant itself having cost $900 000 when erected in 1892. A view of the works is presented herewith, showing their large extent. A better idea of their magnitude can perhaps be had from the following figures: Machine shop, 110x370 feet; erecting shop, 80x285; blacksmith shop, 80x25 ; hammer shop, 80x125; boiler shop, 100x250; wood shop, 70x250; paint shop, 70x170; pattern shop, 60x130; foundry, 80x260; core room, 50x60; cupola, 60x80; boiler room, 50x70; dynamo room, 50x60; office building, 45x130; making a total of 195,260 square feet.

The Siemens & Halske Electric Company of America have not had altogether smooth sailing since their beginning here in 1892, and it is considerable of a personal triumph for Messrs. O. W. Meysenburg and A. W. Wright that in spite of all accidents and unfavorable general conditions they have within three years placed the enterprise in the front rank. The apparatus was well known on this side to technical men, but it was due to the push and energy and business capacity of these gentlemen that the public generally were made aware almost at once of its high character, and that the business took at once so prominent a place. It will be remembered that the plant built in 1892 was completely destroyed by fire in August, 1894. At that time many of the leading railroads and office buildings throughout the country had Siemens & Halske machines in use, and many orders were on the books, some for the largest types of machines. Within six weeks after the fire the company had re-located itself in its present quarters, and had begun to ship apparatus.

At the time of the fire they had several new lines just ready for the market besides Types I. (direct connected) and L. H. (belted). The fire has delayed them seriously, but they are now all ready to proceed with street car motors and other apparatus. Models have been prepared for all these motors, and ELECTRICITY expects to see them on the market by September or earlier.

This news is significant in many ways. Mr. Yerkes is known as one of the most successful railway men in the country. He has controlling interests in many of the systems in our largest cities, and will certainly be a strong man in this enterprise. He has been associated with Messrs. Meysenburg and Wright in many enterprises in the past.

The fact that the president of the Siemens & Halske Electric Company of America is also president of the Wells & French Company, the well-known car builders, will practically enable the Siemens & Halske Company to furnish to customers not only the electric car equipments, but complete cars, including car-body, truck and electrical equipment, all manufactured by themselves or their allied companies.

While the Wall Street bankers are dickering and trading, as pompously as the three tailors of Tooley street, supposing that all they have to do is to agree and then proceed to run the electrical trade of this country to suit themselves, it is cheering news to hear that other capitalists of equal or greater strength ignore them, and proceed in the way of building up a legitimate competing business.

Every additional concern like the Siemens & Halske Electric Company of America is a splendid addition to the strength of the independent forces, and must exert a wholesome influence on the trade as a whole.

Combinations to control will soon be out of fashion.

Obituary.

Henry C. Parmly, senior member of the real estate firm of Parmly Brothers and a member of the Board of Directors of the Standard Electric Company from its inception, died on Thursday of last week. Mr. Parmly was born in Painesville, Ohio, in 1836. In 1860 he went to Paris, and there formed a partnership with his cousin, George W. Parmly, a physician widely known in Europe, and the young firm gradually built up a large practice in medicine and dentistry. Returning to this country in 1873, he was married to Miss Hattie Sumner, daughter of R. B. Sumner, of New Orleans, whom he met while in Europe, and shortly thereafter located in Chicago. Engaging in the real estate business success attended his efforts, and at the time of his death he owned valuable properties in the heart of Chicago. Though of a quiet, retiring disposition, he was a charming companion, a loyal friend, an upright man, a good and progressive citizen.

Chicago Edison Company.

At the recent annual meeting of the Chicago Edison Company the following statement was presented:

Gross income from electric current and merchandise sales		$1,437,042.53
Operating, repairs, renewals and general expenses		953,377.77
Net income from all sources		$483,664.76
CHARGES AGAINST INCOME.		
Interest on bonds and debentures	$155,128.00	
Dividends paid	319,038 21	
		$471,166.21
Balance carried to surplus account		9,498.55
Total		$483,664.76

The old directors were re elected as follows: A. F. Seeberger, John B. Drake, Lambert Tree, E. L. Brewster, R. C. Clowry, Byron L. Smith, Robert T. Lincoln, J. W. Doane, F. S. Gorton, A. A. Sprague, E. M. Phelps, Edson Keith, Samuel Insull.

A. I. E. E.—NIAGARA MEETING.

Since the preliminary programmes of the Niagara Falls meeting of the American Institute of Electrical Engineers were distributed to the members, the Convention rate of one and one-third fare on the certificate plan has been granted by the Central Traffic Association and the Boston Passenger Committee. This, together with the concession of the Trunk Line Association, covers practically all the territory east of the Mississippi River and north of Richmond and St. Louis, conditional upon an attendance of 100 who have traveled by rail to the meeting. Those who expect to attend the meeting, whether members or not, are requested to send their names to R. W. Pope, Secretary, 26 Cortlandt street, New York.

West Shore Railway Arrangements.

For the above meeting the West Shore Railroad has named a rate of a fare and one-third ($10.67) for the round trip from New York City on the certificate p'an; that is, the passenger pays the full rate going, and on stating to the ticket agent that he is a delegate to the above Convention he is furnished with a certificate which, when properly signed and presented to the ticket agent at Niagara Falls, entitles the holder to a ticket from Niagara Falls to New York at the rate of $2.67.

Schedule of train service between New York and Niagara Falls is as follows :

GOING.

Leave New York.		Arrive
Franklin St.	West 42d St.	Niagara Falls.
9:00 a. m.	9:15 a. m.	12:33 a. m.
5:45 p. m.	6:00 p. m.	7:03 a. m.
7:30 p. m.	7:45 p. m.	8:45 a. m.
8:00 p. m.	8:15 p. m.	1:50 p. m.

RETURNING.

Leave	Arrive New York.	
Niagara Falls.	West 42d St.	Franklin St.
8:20 a. m.	10:45 p. m.	11:00 p. m.
5:00 p. m.	7:50 a. m.	8:05 a. m.
8:10 p. m.	10:10 a. m.	10:25 a. m.

ELECTIONS.

The Westinghouse Machine Company.

The annual meeting of the stockholders of the Westinghouse Machine Company was held at Pittsburg on June 10, with a large representation of stock. President Westinghouse was prevented by press of other business from being present. The old officers were re-elected, as follows : President, George Westinghouse, Jr.; vice-president, E. E. Keller, secretary-treasurer, David Jackman. The annual report of the company was favorable, and it was stated that there were numerous orders on the books. The foundation for the new machine shop to be built at the Westinghouse Electric Works at Brinton is almost completed. It is said that between 600 and 700 men will be given employment in the new shops. The other departments of the company are running to their full capacity, and in a number of the departments the employees started on overtime on Tuesday, last week. This is the first time that the men have been working overtime since the works were put in operation.

Phœnix Carbon Company.

The annual meeting of the stockholders of the Phœnix Carbon Manufacturing Company was held on June 11, and the following named gentlemen were duly elected members of the Board of Directors for the ensuing year : Messrs. S. M. Dodd, S. B. Pike, Thos. H. West, J. C. Van Blarcom and James Campbell. The new board met after their election and elected as officers : S. M. Dodd, president ; S. B. Pike, vice-president ; H. L. Page, secretary and treasurer, and S. G. Booker, superintendent. Mr. S. M. Dodd is president of both the Edison Illuminating Company and the Missouri Electric Light and Power Company, and S. B. Pike the secretary and treasurer of both the Edison Illuminating Company and Missouri Electric Light and Power Company of St. Louis; Mr. Thos. H. West is the president of the St. Louis Trust Company; J. C. Van Blarcom is cashier of the National Bank of Commerce in St. Louis, and James Campbell is a well known broker. Mr. S. G. Booker needs no introduction to our readers.

Manhattan Elevated Gossip.

The report from Pittsburg that the Manhattan Railway people have signed a contract with the Westinghouse Company for complete electrical equipment is incorrrect. Those best posted don't expect any such contract to be signed at once.

General News.

What is Going on in the Electrical World.

Goliad, Tex.—Preparations for an electric light plant are under way here.

Stoneham, Mass.—An electric road will soon be constructed from Winchester to Stoneham.

Riverside, Cal.—Bonds are to be issued to supply this city with a first class lighting system.

Wickliffe, Ky.—An electric light plant will be put in here as soon as arrangements can be made.

Madisonville, Ky.—The city council are making investigations as to the cost of putting in an electric light plant.

Winthrop, Mass—A new electric light company is soon to be formed for the purpose of lighting Revere and Winthrop.

Delavan, Wis.—The Delavan Light and Fuel Company are making plans and estimates for an electric light plant for this place.

Worthington, Minn.—At the election held here a few days ago the people voted in favor of a bond issue of $15,000 for an electric light plant.

Waupeca, Wis.—A central plant to furnish heat, light and water will be put in at the Veterans' Home in Waupeca to cost about $10 000.

Windom, Minn.—At the special election held recently a large majority voted in favor of issuing bonds for an electric light plant and waterworks.

Oakland, Cal.—The city electrician is preparing a report on the probable cost of lighting the city hall by electricity as compared with gas.

Milford, Ill.—A company is being organized here to build an electric railway to Onarga or Gilman and possibly to Cissna Park and Boswell, Ind.

Lansing, Mich.—The bill making an appropriation for an electric light plant at the State University, failed to receive the Governor's signature.

La Crosse, Wis.—The La Crosse Electric Street Railway Company have just commenced construction of a four mile extension of their lines to Trotting Park.

Quebec, Can.—At the last meeting of the city council Mr. B emer's application for a franchise for an electric street railway in this city was granted.

Niagara Falls.—The Niagara Falls and Lewiston Railroad Company has been granted a franchise to lay tracks on Third street for their electric road.

Versailles, Ky.—The city council has determined to purchase an arc electric plant for lighting the streets of Versailles, to be owned and operated by the city.

Chicopee, Mass.—The city property committee have decided to petition the council for leave to advertise for bids and specifications for an electric light plant.

Youngstown, O.—The contracts have been let for the construction of an electric railroad from Brier Hill to Niles, and call for the work to be finished sixty days from June 1.

East Orange, N. J.—A canvass is being made in East Orange by John P. Conkling with a view to determining the sentiment of the people in reference to electric lighting.

Chicago.—The Lake Side Elevated Railroad is to be equipped with electricity as a motive power. The West Chicago Street Railroad Company is to furnish the necessary power.

Warren, O.—The North Trumbull Rapid Transit Company has been formed to construct and operate a passenger and freight electric railroad from Farmdale to Mesopotamia, 20 miles.

Oshkosh, Wis.—The Central Wisconsin Electric Railway Company has filed its acceptance of the terms, conditions and obligations governing the extension of franchise granted the company by the common council of Oshkosh.

Laurel, Md.—The Laurel electric light plant has been purchased by a local company, of which Dr. De W. Snowden is president, and has been reorganized under the name of the Electric Company of Prince George's County.

Brookfield, Mass.—One half of the necessary $200,000 of stock of the Southbridge, Sturbridge and Brookfield electric railroad is reported to be subscribed, and the various towns along the proposed line have guaranteed franchises.

Westport, Mo.—An ordinance has been introduced in council granting the Kansas City Electric Railway Company the right to construct and operate an electric light plant in this city and also furnish the city with heating and motive power.

Medina, N. Y.—Charles A. Gorman and John Maher have been appointed a committee to ascertain the cost of the "best system of electric fire alarm that shall come within the reach of the small sum of money appropriated by the village for the purpose."

Monroe, Mich.—A new company has asked the council for a franchise for an electric street railway. Nothing came of a previous grant of a franchise, and the council will need to be assured that the road will be built before granting another franchise.

Niagara Falls.—W. M. Kyle, of Toron'o, has been in the city talking up the project of an international electric railway belt line. Mr. Kyle represents a large number of Canadian capitalists, and is confident that his railroad scheme will ere long be a reality.

Tiffin, O.—Mesch Frost and associates have bought the uncompleted Tiffin and Fostoria electric railway at receiver's sale for $19,784, and state that they will have it completed inside of six weeks. No bids were offered for the Tiffin electric and horse car lines.

Fort Worth, Tex.—The Dallas and Oak Cliff Rapid Transit Electric Railway is to be extended to Fort Worth. The line will be operated by electricity and two power houses will be needed. The purchasers of the Dallas line at its late sale are the parties who have the enterprise in hand.

Lockport, N. Y.—Charles A. Johnson, of New York, president of the Lock City Electric Railroad Company, advocates the building of an electric railroad to connect Buffalo and Olcott, via Williamsville, Swansville and Lockport. He is willing to put up two-thirds of the money to build the line to Olcott.

Louisville, Ky.—A movement is on foot to build an electric railroad from Louisville to Fairfield. W. F. Carrithers, F. O. Carrithers, Lafe DeWitt, J. G. Queen, W. P. Stalliger and J. C. Wright, all living along the proposed route, were appointed a committee at a meeting held here to put the matter before the public.

Webb City, Mo.—The Fitch Electric Railway will be completed from Webb City to Carthage, Mo., by July 15. This will give Carthage electric connections with Joplin. The line now running from Webb City to Joplin will be extended to Galena, Kan. This will make twenty-six miles altogether.

Owensboro, Ky.—This city has been contemplating the building of an electric light plant, but the recent decision depriving cities of the bank tax will make it necessary that the proposed undertaking be laid over unless bonds are issued. The city council has advertised for bids for lighting the city.

East Liverpool, O.—Pittsburg and Eastern capitalists have under consideration the building of an electric road between this place and Salem, via Lisbon; the length of the line proposed is about 35 miles. A. R. Mackell, of East Liverpool, accompanied a party of capitalists over the proposed route a few days ago, and considers the project a feasible one.

Augusta, Ga.—Roby Robinson, Robert F. Shedden and J. H. Gilbert have filed a petition for a charter for the Southern Electric Development Company. The capital stock is named at $10,000 and the privilege of increasing it to $500,000 is asked for. The company is formed for the purpose of dealing in and manufacturing electrical appliances.

Catonsville, Md.—It is understood that arrangements have been completed whereby the Catonsville Short Line Railroad, a branch of the Baltimore and Potomac Railroad, will pass under the control of the Edmonson Avenue, Catonsville and Ellicott City Electric Railway Company which constitutes a portion of the Baltimore and Washington Boulevard Electric Line.

St. Louis, Mo.—The Hausman system, a series of electric roads, forming an almost complete network among the county towns, promises to be built soon. The right of way will be over property deeded to the company, and therefore cars can be run at high speed. Heavy motors will be used, as the projectors are determined to compete with the steam railroad.

Little Falls, N. Y.—The electric railroad project which proposes to connect this place with Richfield Springs is receiving encouragement. The local people interested are Messrs. Tylee & Viele, Victor Adams, Homer Snyder and others. Senator Bates of Massachusetts is the leading capitalist connected with the enterprise.

Boston.—The Gas and Electric Light Commissioners have just approved an issue of $25,000 new stock by the Rawson Light and Power Company, which is a reorganization of the Leicester Electric Company. A similar issue of new stock by the Nantucket Electric Company, a reorganization of the Nantucket Electric Light Company, was also approved.

Cincinnati, O.—It is proposed by the Supervising Architect, Wm. Martin Aiken, to enlarge the capacity of the electric light plant in the Federal Building here so that gas can be dispensed with entirely. The gas bill for the building reaches nearly $5,000 per annum and a first-class electric plant at a cost of between $15,000 and $20,000 would soon pay for itself.

Richmond, Va.—The common council has passed the ordinance granting a franchise to the Richmond Conduit Company for an underground trolley railway from Chimborazo Park to the Boulevard on Broad street.—The Manchester Street Railway Company has applied for permission to change the motive power on one of its lines to electricity.

Brookhaven, Miss.—An improvement company has been organized here with a capital stock of $200,000 by the following well-known business men of Brookhaven: W. H. Seavy, J. W. McGrath, Louis Cohen, A. E. Morelon, E. Bowsky and F. F. Gecker. Their object is to establish a cotton compress, cotton warehouse, canning factory and electric light plant.

Marion, O.—The Marion Water Company has been organized to establish water, gas and electric light works in this city. The capital stock is $250,000. The directors are Charles J. Chapman, Cullen C. Chapman, Chester H. Pease, Robert Chapman, Newman Earl of New York, E. E. Pratt of Boston and C. E. Burke of Cleveland, O. C. C. Chapman is president and C. J. Chapman treasurer.

Birmingham, Ala.—The *Age-Herald* says the Birmingham Railway and Electric Company has the biggest electric car south of the Ohio River. It is named "Picnic," and will be mounted on four motors. It will seat 100 people. It is painted in red and gold, and is by long odds the handsomest car ever run in Birmingham. It is designed to work the picnic travel and will be chartered to private trolley parties. The railway company have arranged to give sacred concerts at Avondale Park every Sunday afternoon.

Dover, N. H.—The directors of the Wells Beach and Ogunquit Electric Railroad Company have perfected their organization as follows: William H. Eaton, of Wells Beach, president; Charles W. Tibbetts, of Dover, vice-president; Thomas G. Jameson of Somersworth, treasurer, Walter D. Davis, of Wells Beach, clerk; William H. Eaton, Charles W. Tibbetts, Josiah Chase, Oscar J. Hubbard and William F. Cousins, executive committee.

Saratoga, N. Y.—The board of street commissioners has granted to Dennis B. Hill, of Greenwich, Washington County, a franchise for erecting poles in the streets of the village and wiring them for electric lighting and also for lighting public buildings and commercial lighting. It is reported that Mr. Hill is connected with the United Gas and Electric Light Company, which has secured the contract for lighting the village from August 15 next.

Staten Island, N. Y.—The trustees of the village of Edgewater have granted to the Staten Island Electric Railroad Company the right to change the motive power upon the old Belt Line Company's route from horses to electricity. The Staten Island Electric Company has already laid some of its track in New Brighton, and work upon the power plant, which is being erected at the foot of Jersey street, New Brighton, is progressing rapidly.

Troy, N. Y.—Work on the Troy and Sandlake Railroad has begun. The Westinghouse Electric and Manufacturing Company of Pittsburg was given the contract for the motors for the cars and the generators for the power station. The motors will be forty horse power each and there will be two on each car. The style of car has not been decided upon, but they will be heavier and longer than those of the Troy City Railroad.

Stafford Springs, Conn.—The Rockville, Stafford and Southbridge electric railroad has been organized and the following officers elected: President, William B Ferguson of Malden, Mass.; treasurer, Charles C Davison of Lewiston, Me.; secretary, R. S. Hicks of Stafford Springs; directors, the above and Charles E. Baua of Plymouth, Mass., A. L. Patten of Lewiston, Me., and F. E. Low of Greenfield, Mass. The stock has been taken up and it is proposed to build a road at once from the Springs to Staffordville.

Burlington, N. J.—A second test by the Pennsylvania Railroad Company of the Westinghouse electric system on the Burlington and Mt. Holly branch has been made since our last report, and a speed of forty-two miles an hour attained. With two standard cars attached thirty miles an hour was reached. There was no flashing on the trolley wires at the highest rate of speed attained. The second motor car, to be fitted with larger motors, is designed to attain sixty miles an hour, and experiments so far indicate that no difficulty will be experienced in running at this high rate of speed.

San Francisco, Cal.—The *Call* says: "The San Francisco Gas Light Company has discovered that the electric light is affecting its revenue, and that if it wishes to keep in the front ranks of progress it will have to add an electric light plant to the one used for furnishing gas to the citizens. For some time past the officers of the company have been engaged in studying the electric light problem, and in an informal way they have decided that they ought to have a plant to furnish the new light. Without estimates they came to the conclusion that such a plant as they require would cost about $2,000,000."

Philadelphia.—The new trolley line to Haddington has been opened to travel. The trial trip assumed the character of an ovation, some of the principal citizens participating; men, women and children turned out, waved flags and pocket handkerchiefs and cheered heartily the advent of the trolley into the hitherto inaccessible portions of West Philadelphia. Magistrate Peter J. Hughes, who was the projector of the new line, was a conspicous figure on the trip and he was the recipient of numerous floral offerings from admiring friends along the route of the new railway.

Albany, N. Y.—The State Railroad Commission will consider the following applications June 25: of the Raquette Lake Railroad Company for a certificate under section 59 of the railroad law, authorizing it to construct a road in the Adirondacks; of the Rome City Street Railway Company to change its motive power to electricity.—The board of trustees of public buildings has approved the contract made with the Municipal Gas Company of Albany for the gas and electric lighting of the capitol and executive mansion at $30,000 a year for three years. The cost of gas and electric lighting last year was $39,688.82. The present contract requires that 3,800 incandescent lights of 16 C. P. each and 54 arc lights, each of 2,000 C. P. shall be furnished, with all repairs, supplies and maintenance.

Buffalo, N. Y.—Jacob Busch and Thomas Murphy have applied to the common council for the right to handle electric power. They have undertaken to form a company with a subscription list of $1,000,000. Of this they say $100,000 has been subscribed, and if the franchise is granted they have assurances that if it is necessary $5,000,000 will be subscribed for the purpose of this enterprise. The petitioners ask the right, privilege and franchise to erect poles, lay conduits and string wires in any and all of the streets, alleys and squares of the city of Buffalo, for the purpose of supplying light, heat and power. They want the privilege of obtaining power from any company, firm, person or persons engaged in transmitting electricity in Buffalo, Niagara Falls or elsewhere and to be allowed to connect wires for the purposes of such electrical transmission. The petition sets forth the purpose of the new company to be to go to Niagara Falls if necessary and bring power to Buffalo.

Washington, D. C.—It is reported that arrangements have been completed for building the long delayed boulevard road between this city and Baltimore.—The Washington and Great Falls Electric Company has secured permission to issue $500,000 in bonds to build its road. The line is about 6½ miles long and the trolley system will be used. Stilson Hutchins is president of the road.—A number of gentlemen who are interested in the development of the power at Niagara propose visiting Great Falls, on the Potomac, to make investigations as to the facilities afforded at that point for manufacturing enterprises. The power obtainable is sufficient to operate a large number of works through the agency of electricity.—P. A. B Widener, Wm. L. Elkins and Thomas Dolan have disposed of all their interests in the Washington City street railways to the Maryland and Columbia Electric Railway Company, which is to build an electric road between Baltimore and Washington. The gentlemen named are also heavily interested in the latter company, and they sold out their Washington interests to enable the new company to secure proper terminals in that city.

Baltimore.—The *American* says: "The narrow-gauge tracks of the Baltimore and Lehigh Railroad and the York Southern, which is that part of the system lying within the State of Pennsylvania, will shortly be converted into a standard gauge road, and not unlikely into an electric line as well, using the heavy and powerful trolley instead of the steam locomotive. Mr. Blackwell, the electrician, who went over the road a few days ago with an inspection party, will make his report to the executive committee at the earliest possible moment. The question of electrifying the road will then be taken up, and if it be found that the line can be operated to advantage by the new method, the change will be made without delay, and will go into effect when the work of broad-gauging the road shall have been completed."—One of the electric locomotives for the Belt Line Railroad has arrived here from Schenectady. It is proposed after completing all arrangements for regularly running the electric locomotives through the tunnel to have a formal opening, to which President Cleveland, the diplomatic corps and other distinguished persons are to be invited.

Telephone and Telegraph.

The city council of Lincoln, Neb., has granted to George D. Sheibley a franchise for an underground telephone service. Six hundred subscribers have been secured. The Kurtz system will be installed.

The Citizens' Mutual Telephone Company, Decatur, Ill., organized three years ago by W. J. Kurtz, of Vandalia, Ill., has sold its plant to a syndicate for $9,448.

A fifty-year telephone franchise has been granted to W. J. Kurtz, of Vandalia, Ill.

The La Crosse Telephone Company, La Crosse, Wis., has contracted with Miller & Dolan, of that place, for the setting of 1,000 poles, work to be completed by July 10th. Wire stringing will commence at once. The company has purchased all the necessary material except telephones, and is in the market for 500 instruments and switchboard.

At Boston on the 12th inst. the Bell Telephone directors declared a regular dividend of 3 per cent. and an extra one of 1½ per cent., payable July 15 to stock of record June 29. They also called a stockholders' meeting for June 24, to act on a recommendation to issue $1,000,000 additional stock. The outstanding capital is now $20,500,000. The new stock must be offered to shareholders at a price to be fixed by the Commissioner of Corporations, and any unsubscribed balance must be sold by auction.

The long-distance telephone line between Columbus and Rome, Ga., will be completed in a week or ten days.

J. A. Clason and others have organized the Eureka Telephone Company at Neosho, Wis.

A local telephone exchange has been established at Lisbon, Minn. Connection will be made with nearby places.

The Standard Telephone Company will soon begin work at St. Paul and other Minnesota towns.

The work of constructing a telephone line connecting Carbondale, Ind., and Murphysboro, has begun.

The Standard Telephone Company has just completed a telephone system in Tomahawk, Wis. The company uses the French Milde system.

M. B. Rice, superintendent of the Telephone and Construction Company of Tallahassee, Fla., has applied to the city council of Jacksonville, Fla., for permission to establish a telephone exchange in Jacksonville, to compete with the present exchange.

The new Capital Telephone and Telegraph Company of Sacramento, Cal., has ordered 700 telephones from a New York telephone company.

A factory to manufacture telephones for the Pana Company has been located at Elwood, Ind., which will be the headquarters of the company.

A telephone line is being constructed from Clifford to Columbus, Ind., tapping Hartsville, Newberne, Hope, St. Louis Crossing, Flatrock, Petersburg and Nortouberg.

George W. Cross, the Baltimore agent of the Standard Telephone Company, has put solicitors at work securing subscribers in that city for a telephone system, which it is proposed to operate in opposition to the present Bell system, and at much lower rates for both local and long distance service.

The Wisconsin Telephone Company finds it rather distasteful to reduce its rates at Milwaukee, but promises—if the citizens are good enough to give it increased patronage—to do so about the 1st of July. One of the directors intimates as much in this statement made to a representative of the *Sentinel*: "However, the rates will be reduced, and the question with the directors only is, whether the reduced rates would stimulate the use of the telephone sufficiently so as to make up for the loss which the directors feel certain will result from the reduction." A lively competing company at Milwaukee is the stimulant the directors are most in need of, and the citizens too.

In accordance with the ordinance of councils of Philadelphia, the Automatic Telephone Company has filed a bond with the city for $87,000. Among the names on the bond is that of the Integrity Title Insurance Trust Company. The Automatic Company was recently granted a franchise to operate in Philadelphia.

At a meeting of the New York Board of Trade on the 12th inst. the report of the Telephone Committee, reciting the diligent but fruitless efforts at Albany for cheaper telephone service, was submitted. The report intimates that improper means were used to influence votes, and suggests unity in measures to defeat the renomination of all Senators and Assemblymen who were against the Telephone bills.

The Postal Telegraph Company has petitioned for a right of way through Madison County, Ind., the proposed line from Richmond to Chicago passing through Anderson, Frankton and Elwood.

E. C. Hein has obtained a franchise for a telephone exchange at Statesville, N. C.

Residents of Lake Odessa, Clarkville, Sunfield, Mulliken and Freeport, Mich., have organized a stock company and put in a telephone line connecting the five villages.

An ordinance has been submitted to the board of aldermen at Louisville, Ky., authorizing the American Telephone and Telegraph Company of Kentucky to use the public streets of Louisville for the purpose of placing poles and electrical conductors thereon and subways for electrical conductors under the same.

The California Telephone and Construction Company of San Jose, Cal., has secured contracts for about all of the independent exchange work in that section. This company is installing an exchange system at Sacramento and is making preparations to extend the service to all parts of the State. Three year contracts are being made with subscribers. In Sacramento and San Jose nearly all of the Bell Company's subscribers have decided to take the service of the new company. The Bell Company has commenced to reduce rates outside of San Francisco and is about to cut rates there to meet competition.

The Southern Telephone and Construction Company and the Telephone and Electric Specialty Co. have been succeeded by the Florida Telephone and Construction Company, recently incorporated at Tallahassee, Fla. The officers of the new company are as follows: Jas. D. Randall, president; W. A. Rawls, vice-president; J. W. Saxon, treasurer; M. B. Rice, secretary. The company will have offices in Tallahassee, Fla., and Memphis, Tenn., and will engage in telephone construction work for both exchange and interior purposes.

COMMERCIAL PARAGRAPHS.

"Interesting Facts" is the title of a booklet that is being distributed by the New York and Ohio Company, Warren, O., manufacturers of the "Packard" Lamp. The title is no misnomer, for the pamphlet tells in an interesting way many facts about incandescent lamps in general and the "Packard" in particular. The performance of the "Packard" Lamp is shown by curves of candle power and efficiency and by curves of comparison. The book tells what a high efficiency lamp really is, as well as other things lamp users need to know.

A part of the latest catalogue and price list of carbon products issued by the Crouse-Tremaine Carbon Company, Fostoria, O., is devoted to the subject of Cored Carbons, in which the following announcement is made: "We are happy to say that we have succeeded in producing a cored carbon fully equal to the best foreign make, which we are selling at a price lower than the importers can afford to make." Cored carbons are made by this company for both high and low potential arc lighting.

The "fin de siecle" catalogue of general electrical supplies issued by the E. S. Greeley Company, 5 and 7 Dey street, New York, is one of the most elaborate works in this line that have been produced. The book embodies 560 closely compiled pages and 2,000 illustrations.

The most recent catalogue issued by the Emerson Electric Manufacturing Company, St. Louis, is devoted to the "Meston" alternating current motors. The text and illustrations make quite plain all the good points of this company's products.

The Sulzer-Vogt Machine Company, Louisville, Ky., long time manufacturers of hydraulic elevators, have added an electric department and are now producing a complete line of electric elevators. A supplementary catalogue, recently issued, is devoted to this department.

The Brady Manufacturing Company, Brooklyn, N. Y., has issued a circular calling attention to its facilities for manufacturing special tools and fixtures and interchangeable metal parts of every conceivable design, and for every possible purpose.

A Promising Industry.

(Fom the Minneapolis Journal.)

The Indianapolis Electric Company, manufacturers of long-distance telephones, annunciators, batteries, magnets, bells, switches, transmitters and receivers, are greatly encouraged over the volume of their business which is increasing daily. Their long-distance telephone is now in use on the Belt road, the Union tracks, by the Indianapolis Natural Gas Company between Indianapolis and Elwood, and a number of the coal operators in Clay County are using this telephone. The Big Four has adopted it on portions of its system. On Saturday the establishment was four hundred behind in orders for telephone instruments.

The Law Battery Company.

The Law Battery Company, manufacturers of batteries, electro-therapeutical apparatus, carbons, battery materials and a line of electrical specialties, have recently erected a new factory at Cranford, N. J. The building is 50 by 100 feet, and is fitted throughout with new and improved machinery. With increased manufacturing facilities the company is now able to meet all requirements and to fill all orders promptly.

A forty-eight page catalogue has just been issued describing in detail all the products of this company. The New York office of the company has been removed to 39 Cortlandt street.

"Economy Guarantees of Engines."

The above is the title of a neat little pamphlet issued by the Westinghouse Machine Company, Pittsburg, manufacturers of the well-known Westinghouse engines.

This company takes pardonable pride in the fact that its business has been conducted upon lines of open statements of facts that the customer might be fully and correctly informed.

The faith of the manufacturers in their product is forcibly shown by the following proposition which is offered to all intending purchasers:

"Any purchaser, so desiring, is welcome to have his engine tested by his own expert at our shops before shipment and may accept or reject the engine on that test before incurring the expense of installation."

Street Lighting.

Nations may be ungrateful, but the chief officials in our Western cities are not so constituted, judging from a letter received by the Standard Electric Company, Chicago, from which we extract the following: "The (Standard arc) dynamo we bought of you has been in constant use in all-night service since November, 1893, and has not cost one cent for repairs. I find it more economical to operate —in the amount of power required—than any other dynamo we use.

A Breeze From the City of Wind.

There is always a refreshing air about the printed matter that comes from the advertising department of the Central Electric Company, Chicago. It is therefore to be expected that a circular devoted to fan motors would be a breezy production. Circular No. 20, just issued, enjoys that distinction while it serves the useful purpose of telling to what good uses the Lundell Fan Motor can be put.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Allegheny, Pa.—Thomas McKee, son of H. Sellers McKee, will erect a dwelling on Ridge ave. at a cost of $60,000; handsome interior finishing.

Austin, Tex.—Geo. W. Littlefield has purchased the Driskall Hotel, and will enlarge it and add an opera house.

Baltimore.—Thomas Gordon, proprietor of the Rose House, has purchased a site on North Eutaw st., and will erect a hotel, restaurant and roof garden combined. ....Frank E. Ewell is building one of the finest residences in this city, in Eutaw Place: it will be lighted by electricity throughout, Architect J. E. Laferty.

Brockton, Mass.—Dr S. J. Gruver, John W. Hall, C. D. Bridgeman, F. B. Gardner and Embert Howard are the construction committee of the new First Congregational Church, Main and Pleasant sts.

Brooklyn, N. Y.—A music hall is to be erected at Alabama and East New York aves., Architects J. B. McElfetrick & Sons, 1193 Broadway, New York.....Memorial Hospital for Women and Children has obtained leave to borrow $70,000 to complete its new buildings, Prospect Place and St. Mark's ave.

Buffalo, N. Y.—Hotel to be built on the grounds of the International Assembly at Crystal Beach: President, W. H. Main.....Rung Bros., furniture dealers, will build five story brick apartment house, south side of Glenwood ave., east of Main st., Architect A. E. Koehn.

Boston, Mass.—Wm. A. Miller will erect a six story block at Elliott and Pleasant sts., according to plans drawn by Architect Patrick A. Tracy; electric elevators; heated throughout by steam.

Charleston, W. Va.—Hon. W. A. McCorkle will receive bids for a four story hotel. Electric lights, steam heating, street, passenger and freight elevators, steam power.

Hartford, Conn.—Hartford is to have an $80,000 theater.

Lebanon Springs, N. Y.—Lebanon Springs Company incorporated to conduct a hotel and mineral water business in Lebanon Springs, Columbia County; capital stock, $300,000. Directors: John H. Fife and F. H. Herron, of New York City, and Issac Smith, of Brooklyn.

Little Falls, N. Y.—The project of building a new city hall is being discussed.

Medway, Mass.—The building erecting by W. B. Hodge is to be fitted up with electric lights.

New York City.—H. O. Havemeyer has definitely decided the style and size of his new buildings to be erected at Prince and Ann sts. The structure for the latter corner is to be a tower-shape structure of 25 stories, fire-proof throughout and contain latest modern office building equipments, elevators, electric lighting and steam heating....Plans are being prepared by Architect George B. Post, 33 East 17th st., for two fire-proof buildings, twelve stories in height, at the northeast cor. of Prince st and Broadway; power plants and machinery will be placed in the basements; the buildings will be steam heated and lighted by electricity....The six story mercantile building to be erected by Andrew H. Smith, at 20 East 42d st., will be lighted by electricity. ....The mercantile building to be erected for the estate of J. C. Ayer, cor. Leonard st. and Broadway, at a cost of $150,000, will be lighted by electricity, Architect Robert Manicke, 33 East 17th st ....Plans have been filed for a $70,000 addition to the Imperial Hotel, Broadway and 32d st....A seven story warehouse and laboratory will be erected southwest cor. of University and Clinton Places, for A. & S. Hirsch, Architect Alfred Zucher, 33 Union Square West....Plans have been filed for a 4-story building to be erected as an annex to the Roosevelt Hospital, 59th st., to cost $150,000.....The Five Points House of Industry, 155 Worth st., will be enlarged by the erection of a fire-proof building to accommodate five hundred children, to cost $100,000. W. F. Barnard, Sup't..... 2 four story brownstone dwellings, 34-36 West 72d st., Architects Thom & Wilson, 1267 Broadway; 5 five story dwellings, north side of 85th st., west of Boulevard, also 4 similar houses, south side of 86th st., east of West End ave., Architect C. H. P. Gilbert, 18 Broadway; 2 five story flats north side of 87th st., west of Amsterdam ave., by James Buckley; five story brick tenement, southwest cor. of Stanton & Willett sts. by Fay & Stacom; sixteen story brick office building, 63-65 Wall st., Architects Clinton & Russell; five story office and flat, northeast cor. of 92d st. and 3d ave., by George Ringler & Co.; six story brick store and offices, at 20-22 East 42d st., by Andrew H. Smith, 15 East 38th st.

Newark, N. J.—J. H. Bonnell & Sons will erect a business building at 196-198 Market st., seven stories, heated by steam, lighted by electricity. Architect Thos. Cressy.

Niagara Falls.—Theatre to be erected on the site of the Park Theatre Architects Leon H. Lamport & Son, Rochester, N. Y.

North Tonawanda, N. Y.—Edward Evans has announced that he will shortly begin the erection of a new opera house in North Tonawanda, seating capacity 1,200.

Philadelphia, Pa.—J. Clark Moore, Jr., will erect 9 four story houses, with Pompeiian brick fronts, on Spruce st., west of 40th....Architects Rankin & Kellogg have finished the plans for the 2d Regiment Armory to be erected on Broad st.....Architect Thomas Bennett is preparing plans for a nine story office building to be erected in the center of the city....Architect J. B. Colesberry is receiving estimates for a handsome residence to be built at Melrose for Mrs. Wm. H. Lorimer; it will have electric lighting and every modern improvement....Work will soon begin on a handsome house for Benjamin P. Opedyke, on northwest side of Drexel ave., near 49th st....It is expected that the contract for the erection of the proposed Augusta apartment house, at 6th and Spruce sts., will be let soon, Architect Willie G. Hale.

Richmond, Va.—Edgerton Rogers has completed plans for a projected theater and hotel building.

Rochester, N. Y.—Sidney B. Roby will erect a five story manufacturing building at West Main and Elizabeth sts. Architects Charles S. and Harvey Ellis.

Roxbury, Mass.—Architect C. F. Clark has prepared plans for a $100,000 apartment house on Humboldt ave., for E. D. Bell. The structure will accommodate eighteen families.

Savannah, Ga.—Architect Frank Cox has announced that the erection of a new theater at this place will be commenced at once.

Syracuse, N. Y.—Architects Benson & Brockway, 55 Broadway, New York City, have prepared plans for a new building to be erected for the Medical College and Syracuse University. The structure will be four stories, the basement to contain dynamos, elevator machinery, boiler room, machine shop, cold storage room, etc.

Pittsburg, Pa.—A company of Pittsburg capitalists are said to have secured ground on Forbes st. and will erect a hotel to cost $800,000.....G. D. Simen has plans under way for a twelve story store and office building to be erected on Grant st....James McNally will erect an eight story business block on Penn ave., Architect P. D. Evans.

Wheeling, W. Va.—The Exchange Bank will erect a bank building.

Windsor, Ont., Can.—St. Andrew's Presbyterian Society will build a brick and stone Sunday-school and church at Victoria and Park ave., to cost $25,000, electric work, etc. Architect Wm. C. Rohns, 1113 Chamber of Commerce, Detroit, Mich.

INCORPORATIONS.

The Chicago Electric Light Enlarging Company, Chicago, has certified to an increase in capital stock from $5,000 to $15,000.

The Allegheny Power Company, Pittsburg, Pa.—to supply light, heat and power by means of electricity. Capital stock, $1,000. Promoters: H. W. Mitchell, Pittsburg; Wm. H. Dodds, Chas. F. Patterson, Allegheny, Pa.

The South Shore Street Railway Company, Erie, Pa.—to build an electric street railway in North East, Pa. Capital stock, $100,000. Promoters: L. J. Chase, Buffalo, N. Y.; E. M. Ketcham, Frank McLaughlin, North East, Pa.

The Chatham Electric Light, Heat and Power Company of Chatham, Columbia County, N. Y. Capital stock, $10,000. Directors: John F. Farrell, of Albany, and H. M. Francis and J. O. Carr, of Schenectady.

The Erie and Eastern Street Railway Company, Erie, Pa.—to build an electric street railway in the city of Erie. Capital stock, $25,000. Promoters: Harry L. Moore, F. F Curtze, C. M Conrad, Erie.

The Erie, Reed Park and Lakeside Street Railway Company, Erie, Pa.—to build an electric street railway in Erie. Capital stock, $50,000. Promoters; Chas. M. Reed, F. F. Curtze, Harry L. Moore, Erie.

The Franklin Company, Pittsburg, Pa.—to supply light, heat and power by means of electricity. Capital stock, $1,000. Promoters: H. W. Mitchell, Chas. F. Patterson, Pittsburg; Wm. H. Dodds, Allegheny.

The Springfield, Clifton, Cedarville and Jamestown Electric Railway Company, Xenia, O.—to build and operate an electric railway from Springfield through towns named to Jamestown. Capital stock, $100,000. Promoters: John B. Stevenson, G. A. McKay, A. C. Carpenter, R. R. Knowles, R. F. Kerr, T. L. Magruder, of Xenia.

The Greenville Light Company, Greenville, Ohio—to manufacture and supply light, heat and electricity for public and private use. Capital stock, $5,000 Promoters John P. Martin, Chas. Darlington, E. M. Milton, M. A. Broadstone, of Xenia, Ohio.

The Carthage Electric Telephone Company, Carthage, Mo.—to erect and maintain telephone lines. Capital stock, $5,000. Promoters: Theo. J. Clark, E. C. Clark, Geo. W. Wheeler, E. R. Wheeler, Carthage.

The Hillsboro Street Railway Company, Hillsboro, Tex.—to operate street railway in Hillsboro. Capital stock, $15,000. Promoters: R. J. Ware, H. W. Carter, S. E. Carter, all of Hillsboro.

The Pressley Single Track Electric Railway Company, San Francisco, Cal.—to purchase, own, use and sell United States patents for electro-magnetic safety railways; grant to others the right to use and buy inventions. Capital stock, $[illegible]00,000. Promoters: L. C. Pressley, J. C. Rhoads, J. O. Jephson, C. S. Wheaton, W. F. Oecling, San Francisco.

The Hammond and Blue Island Railway Company of Indiana (incorporated in Ind.), Chicago, Ill. Capital stock, $80,000. Promoters: Edw. S. Whitney, Fred'k B. Fuller, James T. Maher, Ralph Martin.

The Cairo and Catskill Telephone Company—to connect Cairo, Catskill and other near-by places. Capital, $500. Directors: F. G. Walter, A. V. Decker, H. S. Duncan, J. Leroy Jacobs, Selden H. Hines, John K. Palen and Solon W. Stevens, of Cairo, N. Y.

The Trumansburg Electric Lighting Company of Trumansburg, Tompkins County, N. Y Capital stock, $10,000. Directors: C. C. Sears, A. S. Mosher, James H. Smith and O. G. Noble, of Trumansburg.

A charter has been issued by the State Department at Harrisburg, Pa., to the Buffalo and St. Marys Railroad Company, capitalized at $300,000, to build a line from St. Marys, Elk County, to Clermont, McKean County, Pa., a distance of thirty miles. President, Andrew Kaul, St. Marys. Directors: B. Frank Hall, B. E. Wollendorf, John Kaul, G P. Simons, J. M. Schaefer, St. Marys, Pa.; J. K. P. Hall, Ridgway.

The Central American Development Company, San Francisco, Cal.—to build steam and street railroads, electric cables, etc. Capital stock, $1,000,000. Promoters: C. T. Thomas, A. Ballin, San Francisco; Frank A. Woodworth, Santa Barbara, Cal.; M. Cassin, Salvador, C. A.

The San Jose Lighting Company, San Jose, Cal.—to construct and operate works, plants and systems for the manufacture of gas and electricity for light, heat, power; build pipes, mains, flumes, lines, etc., for transmission of electricity. Capital stock, $250,000. Promoters: Chas. F. Wilcox, Jos. R. Patton, Wm. H. Sumner, San Jose.

The Little Falls Street Railway, Little Falls, N. Y.—to build and operate an electric surface road. Capital stock, $75,000. Promoters: W. H. Tylee, Worcester, Mass.; C. L. B. Tylee, J. L. Miller, F. H. Viele, Corning, N. Y.

The Freemansburg Electric Company, Freemansburg, N.Y.—to manufacture and use electricity. Capital stock, $10,000. Promoters: C. C. Sears, J. H. Smith, O. C. Noble, of Freemansburg: C. S. Wixom, Covert, N. Y.

The Buffalo, North Main Street and Tonawanda Company, Buffalo, N. Y.—to operate the Buffalo, North Main Street and Tonawanda Electric Railroad Company. Capital stock, $75,000. Promoters: S. W. Petrie, T. H. Feeney, J. H. Pardee, Buffalo; J. F. Farrell, Albany, N. Y.

The Bridgton and Harrison Electric Company, Bridgton, Maine—to make, generate and distribute electricity for heat, light and power. Capital stock, $10,000. Promoters: Geo. P. Locke, Norway, Me.; Chas. E. Geason, Chas. A. Scribner, Bridgton.

The Penn Electric Light, Heat and Power Company, Reading, Pa.—to manufacture and supply light, heat and power by means of electricity. Capital stock, $100,000. Promoters: John P. Bechtel, Chas. N. Frame, Milton H. Schnader, Reading.

The Automatic Circuit Breaker Company, Newaygo, Mich.—to manufacture and sell electrical machinery, etc. Capital stock, $10,000. Promoters; Chas. C. Kri zer, A. C. Runnels, Nancy Runnels, Newaygo.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JUNE, 1895.

Date.	Light.	Date.	Exting.
1	11.50 P. M.	2	3.30 A. M.
2	......	..	......
3	1.00 A. M.	3	3.40 A. M.
4	1.10 "	4	3.40 "
5	1.40 "	5	3.40 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	8.00 P. M.	9	11.00 P. M.
10	8.00 "	10	11.30 "
11	8.00 "	11	11.50 "
12	8.00 "	13	12.20 A. M.
13	8.00 "	14	12.40 "
14	8.00 "	15	1.00 "
15	8.00 "	16	1.20 "
16	8.00 "	17	1.30 "
17	8.00 "	18	2.00 "
18	8.00 "	19	2.30 "
19	8.00 "	20	3.00 "
20	8.00 "	21	3.40 "
21	8.00 "	22	3.40 "
22	8.00 "	23	3.40 "
23	8.00 "	24	3.40 "
24	8.00 "	25	3.40 "
25	9.00 "	26	3.40 "
26	9.30 "	27	3.40 "
27	10.00 "	28	3.40 "
28	10.30 "	29	3.40 "
29	11.00 "	30	3.40 "
30	11.30 "	July 1	3.40 "

ELECTRICAL PATENT RECORD.

Letters Patent Issued June 11, 1895

ELECTRIC RAILROADS AND APPLIANCES.

540,653. Supply System for Electric Railways. Oscar A. Enholm, New York, N. Y., assignor, by mesne assignments, to the Electro-Magnetic Traction Company, Washington, D. C. Filed Nov. 3, 1891.

540,664. Electric Railway. Sebastian Hoeninger, Milwaukee, Wis. Filed Aug. 15, 1894.

540,883. Trolley. William E. Steinbach, Philadelphia, Pa. Filed April 6, 1895.

540,900. Conduit Electric Railway. David Brooks, Jr., Philadelphia, Pa. Filed June 9, 1892. Renewed Dec. 7, 1894.

540,901. Conduit-Railway Conductor. David Brooks, Jr., Philadelphia, Pa. Filed Feb. 27, 1892. Renewed Dec. 8, 1894.

541,020. Conduit Electric Railway. Daniel W. Smith, St. Louis, Mo., assignor, by direct and mesne assignments, of two-thirds to Alfred Bevis and Charles H. Longstreth, same place. Filed Sept. 10, 1894.

541,044. Trolley Wheel and Yoke. William H. Fritz, Dayton, Ohio, assignor of two-thirds to Orlando P. McCabe and George R. Decker, same place. Filed March 12, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

540,800. Electric-Arc Lamp. Samuel P. Parmly, Chicago, Ill. Filed Oct. 26, 1891.

DYNAMO ELECTRIC MACHINERY.

540,668. Regulation of Alternating Generators. Rudolph M. Hunter, Philadelphia, Pa. Filed June 21, 1894.

BATTERIES, ETC.

540,620. Electric Circuit. William W. Alexander, Kansas City, Mo., assignor to the Gill-Alexander Electric Manufacturing Company, same place. Filed March 24, 1890.

TELEPHONE AND TELEGRAPH APPARATUS.

540,761. Telephone. Walter W. Scott, Buffalo, N. Y. Filed March 4, 1895.

540,772. Photo-Telegraph. Charles Willoughby, San Francisco, Cal. Filed Nov. 3, 1894.

540,781. Telephone-Transmitter. Daniel Drawbaugh, Eberly's Mill, Pa., assignor to the Drawbaugh Telephone and Telegraph Company, New York, N. Y. Filed Feb. 16, 1895.

540,799. Cross-Bar for Telegraph-Poles. James B. Oliver, Shield's Station, Pa. Filed Aug. 10, 1894.

540,899. Telegraphic Apparatus. Louis Boudet and Pierre Lacombe, Lumel, France. Filed Oct. 20, 1894.

540,959. Telephone-Transmitter. Daniel Drawbaugh, Eberly's Mill, assignor to G. Milton Bair, Hanover, and Calvin W. Ream, Reading, Pa. Filed Feb. 23, 1895.

540,960. Carbon-Holder for Telephones. Daniel Drawbaugh, Eberly's Mill, assignor to G. Milton Bair, Hanover, and Calvin W. Ream, Reading, Pa. Filed Feb. 21, 1895.

540,961 Telephone-Electrode. Daniel Drawbaugh, Eberly's Mill, assignor to G. Milton Bair, Hanover, and Calvin W. Ream, Reading, Pa. Filed Feb. 21, 1895.

540,969. Telephone. Stephen D. Field, Stockbridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Dec. 5, 1894.

540,974. Multiplex Telegraphy. Daniel B. Grandy, St. Louis, Mo. Filed Dec. 17, 1894.

541,036. Telephone-Transmitter. Charles Clamond, Paris, France, assignor to the Clamond Telephone Company, Philadelphia, Pa. Filed March 20, 1895.

541,037. Telephone-Transmitter. Charles Clamond, Paris, France, assignor to the Clamond Telephone Company, Philadelphia, Pa. Filed March 20, 1895.

SIGNALS AND SIGNALING APPARATUS.

540,642. Automatic Electric Railway-Signal. William Daves, Jersey City, assignor of one-half to William H. Peddle, Roselle, N. J. Filed Feb. 14, 1895.

540,859. Electric Railroad Signal. Burton H. Gedge, Anderson, Ind. Filed May 20, 1892.

MISCELLANEOUS.

540,685. Electric Brake. William B. Porter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 9, 1895.

540,687. Covering for Electric Wires. Franklin S. Randall, Philadelphia, Pa., assignor of one-half to Howard A. Engle, W. Howard Holden and Dillwyn P. Roberts, same place. Filed Jan. 2, 1894.

540,949. Electrical Push-Button. Edwin A. Clark, Cleveland, Ohio. Filed Jan. 24, 1895.

ELECTRICITY.

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There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

EDITORIAL NOTES.

Cowardice, Not Ignorance.

At intervals during the past three years Electricity has been at some pains to show in just what particulars the electrical press of this country has failed to be what it should have been in its relations to the trade and to the public. The inevitable results of years of servility and sycophancy on the part of these papers are now so plainly evident that we have recently felt called upon to again call attention to this phase of the situation at considerable length. The case against them has been clearly presented and the charges have been specific.

The *Electrical Review* is so far the only one of our contemporaries which has seen fit to make any attempt to defend itself or to cast discredit upon the statements made by us. The weakness of the *Review's* attempted reply and the silence of the others are simply a confession of judgment. They plead guilty to the charge of conducting their papers solely with the view of extracting as large an amount of money as possible out of the legitimate concerns without giving them any equivalent whatever in the way of protection against the usurpers who have all but succeeded in ruining the entire business.

There are to-day thousands of men in this trade who looked with a measure of skepticism upon Electricity's campaign in the beginning, but who, with the progress of events, the verifications of our charges, have come to be full believers in the justice of our attack upon dishonest methods and upon the men chiefly responsible for those methods. These men see, just as we see, that if the electrical press had done its duty the trade could never have been forced into its present condition. These men are waiting for a reply from the *Electrical World* or the *Electrical Engineer* to our strictures. In the absence of such reply they will not fail to give adequate expression to their contempt for the cowardly policy which has controlled these papers.

We shall take this question up next week in a slightly different manner, and shall then begin the publication of a series of articles, with a vast amount of official data, giving specific instances of the general financiering methods which have been the cause of fleecing thousands of innocent investors, and which have brought the entire range of electrical securities into disrepute. The general plan of these articles may be understood in advance by a reference to the exposé of the Tacoma swindle two weeks ago.

Meantime we would like to have an answer from any or all of our contemporaries to the following question:

If the electrical trade has been conducted upon correct lines, if a radical reform is not demanded, why is it that concerns engaged in it in the early days, with opportunities for making money never before offered in any line of business save perhaps mining and drilling for oil, are all either in the graveyard or in the hospital for incurables?

The case resolves itself into one of two alternatives. Either the lines upon which the business has been conducted were fundamentally wrong, or else the entire industry is a short-lived bubble, the apparatus and devices sold have not been commercially practical, the entire business of electric lighting and power transmission is unstable and short lived and must give way to its competitors. Is the latter true? Perish the thought.

The trade has not been right. It has been conducted upon an entirely wrong basis. The responsibility for allowing the wrong to assume temporary control rested even in 1880 upon the electrical press—the responsibility for the past fifteen years of dishonor and disgrace.

Of course we are aware that the plan of editorial work followed by our contemporaries is different from that in practice in this office. We believe in the notion of getting out among the people, meeting every week just as many of the leaders in the business as is possible and hearing their views, which are then properly dissected and presented for the edification of the multitude, whereas the papers above mentioned evidently believe that editorial work should be done within the four walls of an office, and that the editor should depend upon his own inner consciousness, or Divine grace, to know what is going on and to treat the burning questions of the day with becoming wisdom.

Nevertheless, the excuses of our contemporaries that they are ignorant of the wrongs which have been perpetrated upon the industry, and consequently could not speak, are utterly invalid.

THEY DID KNOW. THEY COULD NOT HAVE BEEN IGNORANT.

The excuses which they advance for not doing their duty by those who have made them what they are have sprung from cowardice and deceit, and are offered in the belief that the standard of intelligence in the trade is so low that they will not be called to book for their cowardice.

Not one of our contemporaries but was familiar with the general trend of affairs since 1879; not one of them but was aware that the situation brought about by the G. E. Company's formation was but the climax of a policy of injustice to competitors and of robbery of investors which had characterized the large companies from their inception; not one of them but knew absolutely that the success of the G. E. Company meant the wiping out of every other concern in the trade, the driving into other fields of hundreds of individuals who had just as good (or better) right to make money out of the electrical business as any man in the combined companies.

Yet, did they speak one word of condemnation of the campaign of extinction and extortion? The record says no.

We propose to *prove* to those who have any lingering doubts upon the subject that ELECTRICITY has been RIGHT, and that the papers mentioned above are WRONG; that they have utterly failed to execute the trust reposed in them; that through cowardice, flunkeyism and mistaken motives of self-interest they have supplied aid to the enemy, and assisted in producing a condition of affairs in this trade never seen in the history of any other legitimate industry, a condition which could not have existed if they had done their duty by the concerns which have supported them since their birth. For even on the narrow view that a trade paper must protect the majority of its advertising customers these papers are clearly open to condemnation. The G. E. interests never gave them over 5 per cent. of their total support. The independent element made them, fostered them, kept them, and has for three years been spat upon by each and every one of them.

ELECTRICITY has been right; our contemporaries have been wrong. We hurl defiance at our critics. We have already seen many of them pass into bankruptcy because of their inability to believe the truth. We shall survive them all. We will be here enjoying the fruits of our honest labors after the trade has been purged of its dishonor, after some of our contemporaries have gone to that graveyard which awaits every paper that persistently fails to do its duty. We shall be here after all those concerns who fail to see their duty in the premises have joined their predecessors.

Can any man with a grain of common sense find any excuse for this breach of trust on the part of the papers mentioned? Would it have been conceivable in any other group of trade papers in the world?

They had been with the industry almost from its birth. They were not ignorant. They had seen the Edison and United States companies organized and conducted upon an utterly false basis. They had seen the efforts to bamboozle the public into supposing that ridiculous patents controlled the business—into the belief that the art itself was born after 1878.

They had seen the old companies selling worthless rights to local users all over the country, extracting large sums of money for something which could never be delivered, planning for the certain commercial failure of a large majority of the stations established, thus undermining the only foundation upon which a solid industry could rest. They had seen these large sums of money so extorted under false pretences wasted in gross mismanagement, the stockholders of the parent companies assessed again and again, thus ruining the public confidence at both ends of the line. They had seen these companies, after less than ten years of existence, and with the grandest opportunities for solid business success ever known in the history of the world, either confess bankruptcy or resort to further manipulation and combinations to prolong the dishonest practice.

They could not have been ignorant of the career of the Thomson-Houston enterprise. The records were plain. They could not have failed to hear, not once but a hundred times, the story of robbery and injustice practised upon central station men from the beginning. They knew the towns in which exclusive T.-H. rights had been sold, where, in violation of all rules of commercial honor, the same men had sold successively Schuyler, Brush, Excelsior and Ft. Wayne apparatus to other stations, selling the bonds as they established the plants to confiding Boston purchasers. They could not have been ignorant that this T.-H. Company came into the business with no higher idea than those of the highwayman, that their salesmen were instructed to place apparatus with utter disregard of the rights of their own customers, and with equal disregard of the question whether or not the plants would pay. If they found a city or a town with a station already established, making insignificant profits or even losing money, they had no compunctions over starting another one in the same town, unloading the securities upon the public, eventually forming a combination of the two plants, issuing fresh securities, and afterwards starting a third plant, carrying the plan out to exhaustion.

We say the electrical papers could not have been ignorant of these conditions. They knew the record of the men controlling the affairs of these large companies. They knew that nothing could come from them or their policy save dishonor and injury to the industry. They knew that the possibility for good in these men or their methods did not exist. They had been tried and found utterly wanting in everything needed to establish a lasting and creditable industry.

These papers were not ignorant; they were cowardly and culpable.

There is no occasion for ELECTRICITY to boast over the results of our efforts to improve the situation of this trade and to prevent the disasters which have overtaken it.

We are justified, however, in pointing out that so far we have been correct in our position, correct in predicting months ahead just what it was coming to. And upon the strength of our record, which is clean, we claim the right to be heard, and urge the careful consideration of our views.

The only journalistic work done in behalf of the independent, honest element has been done by ELECTRICITY. If half as much had been done by each of the other papers the career of the present management of the G. E. Company would have been brought to a close before January 1, 1893, before the trade was bedeviled, profits wiped out, confidence of investors killed, and commercial credits ruined.

Just what is the specific duty of a daily paper is perhaps a fit subject for argument. Among successful and respected newspaper men there are various theories and various policies pursued.

But when we come to the consideration of the duties of a trade paper, especially in a trade such as the electrical trade was in 1880, only one view is permissible as to the duty which confronted every journal embarking in the field. That duty was to keep the adventurers and schemers out, to explode all false notions as to the possibilities of the art, to make clear its limitations, to foster all that was good and condemn all that was bad, to throw cold water upon every scheme in which investors were likely to lose their money, to see to it that the confidence of the public in electrical matters was retained, to prevent at whatever cost the success of every attempt of one company or combination of companies to control the business, to prevent the deals of the speculators, and perhaps first of all to discourage the notion of forcing the demand for the product—putting out unfit apparatus.

Measured by any standard of duty to their trade or to the public, these papers have no right whatever to claim the good-will or support of any honest concern in the manufacturing business.

If the men proposing to put their money into central station enterprises, and who finally did invest, paying large amounts of money for worthless rights, had been informed by the press as to the prospects for success upon the plan then in vogue, would they have lost their money, as thousands have?

In not one single case have the electrical papers ever shown any appreciation of the dangerous methods which have been in practice from the beginning, and which have been carried now almost to the point where legitimate, conservative companies cannot conduct their business.

And it is not only as passive agents that they have assisted the wreckers. They have given active aid up to the full limit of their courage or abilities. They have had no compunctions about illustrating and puffing any and every device or piece of apparatus produced by any company which would advertise. They have wilfully misrepresented the merits and faults of the very things upon which they were supposed to pass as experts, usually printing any statements made by the advertiser as semi-editorial comment when asked to do so. They have descended to the lowest depths in servile puffery, when their duty to the public demanded that they should in a general and dignified way make plain whether or not certain lines of apparatus had the possibilities of commercial success or not. The *Electrical Engineer* has gone so far as to puff an electric hairbrush editorially, and is now throwing open its columns to a contribution to prove that a worthless primary battery is in reality a new and valuable advance in the art.

The record is clear. If the trade is ever to be upon a solid footing, if American electrical journals are ever to be received abroad with the same degree of respect which we accord to our British and Continental contemporaries, it will be because the honest workers in the trade on this side assert themselves and compel the press to change its policy, to stand up firmly for the right, even at some apparent financial loss.

The *Electrical World*, the *Electrical Engineer*, the *Western Electrician* and the *Electrical Review* have all been conducted from the start upon the notion that the *chief aim* of a trade paper is to print advertisements and get pay for them. It should be nothing of the kind. The controlling motive should be to benefit the trade on the lines laid down in the first part of this article. The pursuit of advertising patronage should be only an incident in the general plan.

* * *

IN the absence of any easier padding, the *Electrical Review* printed last week the full text of the Berliner decision. Inasmuch as that paper was not competent to analyze the decision and present a summary of what it meant, we suppose this was the best thing it could do. It was at least more interesting than the reading notice cuts upon which our contemporary usualy relies to fill up its space.

The Elevator Trust. The exposé in our issue of June 12 of the Elevator Trust and its despicable business methods came to many like a thunderbolt out of a clear sky, so unprepared were the general public to believe that what appeared on the surface as the keenest competition among reputable business firms was a combination working under the cover of a false name to drive out of the business by disreputable means other manufacturers in the same line whom they could not bulldoze or cheat out of honestly obtained contracts.

Among those most astounded were the architects, who for years have supposed that the contracts which they had been awarding for what appeared to be competitive bids were in fact awarded to one or the other member of a Trust which apportioned the contracts out according to the territory in which the job was to be erected. Among the better class of architects there is nothing so distinctly abhorred as combinations of this kind, and our publication of the facts was a revelation to these which will not be forgotten.

To the general public, who are less interested in these things, the Trust feature, while equally a surprise, attracted less attention than the methods employed by the Trust. If it were not susceptible of the amplest proof, it would be incredible that firms so well known as the Otis Bros. & Co., the Crane Company, the Whittier, and Stokes & Parish would be guilty of such unbusinesslike methods. There is ample proof, however, and in this issue we give another chapter scarcely less startling than that given two weeks ago.

But it is the method of all trusts and combinations which seek to control a whole industry. The same bulldozing and threatening methods have been employed by all, and it is these disreputable methods that have been the curse of the electrical industry from the start.

When a judge of a prominent court finds it necessary to characterize the testimony of one of the Trust's most valued agents as George K. Reynolds's testimony has been characterized, it is high time that honorable business men should hold themselves aloof from those profiting by or seeking to profit by the work of such agents.

It is scarcely to be believed that one of these companies is any worse than the others, but in the evidence already adduced the Otis Company and Mr. Norton P. Otis seem to be placed in the most unfavorable light. Honorable business men do not conduct their business in the way the Otis Company are shown to be conducting theirs, and honorable business men will not do business with those who are known to stoop to such methods as they employ. We believe therefore that it is only necessary to make the methods of the Trust known to destroy the power of that unholy alliance. We believe that honorable business men when they become familiar with the methods employed by these firms will hold themselves aloof from them in all their future transactions. They will spurn them as they would the leper. They will not lose by this, however. The independent manufacturers of elevators are succeeding, notwithstanding this powerful combination, by sheer merit. They have been wonderfully handicapped in the race but are succeeding nevertheless. We propose to help them in this fight, and believe that we have helped them, for it is only necessary that the methods of the Trust should be known that they should be despised.

To those who prefer the triumph of straight business methods over the spurious kind practised by the discredited Elevator Trust, it is encouraging to know that notwithstanding the vicious attacks made upon competitors all along the line, these competitors flourish and grow stronger every month. Among those companies not before referred to in this article we may mention the following:

The Keystone Electric Company, Erie, Pa., manufacturers of special motors for electric elevators, have made and sold a large number of these motors. They have recently contracted to furnish the Smith-Hill Elevator Company, Quincy Ill., 100 for this season's trade. They do not intend to infringe anyone's valid patents, neither do they intend to be driven out of a field which they have a right to live in.

The Smith-Hill Elevator Company have been devoting their entire attention to the construction of electric elevators, and have for more than two years been doing a successful and profitable business.

The Graves Elevator Company, Rochester, N. Y., is another of the companies which the Trust has been unable to control or ruin. The combination exerted extraordinary efforts to entrap the Graves Company but did not succeed. This Graves Company is still on the outside and doing more business than ever, and doing it in an honest, straightforward way.

Morse, Williams & Co., Philadelphia, and the Moore & Wyman Elevator and Machine Works, South Boston, Mass., are two other anti-Trust elevator manufacturers. Morse, Williams & Co. have branch offices in New York and other large cities and are thoroughly prosperous. The Moore & Wyman Company have sold many of the elevators now in use throughout New England. Several good contracts have been closed which the Trust companies tried hard to get.

Honest, straightforward methods must always win ultimately, and we are pleased to know that in the electric elevator business they have already won.

* * *

Henry W. Frye. In the death of Henry W. Frye electrical journalism has suffered an irreparable loss and those of us who knew him personally and had been most intimately associated with him in his work, as was the case with the writer, will feel his loss most keenly and personally.

Mr. Frye was in all respects a rare man. Well equipped for his chosen profession, he pursued it conscientiously and patiently, and although his retiring disposition and innate modesty prevented his being as widely known as his merits entitled him to be, his work spoke for him in no uncertain terms. Among the somewhat limited circle of those who knew him intimately he was most dearly loved and admired. Among those he will be mourned as a brother.

Never of rugged strength, still there was a force about him which, if properly husbanded, might have carried him to a ripe and honored age. He was, however, a martyr to duty and, forgetful of self, immolated himself upon that altar upon which it is an honor to die, but upon which it would have been a greater honor to have lived. We believe it may be truly said that electrical journalism is better for Mr. Frye's having lived. We know that it has sustained a severe loss in the death of this thoroughly lovable man.

"ELECTRICITY" LEADS.

ELECTRICITY is giving to its readers every week the benefit of more original thought than any other journal in the field. It is away ahead of all competitors not only as a newspaper but as an authority on scientific questions. Last week we presented no less than ten pages of original matter upon topics of vital interest to everyone in the trade. No other paper approached this amount. One of our contemporaries had only one column, and another three columns. We give better value to subscribers than any one of those claiming antedeluvian birth. We lead now, and shall continue to do so.

Under the Searchlight.

Views and Opinions on Timely Topics.

IF the electrical trade has been conducted upon correct lines, if a radical reform is not demanded, will our critics kindly tell us why the concerns engaged in it in the early days, with opportunities for making money never before offered in any line of business save perhaps mining and drilling for oil, are all either in the graveyard or in the hospital? The case resolves itself into one of two alternatives. Either the lines upon which the business has been conducted were fundamentally wrong, or else the entire industry is a short-lived bubble, the apparatus and devices sold have not been commercially practical, the whole business of electric lighting and power transmission is unstable and short lived and must give way to its competitors. Is the latter true? Perish the thought. The art has been a greater blessing to the human race than any other since the dawn of the Christian era save the art of printing. That it was possible to make and sell stable and commercially practical apparatus is proved by the large number of lighting plants put in as early as 1880-82 and still running successfuly.

The proposition upon which we base our campaign cannot be dodged. The industry is all right. Some of the men who have been in control are all wrong, however.

* * *

ASTONISHING MISSTATEMENTS.

According to the *Electrical Engineer* (London), Mr. Sydney F. Walker, in a recent article on the transmission of power, said:

> The increase of the efficiency of electrical power transmission and the growing familiarity with higher and higher voltages are bringing the natural sources of power more and more within the limits of practical usefulness. Already the dream of generations of engineers, the utilization of the energy of the falls of Niagara, is an accomplished fact, in part at least, the city of Buffalo, some seventeen miles away, being lighted by electricity generated by the energy of the falling water, and some of its factories having their machinery driven by the same source. It is but the development of this, certainly a large development but one that may possibly take place within the lives of some of the present generation, for us to be utilizing the energy of Niagara in the same way in this country.

The *Engineer* prints this without a word of comment, in its regular news columns, and becomes really responsible for the spreading of gross misstatements of fact. Mr. Walker's comments on other subjects have been frequently reprinted in these columns, and he has been supposed by American editors to be a man of considerable ability. We fear, however, that we will always have to ask him, when he makes a statement hereafter, how he knows.

If the *Engineer* indulged in these lapses very often it would soon sink to the level of its American namesake, which is a pretty low one where *facts* are concerned.

It ought not to be necessary to tell our English friends that there is yet no line built between Niagara Falls and Buffalo, and that it is as likely as not never to be built.

The Niagara enterprise is a great one and we are proud of it, but it does not yet *prove anything* as regards transmission.

It may or may not be a success, but so far no wheels have been turned by Niagara current.

* * *

Henry Bier's Misfortunes.

At New Orleans Judge Moise has allowed Henry Bier, the millionaire broker who was convicted last month of perjury in the City Railroad franchise case, to be removed from the parish prison to his home on Esplanade avenue, on the ground that he was very sick and would die if confined longer in the prison. Bier was a man of great pride, and seems to have felt keenly the humiliation of his conviction. His physician reports that death may come at any moment.

* * *

It is Absolutely Determined.

(From the St. Paul Globe.)

That ELECTRICITY is to be the great working power of the future is already sufficiently determined.

* * *

A RECENT $10 bill received at this office bore the pathetic legend, written in ink, doubtless at parting, "Never bet on a horse race. M. L." We do not know the writer, but his advice is sound. Across the chasm, shake in spirit, M. L., and never bet at all.

* * *

Smart Writing.

(From London Electricity.)

Our fighting contemporary, ELECTRICITY, devotes nearly six columns of editorial matter to a further condemnation of the General Electric Company (U. S. A.). This tirade begins, "The right will win," and closes, "This is the key-note of the entire conflict—THE RIGHT AGAINST THE WRONG." For a summing up of the position and the features which have led up to it, this commentary is of value; it is worth reading if only as a good example of smart writing on a financial subject in a technical paper. . . . A third editorial deals with the "Load Line," only this load line is that of the sales of the G. E. Company, and not of supply from a central station. What it is like is shown on a page a little further on—it is a big drop. ELECTRICITY foretells the future in the words, "Descensus averni facile est," and brings the curve down to zero. The page looks very gruesome, for under the title we find a presentment of a Coffin—it must be remembered that Mr. C. A. Coffin is a leading spirit in the G. E. enterprise.

* * *

THE following appeared without comment in the *Electrical Review* last week:

THE VALUE OF BEING QUOTED.

To be constantly quoted is certainly a sure sign of successful news paper work. It means that the best judge of a newspaper, the exchange editor, is passing his favorable opinion.—*The Fourth Estate.*

This is sound logic, and ELECTRICITY's scrap book proves that it has been quoted more in three years than all other American electrical papers combined.

* * *

Must Have Been Battery Motor Outfits.

(From New York Sun.)

A fire started in the steamship Massachusetts, of the Atlantic Transport line, at the foot of West Twenty-ninth street, about noon yesterday. The outbreak was in the meat storage room in the rear hold, and was caused by the friction of two large electric fans which are used to keep the meat cool.

* * *

Making Light of a Grave Subject.

Many of our daily contemporaries are cracking jokes at the idea of trolley funeral trains now in use at Harrisburg, San Francisco and other places. This is clearly wrong. If electricity can kill 'em why should it not at least help to bury 'em.

* * *

The Paper That Tells the Truth Has Every Advantage.

(Col. H. G. Prout in New York Independent.)

ELECTRICITY has many advantages.

* * *

It is Also the Power of the Present and of Eternity.

(From Interview with F. K. Hain in Pittsburg Times.)

ELECTRICITY is the power of the future.

Believes in the Paper.

To the Editor of ELECTRICITY.

I am a great believer in your paper, and think that it goes into the hands of people who are apt to purchase electrical goods.

X.

Boston, Mass.

Another Massachusetts patron of ELECTRICITY writes:

Allow me to congratulate you on your last editorial, wherein you stated that the various journals in years gone by had not done their duty in bringing out the various humbugs connected with the electrical business.

Independent Telephone Companies Prefer to Fight.

UNITED ACTION AGAINST THE BELL COMPANY ASSURED.

Harmonious Meeting of the National Association at Pittsburg.

(Special Dispatch to ELECTRICITY.)

PITTSBURG, Pa., June 25, 1895.

The morning and afternoon sessions of the Independent Telephone Companies at the Hotel Duquesne were devoted yesterday to an informal discussion of the situation. Expressions of opinion were invited from representatives present as to their views upon the scope and objects for which the organization should be constituted. These expressions differed somewhat in detail, but in the main it was agreed that it would be best to specifically define the purposes of the organization, the chief of which shall be to offer complete and full protection to all users of telephones manufactured by the members of the Association.

Those attending were: James E. Keelyn and Stanley S. Stout, Western Telephone Construction Co., Chicago; R. S. Johnson, Viaduct Manufacturing Co., Baltimore; P. C. Burns, American Electric Telephone Co., Kokomo, Ind.; H. T. Johnson, Manhattan Electrical Supply Co., New York; A. F. Stanley, Deveau & Co., New York; Frederick Harrington, Union Electric Co., Cleveland; A. H. Chadbourne, U. S. Telephone Construction Co., Philadelphia; E. S. Wallace, Columbia Telephone Co., New York; J. G. Ihmsen and B. Hubbell, Keystone Telephone Co., Pittsburg; L. Levy, Anthony Co., Cincinnati; Chas. W. Price, *Electrical Review*; B. E. Greene and J. L. Gans, ELECTRICITY, New York.

Letters were received from many other companies assuring their support of whatever action the Association may take.

The delegates were guests of Solar Carbon Manufacturing Co., of Pittsburg, as a coaching party to the Country Club, East End. The Keystone Telephone Co. entertained the delegates at lunch. Discussion was continued in an informal manner.

Permanent officers will be chosen to-day.

There was a unanimous expression of opinion in the lobby that the Berliner patent as it stands now can surely be defeated by a well-conducted defence of the first infringement case.

A Georgia Water Power Plant.

A new cotton mill recently erected at Athens, Ga., is to be operated by electric power to be delivered at the mill at $22.50 per horse power per annum of 365 days, twenty-four hours per day. The Athens Electric Railway Company will furnish the power. This company is developing 700 horse power at a water power three miles distant.

The Boston *Advertiser* states that Chief Engineer Carson of the Boston Transit Commission, who has just returned from Europe, has brought home photographs of an experimental electric railway with suspended cars which has been operated successfully at Deutz, Germany, opposite Cologne. Fifty persons can be carried at once, and the suspended car is operated by an electric motor, derailment being prevented by friction plates. The wheels are secured to the motor, and the car is fastened to the motor by means of a center pin. Springs make the car easy riding, each truck having four wheels, and each car is supplied with two motors. Brakes are also provided, which grasp the rail both at the top and bottom. The supply of electricity is so regulated that if one car gets stalled the car following it is not supplied with any more motive power until its predecessor is started on its journey again, thus reducing the possibility of collision. The brakes work automatically.

The Attempted Elevator Monopoly.

In our issue for June 12th considerable space was devoted to the Elevator Trust and its devious methods of attempting to maintain a monopoly of a business which cannot legally or otherwise be bottled up.

Since the appearance of that article, more information has come to hand which makes the crime, for such it is, of this Trust the blacker.

First, in regard to the nature of the organization of which we have said so much. It seems that the four or five companies which are involved came to an agreement by which all of their patents were pooled and taken over by the National Company—the Trust—an organization composed of the members of these several companies. The charter of the National Company does not permit it to manufacture, sell or install elevators of any kind, but simply to license and sue on the patents which it holds in trust. As soon as the National Company was organized the territory of the United States was apportioned out among the Otis Company of New York, the Crane Company of Chicago, the Whittier Company of Boston, and the Stokes & Parrish Company of Philadelphia, each of these companies being licensed to use the patents of all the others in the territory which had been set apart as its own especial preserve. The bids, as before stated, for any given contract were made out for all of the companies by the same party, and hence there was no competition among their own members. It was further agreed, however, that should any company in the Trust invade the territory assigned to another, and effect a sale therein, that company should pay over to the National Company a certain sum of money which should go into the general treasury and constitute a fund to defray the expenses of litigation. The result of this arrangement has been to make an alleged infringement of any one of the individual companies' patents a common cause for all. The cost of the litigation was equally borne by all; the experts of each of the separate companies became the experts for the National Company, and the apparent anomaly was presented of alleged business rivals stoutly maintaining the defence of interests that to the public eye were from a business standpoint irreconcilable. The moral effect of this has been great, almost incalculable, and there is little wonder that the smaller concerns—not in the Trust—feared to measure strength in the courts with this iniquitous Trust.

If the alleged infringement were on a patent originally controlled by the Otis Company, for instance, the title of the action would be National Company and Otis Brothers & Company vs. ——. If it happened to be the patent of the Crane Company; the title would be National Company and Crane Company vs. ——, and so on through the list, but all of the members of the Trust assisted in the litigation to the utmost extent of their ability and all of them benefited by it equally.

The pooling of interests for mutual protection is in itself not a crime, but may be made a crime if legitimate methods of protection are exceeded, and this is just what this Trust has repeatedly done. It is perfectly evident that should an outsider attempt by bidding against them to get a contract, the combined statements of the agents of the Trust antagonistic to the quality of the new candidate's wares would be likely to prejudice the purchaser against those wares. This has been repeatedly resorted to. Still another method to which we have already referred is the threatening of customers of outside manufacturers with suits for infringement should they become purchasers, or being purchasers if they did not discard the apparatus and replace it by elevators made by members of the Trust. Actual suits have been avoided in some cases, but in others the suits have been piled on as numerously as possible, in the hope of bankrupting the offending company and thus acquiring its title and business. Noteworthy instances of this kind are found in the case of the Standard Elevator Company of Chicago and of Morse & Williams of Philadelphia. Since both of these cases were essentially the same, and the chief testimony was also the same, the two may be considered here as one. The testimony of William H. Wells, Jr., is of exceeding interest in this connection. Mr. Wells had been connected with the Standard Elevating Company of Chicago.

Cross-examined by Mr. Chapin.

Cross Q.—You are not very friendly with the complainants (National Company and Otis Brothers & Company), are you?

A. by Mr. Wells.—I feel very friendly towards them, because they have sued me on very similar alleged infringements of patents several times within the past few years, and in each case we have won the suits so far as they have come to a final hearing, and have won them on precisely the same kind of evidence and defence as I have given in this case, so that I feel very friendly towards them, but I doubt very much their deep good feeling to me.

Cross Q. 48.—You are a defendant in a suit now at issue in which the complainants in this suit, the National Company and the Crane Elevator Company, are complainants, are you not?

A.—I have been a defendant in *four* or more suits brought by the National Company and the Crane Elevator Company, and three at least of these suits have either been won on the final hearing by me or have been dismissed by the complainants, who paid all costs. I think that there is one case still pending on which an application for a preliminary injunction was made, which injunction was refused by the Appellate Court. I do not think the final decision has yet been rendered in that case.

Cross Q. 49.—You have, I suppose, the same friendly feeling toward the Crane Company as toward these complainants, resulting from the fact that they have sued you on a number of occasions, have you not?

A.—I have about the same feeling for the National Company, the Crane Company and the Otis Company and all of the members of the companies, because they are all part of one big elevator trust, and the same men are practically the controlling and largest stockholders in each. My friendly feeling for them is not based so much on their having started the various suits which they have against the smaller elevator builders of the country—myself among the number—as it is in the fact that they are losing their suits about as fast as they come to a hearing, and in this way are destroying a mistaken impression which existed throughout the country that they are possessed of a valuable set of patents, the result of this being that smaller concerns will soon have an opportunity to do their legitimate business instead of being obliged to occupy their time and expend their money in defending trumped-up suits brought by a wealthy corporation or elevator trust known as the National Company.

These are very strong words from Mr. Wells, but they are none too strong and went uncontradicted. The policy pursued by the Trust against the Standard Company was to multiply suits for infringement, requiring the defendant in each case to give bond pending a hearing and thus to tie up their capital and cripple their business. The evident intention was when this was accomplished to buy them out and thus end competition from that quarter. The Trust had gotten the Standard Company's business in just about the condition desired when to their surprise others with ample capital captured the prize about which they had so long been weaving their web. The company has been reorganized, and under a new name and ample capital bids fair to break the strength of the monopoly in the Windy City.

In our issue for June 12th we published, somewhat *in extenso*, the remarkable fake statements against the Sprague Elevator by Mr. George K. Reynolds, the engineer of the Crane Company. To show the contemptible and dishonest methods resorted to by the Trust to down the opposition, it may be well to show Mr. Reynolds up in his true light. It seems that he is employed to do, and is willing to do, a great deal of the dirtiest work that the Trust has to do to accomplish its ends. Reynolds poses as the engineer of the Crane Company, but as indicated before, he is available in all suits brought by the National Company. In regard to his character, it is so notoriously bad that Judge Alvey of the Court of Appeals of the District of Columbia, in the suit of Wells et al. v. Reynolds et al., decided in last September, uses the following severe language in referring to his testimony:

"The right here so plainly recognized in the Standard Company to use the device in its elevators certainly did not exist if the claim of Reynolds now asserted be true. He was either recognizing what he knew at the time to be the right of the matter or he was attempting to deceive and mislead both his employers and the public.

"The strong inference from the conduct to which we have referred is that Reynolds *knew* that he had no rightful claim as original inventor of the device, and hence he made no claim until moved thereto by subsequent events."

The circumstances which called forth these remarks from the Court were the following:

Wells and Reynolds were both connected with the Standard Company, and Wells obtained a patent on elevators which the Standard Company acquired. Reynolds while an agent of this company always admitted that Wells's patent was good—in fact, the question does not appear to have arisen in Reynolds's mind during this period as to Wells being fully entitled to the patent as the first inventor. Subsequently, however, Reynolds left the Standard Company and took employment with the Crane Company. He then applied for a patent on essentially the same idea as that involved in Wells's patent—swore that he was the first inventor and claimed an interference. This was so palpably a fraud as to call forth the above quoted remarks from the Court. It was an endeavor on Reynolds's part to cheat the Standard Company out of its rights for the benefit of the Crane Company and the Trust, who had acquired an interest in Reynolds's alleged invention. This is but one instance of the dirty work which Reynolds has been called upon to do for the Trust. The statement quoted in a former issue in regard to the Sprague elevators was another.

Returning now to the methods employed by the Otis Company to drive the A. B. See Company out of business, it was stated in our issue of June 12 that for years the Otis Company had been threatening intending or actual purchasers of the See apparatus with suits for infringement. In this way they doubtless frightened many from purchasing who otherwise would have become purchasers. Finally they did bring suit - not against the See Company as they would have done had they taken the action in *bona fides*, but against a contractor who had erected an elevator purchased of the See Company, in the Oakdale apartment house, No 38 West 35th street. The allegation made in this suit was that the said electric elevator infringed a patent granted to S. S. Wheeler now owned by the Otis Company. This suit was brought two years ago and did not then specify wherein the A. B. See Company infringed, nor have they been able to find out since then.

Recently depositions have been taken in the case, and among those who appeared to give testimony in behalf of the Otis Company was Prof. Charles R. Cross, professor of Physics in the Massachusetts Institute of Technology. Prof. Cross's testimony is a good example of the class of expert testimony which we so strongly condemned in a recent editorial. Prof. Cross is undoubtedly one of the worst offenders in this line before the public, and so notorious has he become in this class of work that among the better class of electrical experts no confidence whatever is placed in anything he says when on the witness stand.

The cross-examination of this witness by Mr. Gifford lasted for eight hours, filled 107 pages of the record and had solely for its object to find out wherein the See elevator infringed the Wheeler patent. Prof. Cross's object was apparently to mystify the Court by bringing in technicalities which were entirely unnecessary and by directly evading the issue. The result of the examination was a total failure, in that it does not show wherein infringement exists, but probably a success as calculated to befog and involve that which nominally it was intended to elucidate.

The patent in suit contains six claims, the first of which is as follows:

"The combination of a normally constant source of electric energy, its circuit, an elevator or support for raising and lowering matter, an electric motor in said circuit for hoisting said elevator which motor may be caused to act at the will of the operator to raise the elevator, connecting mechanism between the motor and elevator *whereby the armature of the motor is mechanically driven when the elevator descends, thereby working the motor as a dynamic generator of electricity*, and the means or manner, substantially such as described, for utilizing the current thus generated."

Every one of the six claims contains the clause italicized above, and it is therefore an essential element in the combination claimed.

We have examined the elevator at the Oakdale which is claimed to infringe this patent. We find that it is a shunt motor driving a winding drum by means of a worm gear. There is a constant source of electricity, a circuit, an elevator or support for raising and lowering matter, and the motor for hoisting said elevator may be caused to act at the will of the operator. It happens that the motor employed is a shunt motor, which is self-regulating. But shunt motors were used and known to be self-regulating long before the date of this patent, viz., Aug. 18, 1885. It so happens that if the armature of a shunt motor be driven fast enough by a properly geared descending load it will give back energy to the circuit. This was well known long before the date of Wheeler's patent. There is therefore absolutely nothing new or patentable in the specifications upon which this suit is brought. Wheeler shows a number of methods of gearing by which it is possible to recover a portion of the energy of the descending car. The methods shown are either spur gearing or by belt. In the case under discussion neither of these methods is employed. The gear is a worm gear as stated before. The worm in this case is a single thread screw 6 inches in diameter and 1⅜" pitch. While it would be possible for the descending car to drive the armature by the methods shown in the patent it would be impossible for it to do it in this case, and as a matter of fact it does not. It was never contemplated that it should, and it couldn't if it had been, and even if the Wheeler patent were a valid one, which we think it would be difficult to maintain, there is still no infringement, because one of the essential features of the combination claimed is conspicuously absent.

This is one of the absurdest claims that we have ever seen or heard soberly made, and the Otis Company and their attorneys have made themselves the laughing-stock of every one familiar with the case by making it. The truth is, neither of them ever intended it to come to trial. It is too absurd to be made public. They never yet have been able to tell the defendant what he infringed, and Prof. Cross in his eight hours of examination was unable to do so. They intended to use this suit, and have used it as a club by which to frighten off customers from an honest rival. Now that they have been challenged to show their hand, it is shown to have been but a dishonorable bluff. Their only hope is to mystify the Court by bringing in issues not pertinent to the case, and to assist them in this they have paid Prof. Charles R. Cross to do some of the dirty work. Such a case as this can have no standing in court, and we believe and hope that if it ever comes to trial it will be dismissed at once with a reprimand from the Court such as will prevent a continuation of a practice which is a disgrace to a civilized community.

EXPERIMENTS ON THE RELATION OF HYSTERESIS TO TEMPERATURE.*

BY FRANK A. LAWS AND HENRY E. WARREN.

This paper gives an account of some experiments to determine the effect of temperatures much above the normal on the dissipation of energy by hysteresis in a specimen of steel.

At the time of the beginning of this research, in February, 1894, there were no complete studies of this subject known to us. A casual reference is to be found in the Proceedings of the American Institute of Electrical Engineers, Vol. VII, p. 325, 1890, by Prof. Harris J. Ryan. The tests there referred to were made on a cast-iron ring. The maximum temperature employed was 360°. The details of the measurements are not given. A short paper by Dr. Wilhelm Kuntz appeared in the *Electrotechnische Zeitschrift*, Vol. XIII, May 6, 1892. In this Dr. Kuntz showed that the hysteresis loss decreased with rise of temperature. A second paper by the same author appeared in the *Electrotechnische Zeitschrift*, Vol. XV, April 5, 1894. The magnetometer method was used by Dr. Kuntz in this work. In this paper tests of several ferrous materials are given, as well as some on a specimen of nickel.

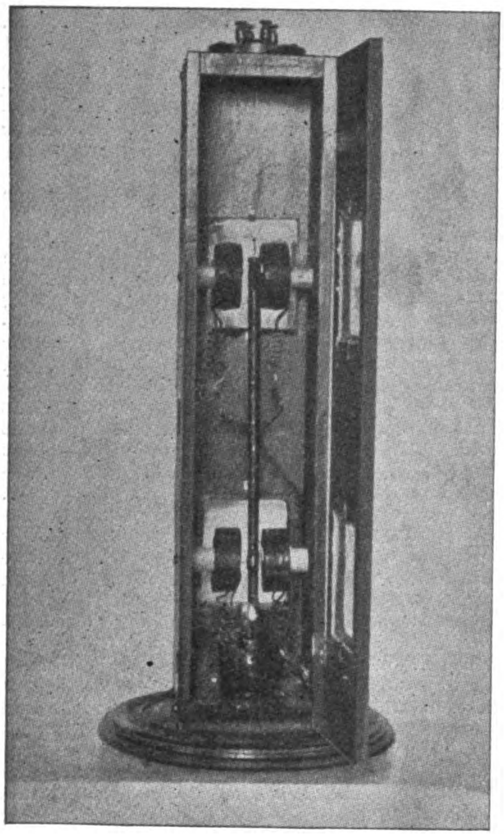

FIG. 1.

At the outset of this research it was decided that alternating currents should be used, and that the losses should be determined by a wattmeter, thus reducing the time required for observations to a minimum. The instrument which we designed and used is shown in Fig. 1. We have decided to call the arrangement a watt-balance. Mr. A. E. Kennelly has given in the *Electrical Engineer*, December 21, 1892, a description of a "Differential Wattmeter." This instrument gives the difference of the mean values of two definite integrals representing the primary and secondary energy in a transformer—that is, the losses. The watt-balance measures the ratio of the mean values of two definite integrals. It can therefore be used to measure the efficiency of a convertor, giving the result by a single reading.

The watt-balance consists of two electrodynamometer wattmeters, one above the other. The movable coils are rigidly connected in our instrument by a spiral-wound paper tube, and consist of 100 turns of silk-covered german-silver wire, No. 32 B. & S. gauge. The resistance, including leads, is 103 ohms; the diameter of coils, 2 cm. In series with the movable coils are two adjustable resistances, r_1 and r_2, as shown in Fig. 2. The stationary coils are arranged in pairs; each is 2.8 cm. in mean radius and contains 130 turns of No. 12 cotton-covered wire. They are movable along their axes, so that the factor of the instrument may be adjusted. The vertical distance between the two dynamometers is 30 cm. The movable parts are suspended by a silk thread inside a narrow paper tube to prevent disturbance by air currents, and directive force is given by four spiral springs, made of copper wire, 0.005 cm. in diameter. These springs serve as leading-in wires for the movable coils. The instrument is read by a telescope and scale.

In Fig. 2 is shown the scheme of connections for a hysteresis test. At the left the resistances for controlling the currents are shown. By the proper insertion of the connection, *C*, either a direct or an alternating current could be sent through the remainder of the apparatus, which in the main circuit consisted of an electrodynamometer, one pair of stationary coils, the specimen under test, a known resistance, *R*, of german-silver strip immersed in kerosene oil to keep it at a constant temperature, and the second pair of fixed coils. At one terminal of *R* a connection was made by means of a short piece of stout wire and a key, *K*; beyond the key the circuit branched, passing through the adjustable resistances r_1 and r_2, the proper movable coils, and returning one lead to the external terminal of the specimen, and the other to the corresponding terminal of *R*. The resistance r_1 was some hundreds of ohms, seldom falling below 300, and was more frequently in the neighborhood of 1,000; r_2 was kept at a constant value, 976 ohms. The resistances r_1 and r_2 were ordinary plug boxes, and the assumption was made throughout the work that the resistances of circuits r_1 and r_2 were so high in comparison with their inductances that no correction need be applied to the indications of the watt-balance. It may be well to mention that the use of high resistances constructed in the usual way by double winding may lead to serious errors in alternating current measurements on account of the capacity effects.

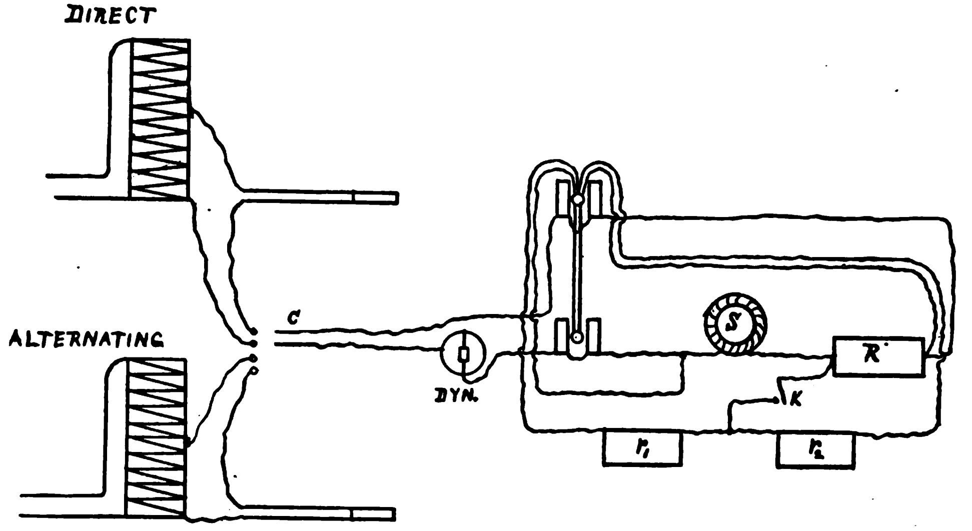

FIG. 2.

If the plug *C* be inserted so that a current flows in the apparatus, and no deflection is observed, then the factors of the upper and lower dynamometers are equal; if the key *K* is depressed, there will in general be a deflection, which may be reduced to zero by adjusting r_1, as a zero reading means that the average value of the products of the currents in the two coils of the upper and lower dynamometers are the same. It is known that the work in *S* bears the same ratio to the work in *R* that the total resistance in circuit r_1 does to the total resistance in circuit r_2. If the current is alternating, the work in *S* is of course divided between hysteresis and heating losses. No allowance has been thought necessary for the work done in the suspended coils. If W_s and W_R represent the work in the specimen and in *R*, then

$$W_s = W_R\left(\frac{r^1 + 103}{r^2 + 103}\right) = \frac{I^2\, R\,(r_1 + 103)}{r_2 + 103},$$

I^2 is given by the electro-dynamometer *DYN*.

To correct for the heating loss in *S* a direct current of any convenient magnitude is sent through the circuit, and a second balance, $r_1{}^1$ obtained,

$$R = 1{,}079 \text{ ohms}, \; r_2 = 976 \text{ ohms};$$

$$\text{so } W_s = \frac{I^2}{1000}\,(r_1 - r_1{}^1).$$

It will be seen that the watt-balance as used in the present case is a wattmeter with an electrodynamic control. The advantage derived from obtaining this control by shunting a portion of the main current is that any manipulation of the circuits does not disturb the equilibrium of the instrument, and that it renders it possible to use the instrument in a null instead of a compensation method.

As the hysteresis loss is a function of the maximum magnetization, denoted by *B*, it was necessary to provide some means by which the maximum might be kept constant and its value determined. The device sketched in Figure 3 was used for this purpose. In addition to the magnetizing coil, the specimen was provided with a winding of 24 turns, which was connected in series with an adjustable resistance of 874 ohms during the tests, and a galvanometer of 126 ohms. Leads were carried to the dynamo room, and terminated in brushes which rested on the edge of an ebonite disk 11 inches in diameter, fastened rigidly to the dynamo shaft; the brushes were carried by a radial arm, the motion of which is controlled by a small magneto-motor driven by three Leclanche cells. The motor was governed by a reversing key in the testing room, about 100 feet away. The alternator used had ten poles, thus making the length of a wave 72°. A piece of brass, 36° or one half a wave long, was set into the edge of the disk, and the whole carefully trued up. When the dynamo was in action the *B* current was closed once during a revolution, and for a time corresponding to one half a wave length. The galvanometer then performs the operation

$$\frac{2}{T}\int_{t^1}^{t^1+\frac{T}{2}} C\,d$$

1,500 times a minute. The value of this integral will be a maximum when it extends over the time between +*B* and −*B*. By the use of the key K^1 the brushes may be shifted, and the reading of the galvanometer brought to its greatest value. With the dynamo running at its normal speed a Leclanche cell, E. M. F. 1.4 volts, was inserted in the circuit; $R\,h$ was 1,374 ohms, and the deflection 21.2 cm.; with brushes short circuited and $R\,h$ equal to 14,874 ohms the deflection was 21.8 cm., the ratio of deflection being .972. If the brushes made perfect contact and there was no self-induction effect, the ratio would be unity, the entire cycle of operation being performed in a time short compared with the period of the galvanometer. During the tests the reading with $B\ h = 1{,}374$ was frequently repeated in order that the brushes might be kept in as uniform condition as possible.

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* Contributions from the Physical Laboratory of the Massachusetts Ins. of Technology, in Proceedings of the American Academy. Presented by Charles R. Cross, October 10, 1894.

Owing to the manner in which the specimen is constructed, the area included in the B winding is but partially occupied by the iron. In calculating the approximate values of B no allowance has been made for this, as the permeability is high in the cases where B has been determined. If observations were taken at temperatures where the permeability was very low, it would be necessary to apply a correction for this unoccupied area. The values of B were calculated by the formula

$$B = \frac{E^1\ R\ D}{20\ A\ N\ n\ R^1\ D^1}.$$

D is the deflection corresponding to the value of B to be found. R is the resistance in circuit $R\,h$; N, the number of turns on B winding; n, the number of revolutions per second. A is the area of the iron included in the B windings. D^1 is the deflection of the galvanometer where an E. M. F. of magnitude E^1 and a resistance R^1 are inserted in the circuit $R\,h$, the dynamo turning at the normal rate.

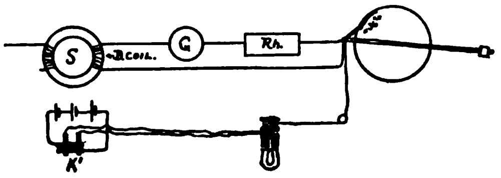

FIG. 3.

The furnace used for heating the specimen was built of fire brick, the external diameter was about 36 inches, height 18 inches. Inside the fire brick was a layer of asbestos wool 2¼ inches thick, kept in place by asbestos board, which was protected by thin sheet iron. The box containing the specimen was made of asbestos board about 1½ inches in thickness, and lined with retort cement. During the tests it was tightly closed. The furnace was heated by three blast jets made of gas pipe, the external tubes were ¾ inch inside diameter, the inner tube ⅜ inch. The supplies of gas and air were regulated by slide valves. The jets were directed into the furnace tangentially and with a slight upward inclination, the effect being to establish a good circulation and keep the interior of the furnace at a uniform temperature.

The specimen upon which the following tests were made was composed of so-called French steel, which showed on analysis the following impurities:

Manganese	0·535 per cent.
Phosphorus	0.013 "
Silicon	0.085 "
Sulphur	0.018 "
Carbon	0.970 "

The mass of iron employed was 628 grams. From this material, which was four one-thousandths of an inch thick, rings of 3 inches' outside and 2 inches' inside diameter were stamped, and the specimen formed by piling them. Each was insulated from its neighbors by a layer of pipeclay, applied as a sort of paint, the clay having been moistened with alcohol. Every tenth layer was insulated with mica. The pile so formed was wrapped with asbestos cloth, and the magnetizing coil of 36 turns of No. 14 copper wire wound on. The wire was insulated by winding it with asbestos twine. Interwound with the magnetizing coil was the B coil of 24 turns. These two windings formed on the outside of the specimen a single layer. The temperatures were determined by a Le Chatelier pyrometer, calibrated by known melting points. The hot junction was placed inside the asbestos wrapping resting against the iron, the leads were brought out through the usual double-cored fire clay tube; this was surrounded by a piece of gas pipe thoroughly wrapped in asbestos cloth, because in using this pyrometer in a case like the present, where the leads pass from the hot junction through a space at a higher temperature at a short distance from the junction, it is necessary to guard against conduction along the leads, and consequent errors in the temperature.

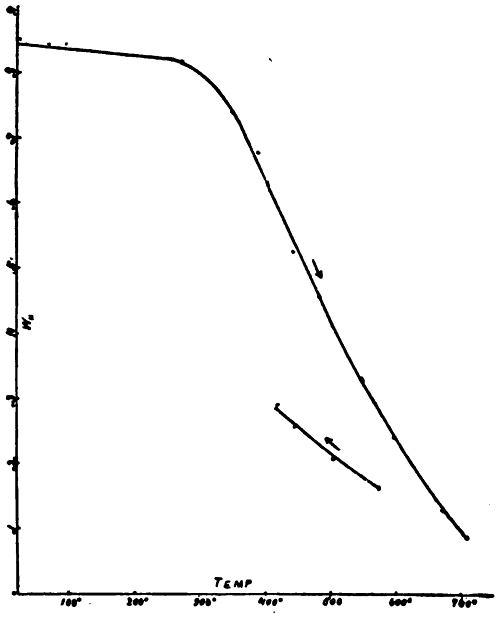

FIG. 4.

The manner of making the tests and the subsequent calculation was as follows. Owing to the construction of the furnace, the specimen being well shielded from the heat of the flames by the internal chamber, the air insulation, and its own asbestos covering, the temperature of the iron rises gradually; consequently the specimen will be at very nearly a uniform temperature. When a reading is desired, the alternating current is turned on, and the B deflection adjusted to its dynamometer reading and time observed; after a few minutes the observations are repeated, the temperature having risen in the mean time. This process is kept up until the iron loses its magnet-maximum value by K^1, and to its correct numerical value by varying the magnetizing current. Watt-balance resistance r_1 is now adjusted, and the pyrometer reading corrected for zero, and ism. Occasionally, a direct current was sent through the apparatus and the watt-balance, dynamometer, and pyrometer readings taken; these allow the value of $r_1{}^1$ in the hysteresis formula to be determined by making a plot, the co-ordinates being watt-balance and pyrometer readings; from the plot the value of $r_1{}^1$, corresponding to any pyrometer reading, may be read off. The electro-dynamometers were calibrated by sending a direct current through them, and measuring the P. D. at the terminals of a known resistance by projection against the E. M. F. of a Clark cell; the values of deflections and currents squared were plotted, giving straight lines. I^2 was determined by reference to these plots. The zero errors of the dynamometers employed were very variable, and were determined after each reading.

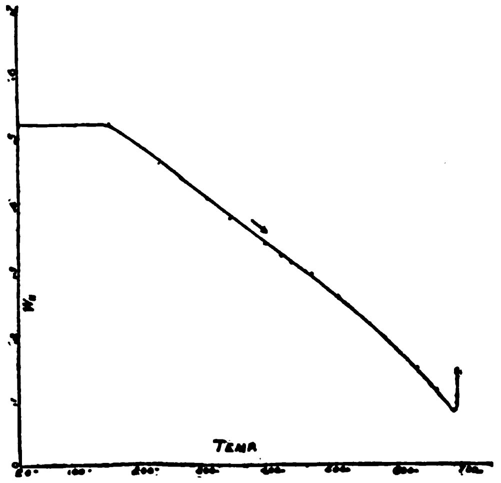

FIG. 5.

The results of the measurements will now be given. They are plotted as referred to at the beginnings of the several tables.

TABLE I.

FIRST HEATING: ASCENDING CURVE.

(See Fig. 4.)

B = 1970. $n = 125$. W_H = Hyteresis loss in specimen.

W_H.	Temp. °	W_H.	Temp. °
.852	28	.678	387
.834	45	.526	440
.845	67	.456	481
.845	98	.331	546
.817	132	.241	595
.809	181	.130	672
.818	272	.088	709
.742	347		

The specimen lost its magnetic properties so rapidly that further measurements could not be taken on the ascending curve.

TABLE I—DESCENDING.

W_H	Temp. °
.0	787
.161	576
.206	503
.255	445
.290	417

Power shut off.

TABLE II.

SECOND HEATING: ASCENDING.

(See Fig. 5.)

$B = 1974$. $n = 125$.

W_H.	Temp. °	W_H.	Temp. °
.516	20	.149	632
.520	75	.121	658
.519	108	.115	662
.522	160	.093	679
.440	269	.083	688
.407	310	.094	692
.378	345	.104	693
.340	397	.130	693
.321	423	.130	693
.311	438	.142	693
.293	470	.144	693
.258	511	.142	692
.228	555	.140	694
.167	593		

Inspection of the plots shows (Figs. 4 and 5) that for this sample of steel a moderate elevation of temperature up to about 270° has but a small influence on the hysteresis loss; that at this point a change takes place, and the diminution of hysteresis, with rise of temperature, is much more rapid, the decrease being such that at 675° the loss is but 13 per cent. of its value at ordinary temperatures. After heating above the inflection point, the specimen shows on cooling a marked decrease of the hysteresis loss from its value at the same temperature on the ascending curve. If the specimen be heated again, a change of direction of the curve takes place, but at a lower temperature. The second plot (Fig. 5) shows an increase of the hysteresis loss after the point of inflection has been reached. As only two heatings were made, we were unable to verify these observations, the results of which became apparent only when they were reduced. In addition to the expeiiment at high temperatures, the following observations were made. A specimen was made up and the loss measured at the ordinary temperatures; a mean of three measurements gave .289 watts as W_H. The specimen was then covered with a mixture of solid carbonic acid and ether; a mean of three measurements showed W_H as .288 watts, showing that there is practically no change of hysteresis for a diminution of temperature to about —80°.

Between the ascending and descending observations of the second heating, readings were taken for the purpose of finding whether the temperature at which the iron becomes markedly magnetic on cooling is the same as that at which the sudden diminution of the magnetic properties occurs on heating. Simultaneous readings of the *B* galvanometer and pyrometer were taken, the current remaining constant; no adjustment for maximum was made. The readings, together with some from the descending curve of the first heating, are given below, and, after being corrected for zero, are plotted in Figure 6.

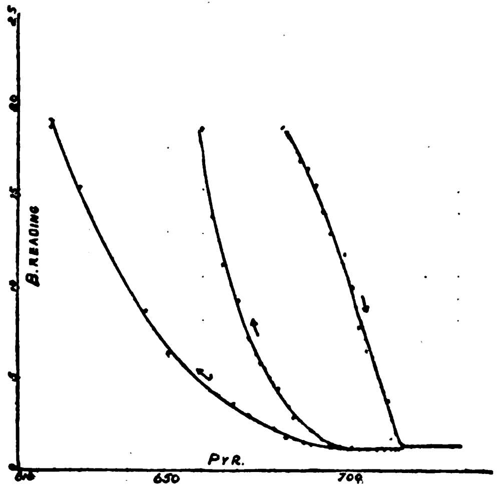

FIG. 6.

TABLE III.

First Heating.		Second Heating.	
B Reading.	Pyr.	*B* Reading.	Pyr.
38.8	7.17	28.1	6.99
38.8	7.10	29.9	7.01
38.8	7.05	31.0	7.02
38.8	7.00	32.1	7.03
38.7	6.95	33.4	7.05
38.55	6.90	34.8	7.10
38.15	6.88	36.1	7.11
37.70	6.80	37.2	7.12
37.00	6.73	37.9	7.13
36.8	6.69	38.3	7.14
33.65	6.51	38.6	7.15
31.2	6.45	38.7	7.15
		38.6	7.19
		38.8	7.14
		38.75	7.10
		38.75	7.03
		38.7	7.01
		38.65	6.98
		38.55	6.95
		38.25	6.93
		37.85	6.90
		37.1	6.85
		36.5	6.84
		34.1	6.76
		32.7	6.73
		30.7	6.70

Fig. 6 shows that the two points do not coincide, that on the descending scale being about 12° lower than that on the ascending curve. The difference of form of the curves is noticeable, showing that the regaining of magnetic properties on cooling is more gradual than their loss on heating; the sudden exaltation of magnetic properties occurs at the same temperature in the first and second coolings.

At the time of this writing the research has not been fully completed. We are, however, now engaged on further experiments, and hope to present additional data in the near future.

An Apparatus for Measuring Difference of Phase Between Alternating Currents.*

BY LOUIS DERR, M. A., S. B.

Most of the methods hitherto employed for the measurement of difference of phase between alternating currents (*vide La Lumière Electrique*, March 10 and 17, 1894,) assume that the currents measured are truly sinusoidal in character, or demand exceptional conditions of steadiness. The method here described is applicable to the measurement of periodic currents of any form whatever, and can be used under any ordinary conditions.

The apparatus is a modification of that employed by Dr. J. Puluj for a similar purpose, and described at length in the *Elektrotechnische Zeitschrift* for December 1, 1893. Dr. Puluj's apparatus consists in brief of a pair of electromagnets, each carrying a flat steel spring at the free end of its core, a small mirror being mounted on the spring. A beam of light is reflected from one mirror upon the other, and thence to a screen. If alternating currents are sent through the magnet coils, the springs will be set vibrating, and the spot of light on the screen will be lengthened into a line if the springs are parallel; and if the springs be turned so that the vibrations are perpendicular to each other, the line becomes an ellipse whose dimensions afford a measure of the difference of phase between the currents in the coils.

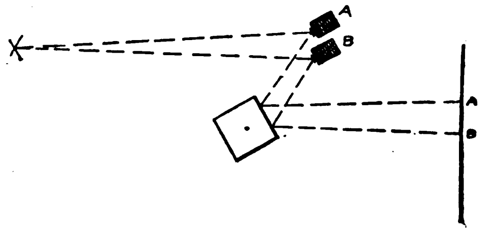

FIG. 1.

It is evident that to maintain an ellipse sufficiently stable to permit measurements of precision requires great steadiness in the currents, a condition not always obtainable. The springs give best results when their period of free vibration is that of the current or its octave, and slight changes of the current period will throw them out of tune, instantly affecting the amplitude of vibration, as the inertia of the moving parts is very small. Belt slip at the generator, irregular load or changes of steam pressure make precise measurements very difficult.

To obtain results without the steadiness demanded by the above method, the following modification was devised by the writer and successfuly used by Messrs. L. R. Nash and J. C. Nowell, of the class of 1894, in their thesis. The two electromagnets were placed side by side, and the beams reflected from their mirrors received upon a prismatic mirror and thence sent to the screen. This is shown in plan in Figure 1. In this case the spots of light which appear on the screen when the mirrors are at rest are elongated into two vertical lines when currents are sent through the magnets, and these lines are drawn out into curves which flash across the screen when the prismatic mirror is rotated. As the motion of the springs is harmonic, these curves are sine curves, and thus bear no necessary resemblance to the original wave form. Figures 2 and 3 show some of these curves, whose wave length is, however, much less than that employed in measurements.

The theory of measurements is as follows: If the spots of light on the screen are in the same vertical line when the prismatic mirror is at rest, the curves produced by revolving it will have the same time origin, and will be parallel if they are in the same phase. Any time lag of one behind the other will be shown by a lateral shifting of the lagging curve ahead of the other, and if a variable inductance is inserted in the circuit of *B*, the *B*-curve will be seen to move farther and farther ahead of the *A*-curve as the inductance is increased. The difference of phase is thus evident to the eye, and to obtain a direct measure of it requires only a knowledge of the angle through which one curve must be shifted to bring it into parallelism with the other. This is readily expressible in degrees by finding the angle through which *B* must be turned to bring *E* and *F* (Figure 4) into the same vertical, and then finding the angle through which *B* must be further turned to bring *G* and *E* into the same vertical, the first adjustment giving the portion of a wave length by which the two curves are separated, and the second the value of the whole wave length. Calling these quantities *c* and *d* respectively, the phase difference of the curves on the screen is, in degrees, $360^{c}/_{a}$.

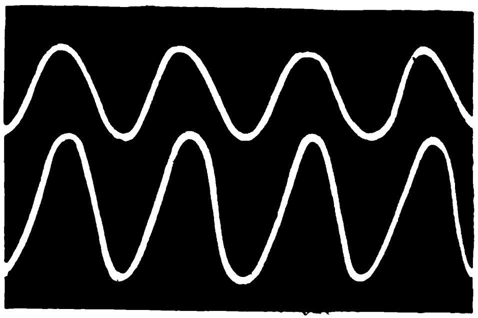

FIG. 2.

One consideration is to be noted here, that as the vibrating springs execute a complete vibration for every reversal of the current, their vibration frequency is just twice that of the current, and hence the phase difference of the curves on the screen is twice that of the currents measured. The desired value is thus $180^{c}/_{a}$

As *c* and *d* are too small to be directly measured with precision, a multiplying device is necessary. Mirror *B* is turned by a gear wheel meshing with a small pinion which carries a long pointer moving over a divided scale. With this device a wave length on the screen is covered by a displacement of 13 centimeters of the end of the pointer.

The procedure is as follows: With the prismatic mirror at rest, send the currents to be studied through *A* and *B* respectively. Turn *B* until the lines on the screen are in the same vertical, and take the pointer reading *m*. Start the revolving mirror, and when the curves are sufficiently elongated to permit convenient comparison turn the pointer until the curves are parallel, and take the reading *n* of the pointer. Turn the pointer still further until the *B*-curve has moved through an entire wave length and is again parallel to the *A*-curve, and record the new reading *p* of the pointer. Then the phase difference in degrees between the currents is

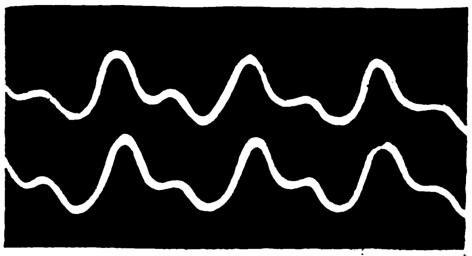

FIG. 3.

$$180\frac{m-n}{n-p}.$$

The result of these measurements plainly depend on the accuracy of bringing the curves into parallelism. This adjustment can be satisfactorily made by moving *A* vertically until the curves are brought close together. As used in the following transformer measurements, the mirrors were of silvered glass and the outlines of the curves consequently indistinct from multiple reflection. This makes the adjustment less precise than might be expected if metallic mirrors were used, and partially accounts for the relatively large deviation attached to the results below.

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* From "Technology Quarterly," Vol. VII, No. 3, October, 1894.

Small Experimental Transformers.	Lag in Degrees.	Average Deviation.
Transformer with 4 secondaries, idle circuits open.	173.75	± 0.38
Transformer with 4 secondaries, idle circuit closed.	177.0	....
Ring transformer, overwound with iron wire....	172.29	± 0.82
Ring transformer, closed secondary......................	176.50	± 0.50
Two telephone induction coils in series................	332.11	± 0.84
Giving for each coil.........	166.06	± 0.42

The following measurement affords a comparison of calculated with known values. The apparatus was applied to the measurement of the lag between the branches of a three-phase circuit. Perfect symmetry in the dynamo windings would give 120° in each branch, and in any case the sum of the three lags should be 360°. The values actually obtained are 119.22, 120.44, and 119.44. The sum of these is 359.00, the average deviation (0.92) in this case being not far from the real error.

Among the advantages of the method described above are: (a) Since the wave form does not enter the calculation, any source of periodic current may be employed, whether sinusoidal or not; (b) slight changes in the electromotive force do not impair the measurements, for their effect is only to vary the amplitude of the curves, a quantity of small consequence; (c) constancy in the speed of the revolving mirror is unnecessary, since irregularity affects both curves alike and does not alter their parallelism; (d) the approximate value of the lag can be seen at once, as well as the quadrant in which it lies; (e) the curves need not fall successively in the same positions on the screen, as no measurements are made there, hence the speed of the revolving mirror need bear no definite ratio to that of the springs; (f) the apparatus is simple and easily constructed.

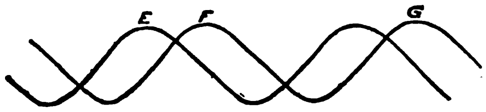


FIG. 4.

Fig. 3 shows the form of the curves produced when the free vibration of the springs is the octave of the current frequency. These curves were obtained from the three-phase circuit before mentioned.

New York Electrical Society.

The following are the officers elected at the Annual Meeting of the New York Electrical Society held on the 18th inst.:

President—John W. Lieb, Jr.; vice-presidents, Herbert Laws Webb, Edward Caldwell, Francis Forbes, Nelson W. Perry, Prof. L. H. Laudy, Prof. Morris Loeb; secretary—George H. Guy; treasurer—H. A. Sinclair.

There have been five deaths and eight resignations during the year; 33 members have been elected, and the net increase in membership is 20. The number of members now on the books of the society is 370.

Although last year the average attendance showed a marked improvement on the preceding year, during the season just concluded the society has had most gratifying evidence that its lectures have been on the whole even more thoroughly appreciated than ever. The range of subjects has been wide and in almost every instance the society has been fortunate in an able and exhaustive treatment of the theme selected. Some of the best lectures promised are still on the programme for next season, and will in all probability be delivered at an early date.

Frank E. Grover's 3,000-Volt Shock.

The resuscitation of a man who had sustained a shock of 3,000 volts of electricity has given the press and the electrical experts new ground for speculation as to the killing power of electricity. It is stated that on the evening of the 20th inst. Frank E. Grover, foreman of the Rochester Gas and Electric Company, while standing near the dynamo in the power house of the company, was thrown suddenly to the floor, and as he fell uttered a cry which was heard by the other station men present who rushed to his assistance. He was to all appearances dead, but the men determined, after sending for a physician, to try the D'Arsonval method of resuscitation, which they were more or less familiar with. They proceeded at once to produce artificial respiration by raising and lowering the arms in regular succession, at the same time pressing and releasing his chest. This was continued for nearly an hour before the arrival of the physician, Dr. Charles W. Wilbur, who had been summoned. Although Dr. Wilbur, after the usual tests, considered the man dead, he ordered the treatment continued, and shortly afterward, to the surprise of all, the patient began to show signs of life. A few minutes later natural respiration set in and the man was soon sufficiently restored to be taken to his home where his recovery was rapid. There seems to be some doubt about Grover's having received the full force of 3,000 volts, but the electricians at the station are confident that he was struck by quite or nearly that amount of current. Grover cannot account for the accident. He said to a reporter next day after the occurrence: "I don't think that I leaned against the dynamo, as I have been an electrician too many years to do so foolhardy a thing. I must have moved my arm in such a manner that it swept the brushes, thus coming in direct contact with the current."

Obituary.

News has just reached this city of the death at Folsom, New Mexico, of Henry W. Frye, formerly editor of the *Electrical World*. Mr. Frye was compelled to give up active work on the paper last winter by a severe attack of pneumonia from the effects of which he never recovered. About the first of January, on the advice of his physician, he sought relief in an entire change of climate, going first to Clayton and then to Folsom, New Mexico, where the invigorating and dry climate gave promise of restored health. His improvement was in fact marked and rapid for a while, but this proved to be but one of the familiar symptoms of the insidious disease, and a change for the worse recently set in resulting in his death on June 20.

His sister had been with him throughout his stay in the West and was at his bedside at his death. Alarmed at the recent sudden change for the worse she sent for her mother, who was on her way to join her son when she was met by the sad news of his death.

ELECTRICITY extends its most heartfelt sympathy to the bereaved mother and sister, and mourns with them a personal loss.

Too Heavy for Horses.

It is announced that the Budapester-Strassenbahn-Gesellschaft, which now works its lines by horses, is proposing to work its lines by electricity, and the Hungarian Board of Trade has given its provisional consent.

This new application of electricity to the driving of Budapesterstrassenbahngesellschaft is noted with pride and satisfaction.

LEGAL NOTES.

Judge Nelson, of the U. S. Court, has filed a decree in the suit of H. B. Moore, receiver of the Great Western Electric Company, insolvents, vs. E. C. Fowle et al., to gain possession of the electric works at West Duluth. He decides that Moore may have possession, but that Fowle cannot be mulcted for damages. Fowle, after his appointment as receiver by the federal court in Chicago, took no steps towards assuming charge in Duluth until Moore had been appointed receiver. The decision of Judge Nelson is satisfactory to the stockholders and people of Duluth as the management of the works is again in local hands. There will now probably be a big fight on the various conflicting claims against the company.

An action was on trial last week before Judge Bookstaver and a jury in the Common Pleas, brought by W. Preston Hix against the Edison Electric Light Company to recover $45,670 on a promoter's contract, whereby it is alleged the defendant agreed to pay Hix 15 per cent. of the capital stock issue of the Edison Electric Light Company of Philadelphia and 5 per cent. on any increase of its capital stock. The Philadelphia company was organized with a stock of $1,000,000, of which 35 per cent. went to the other company. Hix received $150,0 0 as his share of the original stock, and is now suing for his share of three separate increases in the stock of the Philadelphia Company of $2[illegible]0,000, $273,000 and $277,000 in the fall of 1892 and winter of 1898. The defence is a general denial. J. C. Tomlinson is for the plaintiff, and Eaton & Lewis with Joseph H. Choate of council for the defendant. The case not being finished on Thursday evening an adjournment was taken until Monday.

General News.

What is Going on in the Electrical World.

Fredericksburg, Va.—It is proposed to build a line of electric road from Milford to Bowling Green, in Caroline county.

New Britain, Conn.—The Central Railway and Electric Company's line to Berlin Center is completed and ready for public traffic.

Canton, Ill.—Gas is to be displaced by electricity in lighting Canton. The town has contracted for 115 powerful arc lights.

Goldsboro, N. C.—A company of Northern capitalists has been formed to build a railway from Goldsboro to Swansboro.

Chattanooga, Tenn.—The Chattanooga Electric Light Company has been awarded the contract for lighting this city for seven years.

Milwaukee, Wis.—The Clybourne street railway line is to be equipped with electricity, and the Sixth street line is likely to follow.

Lansingburgh, N. Y.—A special election will be held here July 1 to determine whether $13,000 shall be raised for lighting the streets with electricity.

St. Joseph, Mo.—An ordinance has been introduced in the city council granting an electric street railway franchise to W. A. Kellond and W. T. Van Brunt.

Butte, Mont.—The Butte Electric Light Company has decided to consolidate the Butte and Silver Bow plants in one hereafter, in the interest of economy.

Portsmouth, N. H.—The board of aldermen has granted permission to the Portsmouth Horse Railroad Company to use electricity as a motive power on their lines.

Charlevoix, Mich.—The council has contracted with Charles Gabriel, of Saginaw, to put in electric lights on a 10-year franchise. Work will begin immediately.

Cortland, N. Y.—The Cortland and Homer Traction Company have secured the right of way over their entire branch connections, and will begin work on them at once.

Atchison, Kan.—The lease of the equipment of the Atchison Railway, Electric Light and Power Company to B. P. Waggener and C. S. Hetherington has been filed.

Portland, Conn.—All the stock in the proposed electric street railway has been subscribed. Charles F. Parks, of Boston, is largely interested in the new company.

Toledo, O.—The Consolidated Street Railway Company intends as soon as a proper site is obtained, to erect a magnificent new power house at a cost of over a million dollars.

Syracuse, N. Y.—Franchises have been granted by all the towns on the route of the South Bay Electric Road and work on the line may be commenced this summer.

Erie, Pa.—It is reported that a company has been formed to build an electric street railway from Erie to North East. Frank L. McLaughlin, of North East, is interested.

Rockville, Conn.—The surveyors for the Hartford, Manchester and Rockville Electric Railway have the route for the road staked out from Manchester to this city.

Scotland Neck, N. C.—The stockholders of the new electric light company have appointed Mr. A. McDowell a committee to correspond with the various concerns that furnish plants.

Bath, N. Y.—It is reported that an electric road is to be built between Bath and Hammondsport. Some Buffalo capitalists have been looking over the ground with that purpose in view.

New Orleans.—John F. Buckley has invented a hydraulic elevator to be operated by an electric motor which it is claimed has all the virtues of the old hydraulic but none of its defects.

Dover, Del.—The town council has passed a resolution granting the Hilford-Dover Electric Railroad Company the privilege of laying tracks and erecting poles on the streets of Dover.

Charleston, S. C.—F. W. Wagener & Co. expect to extend their electric light plant by adding a 100 horse-power engine and a 100 horse-power boiler and additional electric machinery.

Hamilton, N. Y.—The contract for lighting this village by electricity has been let to the Western Electric Company, and it is expected that the system will be in operation by August 1.

McKeesport, Pa.—The trolley line between Pittsburg and McKeesport has been formally opened to traffic. The line is 10¼ miles long, and the trolley cars make the trip in about 45 minutes.

Newburg, N. Y.—A syndicate, including the Newburg Electric Light and Power Company, has purchased the controlling interest in the stock of the Edison Electric Illuminating Company of this city.

Baltimore.—Mayor Latrobe has signed the ordinance for the creation of an electric commission, whose duty it shall be to report upon a plan of subways for placing all wires in the city underground.

Woburn, Mass.—The car houses of the East Middlesex Street Railway Company were destroyed by fire on the 15th. Thirty-five street cars were burned, and the total loss is estimated at about $40,000.

Boston, Mass.—A few days ago a trial was given the new electric branch of the New York, New Haven and Hartford Railroad at Nantasket Beach. The results were highly satisfactory to those who witnessed the test.

Mt. Clemens, Mich.—The Mt. Clemens Street Railway and the Lakeside Company have effected a consolidation. This means an electric system all over the city and to the lake in place of the present horse car service.

Alton, Ill.—President J. F. Porter of the Alton Electric Street Railway has purchased all the old lines of street railway here and will improve their equipment and operate the combined systems under one management.

Youngstown, O.—A 20-year franchise has been granted by the city to the Youngstown Park and Falls Electric Street Railway, in which Pittsburg parties are stockholders, and the construction of the line will be commenced immediately.

Seattle, Wash.—The Consolidated Street Railway Company's power house was burned on the 2 th inst. Twenty-five cars were destroyed. The electric plant, said to have been the most complete in the Northwest, is in ruins.

Ridgewood, Ill.—David Chirrin of this place is the inventor of an electric camera. It can be attached to the telephone or any other electric instrument or circuit, its object being to reproduce a photograph of the persons speaking to each other.

Belleville, Mich.—It is stated that capital is being rapidly subscribed at Chicago for the scheme of building a dam in the Huron River near this place, the power to be used in the manufacture of electricity to be transmitted to Detroit and elsewhere.

Pekin, Ill.—The Pekin Electric Light and Power Company has agreed to absorption by the Pekin Gas Company, and both companies will be merged under one management. The chances are that a new electric light company will be started in Pekin.

Allentown, Pa.—The Old Colony Trust Company of Boston has filed a bill in equity to foreclose a mortgage of $200,000 against the Allentown and Bethlehem Transit Company and allied corporations. The appointment of a receiver is asked for in the bill.

Sheboygan, Wis.—The common council has passed the bill granting the Electric Lighting Company the contract for lighting the city for ten years at $95 per lamp over the veto of the mayor. The building of the electric street railway will be commenced at once.

Vicksburg, Miss.—Proposals will be received at the Mayor's office until 7:30 P. M., July 15, for the lighting of the city of Vicksburg with 81 arc electric lights, 1,200 C. P., and 34 incandescent electric lights, 50 C. P., for periods of three years and of five years.

Chautauqua, N. Y.—The matter of building an electric railroad from Chautauqua to Mayville by way of Duquesne Lawn Resort is being pushed by a number of Mayville citizens. Among those interested are Postmaster Burns, W. F. Fisher, Judge Van Duzen, George W. Hewes and others.

Greenwich, N. Y.—Plans for an electric railway between Greenwich and Schuylerville are progressing, and active steps are being taken in Greenwich for commencing and rapidly pushing the work. Engineer Reeves Smith, of Troy, will complete the survey at once.

St. Louis, Mo.—E. J. Thurman and W. D. Waters of St. Louis, and J. B. Clayton of Fenton, Mo., have been granted a charter to construct and operate a double track electric railway from St. Louis to Morse Mill, a distance of thirty-five miles. Capital stock $500,000.

Montreal, Can.—An electric railway is planned to run through many of the country parishes of this province. Directors: Gen. Rielley, United States Consul, Ottawa; James Fowler, United States Consul at Charlton Place, and Thomas Henry, Canadian Agent of the Northern Pacific.

Niagara Falls.—The plans for the Niagara Falls, Wesley Park and Clifton electric railroad call for about eight miles of single track with necessary switches, turnouts, etc. The company comprises ex-Mayor Manning of Toronto, Messrs. Blake, Lash and Cassels of that city, and several New York capitalists.—The general meeting of the American Institute of Electrical Engineers which was begun here yesterday attracted members from all over the country. During the convention it is proposed to visit, among other objects of engineering interest in the vicinity, the new works of the Niagara Falls Power Co., which has "put the Falls in harness," and the Park and River Railway on the Canadian side, also the great central station of the Buffalo Electric Power Co.

Reading, Mass.—The project of organizing a new company and building an electric railroad from Reading to Lowell, it is stated, will soon materialize. Col. C. F. Woodward, president of the Wakefield and Stoneham Street Railway Company, is said to be interested in the new enterprise and has practically completed all the preliminary arrangements.

Stockton, Cal.—The survey for an electric railroad between Stockton and Lodi is finished and the work of grading for the roadbed has begun. The enterprise is being pushed by ex-Congressman James A. Louttit, Harry C. Bunn of Chicago and Mr. Hartzell, who was at one time connected with the San Mateo Electric Railway.

Atlanta, Ga.—The *Constitution* states that "George E. Wood, electrician of the Fort Wayne Electric Corporation, has been in Atlanta for several days putting in the celebrated low speed dynamos for the Georgia Electric Light Company. He is a brother of the justly celebrated James J. Wood, who invented this wonderful piece of electric machinery."

Philadelphia.—At a meeting of the directors of the Electric Traction Company it was decided to increase the capitalization to the full amount authorized, $8,750,000, by the issue of 22,604 additional shares of a par value of $50 each. The money thus obtained, amounting to a little more than $1,100,000, will be used to pay for prospective extensions of the company's system.

Cincinnati, O.—A special meeting of the stockholders of the Cincinnati, Hamilton and Dayton Railroad is called for July 8, at Cincinnati, the object being to vote upon the question of consolidating all the properties now included in the system. This will unite the Cincinnati, Hamilton and Dayton, the Cincinnati, Dayton and Ironton, and the Cincinnati, Dayton and Chicago.

Pittsfield, Mass.—It is understood here that the electric railway which has been started from Troy to Sandlake will eventually be continued to Pittsfield, Sandlake being about half way between the two cities. The whole distance from Troy to Pittsfield by road is only 33 miles, and an electric line would strike several towns which have no good railroad facilities now.

Canastota, N. Y.—William H. Patten and other capitalists of this village have acquired an interest in the Marvin Electric Drill Company of Syracuse, and have arranged to have the factories of the company removed to Canastota. The company will manufacture electric percussion drills and dynamos for their operation under the patents of H. N. Marvin, formerly of Syracuse, and now of this village.

Stevens Point, Wis.—Negotiations have been in progress for some time looking to the consolidation of the Clark Water Power property and the Electric Lighting Company. If the deal is consummated, a new electric power house will be built at the dam to furnish power for the lighting plant and for the prospective city railway. The new company may see fit to establish several manufacturing plants in that immediate neighborhood.

Topeka, Kan.—The Brush electric light plant of Topeka has been sold to Cleveland parties, one of whom is Mr. Hazard, a banker. A former shareholder stated to a reporter: "Cleveland, O., is the home of the Brush light, and plants similar to the one in Topeka were being purchased by the same parties in many other cities, possibly with the intent of getting all of the Brush electric light plants under one management."

Mason City, Iowa.—T. S. Roberts, a local capitalist, has purchased a controlling interest in the Mason City Electric Light plant, and there has been a reorganization. M. I. Clark was elected president, T. S. Roberts secretary and treasurer, and W. P. Fitch manager. They expect at once to put in an electric street car line connecting all the depots of the city, and it is contemplated to soon put in a line connecting Clear Lake and Mason City, a distance of ten miles.

Brooklyn, N. Y.—The board of aldermen have adopted a resolution directing the park commissioners to advertise for proposals for lighting the Ocean Parkway with electricity for a term of three years.—At a special stockholders' meeting of the Edison Electric Illuminating Company of Brooklyn, on the 19th, the capital stock of the company was increased $750,000 to $3,750,000. The directors were authorized to issue additional bonds to the amount of $500,000 for the purpose of purchasing the capital stock of the Citizens' Electric Illuminating Company and for extensions of the combined plants.

Rockdale, Milam Co., Tex.—A number of the leading citizens are taking an active interest in the proposed electric street railway. J. R. Rowland, one of the most substantial merchants, is taking the lead in the matter. R. H. Ames, manager of the electric plant, is also interested. Plans have been drawn up and estimates made on both a regular railway and an electric line. The line is to be extended northwest to Elm Grove, in Williamson county, a distance of twenty miles, and will follow up the valley of the San Gabriel the entire distance.

Chagrin Falls, O.—The Cuyahoga Suburban Railway Company has secured the entire right of way from Randall, where work is progressing on the new electric line to this place, and has applied for the franchise. As soon as this is granted the company will begin work, after increasing its capital stock from $50,000 to $150,000. Solicitors of the line running from Kinsman to this place to connect with the Cuyahoga Suburban Railway line are securing the right of way rapidly. E. M. Yeomans, of New York, now proposes to push the line on through to Meadville, Pa., which will make a continuous railway through unexcelled farming country from Meadville, Pa., to Cleveland.

Buffalo, N. Y.—Buffalo capitalists have a project on foot to build an electric road to Gardenville, to be called the Buffalo and Gardenville Electric Railway. The capital stock is to be $20,000, and efforts are now being made to get the matter in such shape that the building of the road may soon be commenced.—The Niagara Falls Power Company has refused to accept the franchise offered by the city of Buffalo. The company objects to certain restrictions, among them the time limit of 25 years instead of 40, and fixing the price of power within the city.—Governor Morton failed to sign the bill permitting Alonzo C. Mather to erect an experimental bridge and turbines on the Niagara River for the purpose of developing electric power.

Knoxville, Tenn.—Sealed bids will be received by the board of public works at their office in Knoxville, Tenn., until July 11, 1895, at 2 o'clock P. M., for lighting the city with electricity or gas. For 200 arc lights 2,000 candle power each, all night service; or 800 to 1,000 gas lights of 18 to 20 candle power. Either contract to run for the term of five or ten years. All bids must be based upon the form of a contract which may be had upon application. Also, bids will be received for the erection of an electric light plant to be paid for in yearly installments in five or ten years, the city to take charge of and operate the same within thirty days after completion. Certified check for $1,000 must accompany each bid.

Telephone and Telegraph.

The Select Council at Philadelphia has refused to reconsider the Drawbaugh Telephone bill.

Suits are now pending in Philadelphia against a number of telegraph and telephone companies for license fees, amounting in the aggregate to $100,000.

The Richmond and Huntington Telephone Company was organized lately at Richmond, Vt.; capital stock, $15,000; officers: President, A. E. Ellis; secretary, J. C. Sibbins.

The Oberlin Telephone Company, of Oberlin, O., proposes to construct a magnetic telephone line across Ohio. Its capital stock is $19,000. W. H. Pearse, F. L. Fuller, E. S. Johnson and W. B. Dodoritha are the incorporators.

The common council of Battle Creek, Mich., has voted to put in signal and telephone boxes.

There is a fair prospect of a telephone franchise being granted the Mutual Automatic Telephone Company at Syracuse, N. Y.

The Framingham Telephone Company of Framingham Mass., has secured a franchise for that town and will also furnish service at Natick. The corporation is capitalized at $15,000.

The Asbury Park Mutual Telephone Company, of which Washington White is president, has been granted the right to construct a line in Ocean Grove. Work will be begun at once.

Thos. M. Ferguson has been granted a franchise to construct a telephone line at Meridian, Miss.

A number of Rochester, N. Y., capitalists, among them Frederick Cook, Max Brickner, James Fee, Edward Peck and William C. Barry, have applied to the common council of Rochester for a telephone franchise. It is proposed to enter into active competition with the Bell Company at much lower rates than those of the latter company.

Charles E. Johnson will construct a telephone line from Raleigh to Hamlet, N. C., a distance of ninety-six miles.

The Carbondale Telephone Company, now in progress of organization by members of the board of trade of Carbondale, Pa., has petitioned the council for leave to establish a telephone system in that city.

It is stated in a Madison, Wis., despatch that "the Standard Telephone and Electricity Company of Madison have closed a contract with the Western Electric Telephone Company of Britt, Ia., for 10,000 telephones, with Milde non-infringing transmitters. This is said to be the largest order ever placed for telephones in the United States."

The telephone company recently organized at Binghamton have protested against the restrictions imposed in the franchise prepared by the city council.

The Newark Mutual Telephone Company has been incorporated with a capital stock of $300,000. The incorporators are Ernest J. Foord of Jersey City, P. Justus Atkinson of New York City, and Samuel L. Boyd of Brooklyn, N. Y.

The New Harrison Telephone Company perfected its organization at Grand Rapids. Iowa, by electing as officers: President E. B. Fisher; vice-president, C. B. Rood; secretary, Amos S. Muzzleman. The company will at once place $30,000 more bonds on the market and immediately after July 4 will begin building the exchange.

Edward P. Meany, Melville Egleston, James E. Caldwell, Leland Hume and T. Dwight Webb have taken out a charter at Nashville, their purpose being to construct and operate telephone lines and telephone exchanges as the American Telephone and Telegraph Company of Tennessee.

The Columbian Standard Telephone Company, the branch of the Standard Telephone Company for Maryland, the District of Columbia, Virginia and West Virginia, has been formally organized, and will soon begin active operations. The headquarters of the local company will be in Washington, with branch offices in Baltimore and Richmond.

A Racine, Wis., dispatch states that a new telephone company has been established at Western Union Junction, Wis., to operate a line between that place and Somers, Kenosha County, and will eventually extend to the other towns in the two counties. The capital stock is $5,000 and the officers are: President, C. A. Brown; secretary, Frank Lingsweiler; treasurer, Dr. Stonebreaker.

At the Convention of Railway Telegraph Superintendents, held on the 18th inst. at Montreal, Can., several papers interesting to the fraternity were read and discussed. The election of officers resulted as follows: J. B. Leonard, president; J. W. Fortune, vice-president; P. W. Drew, secretary-treasury. Fortress Monroe was chosen as the place at which the Convention will assemble in July, 1896.

A new telephone company, entitled the Commercial Telephone Company, has been incorporated to do business in the county of Alameda, Cal. The directors are E. R. Smith, Albert L. Stetson, J. D. Johnson, John W. Butler and S. P. Lunt. The capital stock is $100,000, $50,000 of which has been actually subscribed. The new company contemplates establishing connections in San Francisco.

Judge A. C. Coxe of the United States Court has granted an order in the case of the American Bell Telephone Company of Boston against the Baxter Overland Telephone and Telegraph Company of Utica, N. Y., which gives the latter the privilege of withdrawing its exhibits from the files of the court, the patents of the plaintiff having expired. This practically amounts to a dissolution of the injunction which has existed against the Baxter Overland Telephone and Telegraph Company for seven years and that company is now making preparations to resume business.

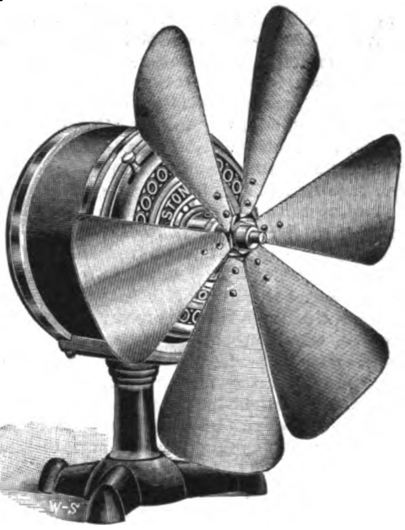
At a meeting of the Board of Managers of the Bell Telephone Company in Philadelphia on the 18th, Messrs. Merrihew, Gill, Tinker, Clark, Westbrook and Plush resigned, and C. J. French and Thomas Sherwin, of Boston, Mass.; Francis B. Reeves and Joseph E. Gillingham, of Philadelphia; J. King Goodrich, of Pittsburg, Pa., and Edward J. Hall, of New York, were elected to fill the vacancies. John E. Hudson, of Boston, was elected president, A. A. Ziegler, of Philadelphia, treasurer, and Samuel B. Huey, of Philadelphia, secretary and solicitor. The retiring members of the old board represented the controlling interest in the stock held by the Western Union Telegraph Company, which has been sold to the American Bell Company of Boston. General Eckert is the only officer of the Western Union Company who continues in the present management.

A novel ceremony was held in the office of the Maryland Trust Company in Baltimore one day last week. It was the counting of the contracts of the Home Telephone Company. This company has 3,400 contracts with the citizens of Baltimore to take its telephone service for three years at $36 and $48 per year. The public counting of contracts was held to show the people of that city that the new company means business. The counting was done by a committee of the leading business men of the city, after which lunch was served. The Home Telephone Company has purchased a franchise which gives it full right to extend its lines through the streets and conduct a telephone business in Baltimore. This franchise was originally from the Maryland Legislature for the Writing Telegraph Company, in which the Abells were interested. This company was formed for the purpose of applying a patent to the reproduction of writing by electricity, but it never did any practical work and the projectors sold the franchise to the Home Telephone Company.

10,000 Meston Fan Motors.

The rapidly revolving blades of 10 000 Meston alternating current fan motors now help to make life more endurable during the heated term in various sections of the country. The Emerson Electric Manufacturing Company, St. Louis, Mo., manufacturers of these motors, report that the sales to date have aggregated the above number and that the second 10,000 has already been started upon.

The accompanying illustration shows the model of 1895, with improvements.



The Meston fan motors are sold on the following guarantee:

"We guarantee our motors to be perfect in every detail of design and construction, and we will be responsible for all repairs not due to carelessness or accident, including brush renewals, if any should be necessary, for three months from date of purchase."

Wagner Fan Motors.

The Wagner Electric Manufacturing Company, St. Louis, report that the demand for their new fan motors has been so great that they are nearly three weeks behind in orders. Several large transformer contracts have been closed recently. The company's factory is running with full force. The prospects for a large fall trade are very bright.

Spread of Electric Street Lighting.

That there is a steady demand for both outdoor arcs and incandescents is shown by the rate at which George Cutter, of Chicago, is supplying his Lamp-supporting Pulleys and his Streethoods The demand for these has kept up steadily month after month.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Boston, Mass.—A six story building is to be erected at Elliott and Pleasant sts., by Wm. A. Miller.

Buffalo, N. Y.—J. P. White will build a three story brick and terra cotta dwelling, on North st. near Elmwood ave., to cost $35 000....Charles H. Williams will build three story brick dwelling at 6[illegible]2 Delaware ave., to cost $72,000.

Cambridge, Mass.—Hartwell & Richardson, of Boston, have prepared plans for the Cambridge Y. M. C. A. building, to cost $100 000.

Charleston, S. C.—W. T. Keogh will expend $150 000 in remodeling the Academy of Music.

Chicago, Ill.—Alexander Davidson intends building a theater next to the Great Northern Hotel on Quincy st., to be called the Great Northern, cost $1,000,000.

Coney Island, N. Y.—A club house is to be erected at Norton's Point, to be equipped with all modern improvements; Architects Lord & Newett, 123 East 23d st., New York.

Galveston. Tex.—Plans of a Y. M. C. A. building, to cost $50,000, have been prepared by C. W. Bulger, and its construction is to begin at once.

Hornellsville, N. Y.—Hornellsville has just voted $30,000 for a new court house and city hall.

Kingston, N. Y.—The new factory for the Cunningham Manufacturing Company will be erected on a plot between Gage st. and Fonhall ave.; it will be lighted by electricity.

Kissimee, Fla.—W. L. Van Duzor & Co. have effected a sale of a plot of land to Northern capitalists for hotel site. Work on the buildings, etc., will be commenced July 1. The structure will contain 150 rooms, fitted up with all modern improvements, electric lights, etc.

Marco, Fla.—W. P. Neal and W. B. Collier contemplate building a hotel on Marco Island.

Melrose, Mass.—Melrose Athletic Club will erect a handsome club house on site of present structure, cost $20,000; Architect Fred Ellis.

Menominee, Mich.—The new opera house which it is proposed to build here will have a seating capacity of 1,500.

New York City.—An office building, sixteen stories in height, is to be erected on the site adjoining the Field building, at the lower end of Broadway, Architect Richard M. Hunt, 1 Madison ave....Mercantile building, six stories and basement, at 265 Bowery, all modern improvements, Architects Schneider & Herter, 48 Bible House.... Four story building for Association of the Bar, south side of 44th st., east of 6th ave., to cost $350,000, Architect C. L. W. Eidlitz, 100 5th ave....Metropolitan Life Insurance Co. will erect a building on 4th ave. near 23d st., site of the Lyceum Theater....Union League Club will expend $10,000 on improvements to club house....A six story building will be erected by a syndicate at 39-43 West 42d st., opposite Bryant Park....Plans have been filed for a six story Maternity Hospital building to be erected at Amsterdam ave. and 59th st. by Wm. Sloane, 642 5th ave.... A magnificent mansion is to be erected at West 55th st., a plot from St. Luke's Hospital grounds....The block fronting on Riverside Drive, from 74th to 75th st., has been sold to ten individuals under an agreement that each is to build a dwelling of the better class; plans for these houses have been drawn by Architect C. H. P. Gilbert, 18 Broadway, and they call for 10 five story American basement dwellings, to be finished in hard wood, heated by steam and lighted by electricity....Flats, Apartments, etc.: Four story building, 44 West 24th st., Architect A. E. Barlow; five story apartment house, St. Nicholas ave. and 181st st., to contain latest improvements, Architect John C. Burne, 161 West 42d st; 4 four story dwelling houses, south side of 77th st., west of West End ave. by W. E. Thompson; seven story apartment house, northeast cor. 68th st., plans prepared by George Kerster, 110 West 34th st.; 2 five story flats, north side of 119th st., west of Park ave., Architects Neville & Bagge, 215 West 125th st.; the same architects are about to file plans for a five story double flat, north side of 111th st., west of 8th ave.; six story tenement with store, northwest cor. Stanton and Pitt sts., Architect Charles Rentz, 153 4th ave.; 2 five story apartment houses, north side of 126th st., east of Columbus ave.; five story flat, 852 First ave., by Randolph Guggenheimer and Solomon Marx; 2 four story dwellings, south side of 76th st. west of West End ave., Architect Henry F. Cook, 964 Columbus ave.; four story dwelling, south side of 86th st., east of West End ave., Architect C. P. H. Gilbert, 18 Broadway: four story dwelling, 75th st., east of Madison ave., by A. G. Gersten, 56 East 25th st.

Philadelphia, Pa.—Wm. Schollenberger, Jr. will erect a three story factory building at northeast cor. of Mascher and Oxford sts....George B. Davis, merchant, of West Philadelphia, is about to erect a building at 3930-3932 Lancaster ave., lighted by electricity....Allen B. Rorke is to erect a handsome residence for himself at 131 South 18th st. to be four stories....Charles McCaul is receiving estimates on a handsome six story fire proof building, to be erected at northeast cor. of 10th and Sansom sts. Mr. McCaul also contemplates erecting a six story store and factory building on property recently purchased by him, 10th st. south of Market.

Pittsburg, Pa.—James McKay will erect an eight story brick building, 25 x 110, at 1005 Liberty ave., to cost $26,000....A new play house is to supplant the old Harris theater; Harry Davis will probably be the lessee and manager.

Poughkeepsie, N. Y.—The trustees of Vassar College are to build a $25,000 residence for its president and a new $100,000 building for the college.

Syracuse, N. Y.—Thomas Hogan, who owns the site formerly occupied by the United States Hotel, at West Fayette and Franklin sts., is having plans drawn for five story brick block to cover the entire site.

Worcester, Mass.—It is understood that Charles L. Nicolls contemplates the erection of a six story flat building adjoining the Plymouth church property.

INCORPORATIONS.

The Fawkes Electric Manufacturing Company, Denver, Col.—to manufacture, sell and deal in electrical machinery, etc., under patent rights. Capital stock, $600,000. Promoters: Geo. P. Blair, Sydney Williams, John R. Smith all of Denver.

The Marion Water Company, Portland, Maine—to construct and maintain water works, gas works and electric works in Marion, Ohio. Capital stock $250,000. Promoters: Chas. J. Chapman, Cullen C. Chapman, Rob't Chapman, Portland; C. E Burke, Cleveland, O.

The Hammond Lighting Company, Chicago, Ill.—to furnish light, heat and power, by use of steam, gas and electricity; acquire, purchase and operate electric, gas, and steam franchises, etc. Capital stock, $210,000. Promoters: Wm. P. Engel, Chas. F. Griffin, E. Barnhart.

The McKeesport and Port View Passenger Railway Company, McKeesport, Pa.—to construct and operate an electric railway at McKeesport. Capital stock, $18,000. Promoters: R. T. Carothers, T. D. Gardner, J. W. Allig, McKeesport.

The Maywood and Proviso Electric Light and Power Company, Chicago, has increased its capital stock to $60,000.

The Badt Multiphase Electric Railway Company, Chicago. Capital stock, $1,000,000. Incorporators: William A. Aylsworth, James C. Essick and Adolph Gray.

The Hall Electric Power and Reduction Company, Des Moines, Iowa—to buy and sell, to own and operate and to build and equip electric lighting and gas plants and to sell all kinds of electric and gas appliances. Capital stock, $500,000. Incorporators: Thurston Gardner Hall, Truman Miles Hall and Robert H. Laird.

The Washington and Tyler Electric Light and Power Company, Washington, Pa. Capital stock, $10,000. Directors: Arthur Kennedy, Francis J. Torrence, of Allegheny; Thomas R. Hutchinson, of Pittsburg; John N. Murdock and John W. Vester, of Washington.

The Atchison Railway, Light and Power Company, Atchison, Kan.—to build and construct electrical street railway and electric power for light in the city of Atchison. Capital stock, $200,000. Promoters: Jas. W. Orr, R. B. Morris, E. C. Post, R. L. Pease, Atchison.

The Wizard Telephone and General Electrical Manufacturing Company, Council Bluffs, Ia.—to build, equip, maintain and operate telephones, telephone exchanges and lines. Capital stock, $100,000. Promoters: J. C. Willow, J. E. De Lee, Eli Brown, Council Bluffs.

The Springfield Traction Company, Springfield, Mo.—to build and operate street railways. Capital stock, $400 000. Promoters: S. W. Fordyce, Geo. W. Barker, Moses Rumsey, R. C. Kerens, St. Louis, Mo.; C. B. McAfee, J. F. G. Bentley, Springfield.

The Standard Electric Company of Chicago has increased its capital stock to $1,500,000.

The Western Electric Telephone Company, Britt, Hancock County, Iowa—to build, own, manage and lease telephone lines in Iowa. Capital stock, $100,000. Directors: J. F. Cass, of Sumner; Charles Webster, of Waucoma; T. A. Potter, of Corinth; Thomas A. Way, of Britt, and S. A. Way, of Wesley, Iowa.

The Amplified Electric Company, East St. Louis. Capital stock, $1,000 000. Incorporators: Frederick Ulrich, Edwin J. Paule, John T. Dodwell.

The Jacobson-Blosser Electric Company, Portland, Maine—to manufacture and deal in all kinds of tools and machines. Capital stock, $ 00,000. Promoters: J. Lestor McLean and Edward B. Jackson, Boston; Alfred Pinal, Quincy, Mass.

The Portland Suburban Railway Company, Portland, Ore.—to own and operate a city and suburban railway, either and both electric and animal power; own water systems, real estate, etc. Capital stock, $2,500,000. Promoters: James M. Lively, Ezra D. Baker, Portland; L. D. Lively, Athena Ore.

The South American Light, Power and Traction Company, Beatrice, Neb.—to establish plants for and furnish light to municipalities and individuals, from gas and electricity. Capital stock, $1,000,000. Promoters: A. S. Paddock, Robert S. Forbes, Edwin W. De Leon, Samuel H. Guggenheimer.

The Little Rock Traction and Electric Company, Little Rock, Ark.—to own, purchase and construct street railways in the city of Little Rock and furnish the said city with light, etc. Capital stock, $500,000. Promoters: Samuel Carr, R. T. Paine, Jr., Isaac T. Burr, Allston Burr, Arthur Perry and Francis Peabody.

The People's Light, Heat and Power Company, Denver, Col., and Hastings, Neb.—to construct an electric light plant in the town of Hastings, Neb. Capital stock, $ 00,000. Promoters: Wm. H. Brevoort, Chas. F. Lacombe, Samuel S. Campbell, Denver.

The Central California Electric Company, Jersey City, N. J., and New York City, N. Y.—to manufacture and construct plants, machinery, generators, etc., for the manufacture, use, distribution, etc., of electricity. Capital stock, $100,000. Promoters: Warner Van Norden, Wm. de la M. Van Norden, New York; H. T. Bronson, Rye, N. Y.; Edw. C. Boardman, Garden City, N. Y.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JUNE, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.50 P. M.	2	3.30 A. M.
2	......	..	......
3	1.00 A. M.	3	3.40 A. M.
4	1.10 "	4	3.40 "
5	1.40 "	5	3.40 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	8.00 P. M.	9	11.00 P. M.
10	8.00 "	10	11.30 "
11	8.00 "	11	11.50 "
12	8.00 "	13	12.30 A. M.
13	8.00 "	14	12.40 "
14	8.00 "	15	1.00 "
15	8.00 "	16	1.20 "
16	8.00 "	17	1.30 "
17	8.00 "	18	2.00 "
18	8.00 "	19	2.30 "
19	8.00 "	20	3.00 "
20	8.00 "	21	3.40 "
21	8.00 "	22	3.40 "
22	8.00 "	23	3.40 "
23	8.00 "	24	3.40 "
24	8.00 "	25	3.40 "
25	9.00 "	26	3.40 "
26	9.30 "	27	3.40 "
27	10.00 "	28	3.40 "
28	10.30 "	29	3.40 "
29	11.00 "	30	3.40 "
30	11.30 "	July 1	3.40 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JUNE 18, 1895.

ELECTRIC RAILROADS AND APPLIANCES.

541,073. Electric-Car Brake. George B. Damon, Lowell, Mass., assignor of one-half to Gardner W. Pearson, same place. Filed April 30, 1894.
541,0 8. Crossing for Trolley-Wires. John Kroger, Pleasantville, N. J. Filed Nov. 3, 1894.
541,126. Trolley-Wheel. Charles Smith, Belleville, N. J., assignor to the Eastwood Wire Manufacturing Company, same place. Filed March 3 , 1894.
541, 65. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Original application filed Jan. 12, 1887. Divided and this application filed Sept. 7, 1889.
541,38 . Underground Closed-Conduit System for Electric Railways. Adolph J. Smith, Milwaukee, Wis. Filed June 6, 18 4.

ELECTRIC LIGHTS AND APPLIANCES.

541,1 1. Device for Conducting Electricity to Lamps, etc. George F. Rose, London, England. Filed Feb. 27, 1895.
541,179. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill., assignor to the Standard Electric Company, same place. Filed July 2, 1894.
541,290. Arc Lighting. Samuel W. Rushmore, Brooklyn, N. Y. Filed March 20, 1895.

DYNAMO ELECTRIC MACHINERY.

541,357. Compound-Wound Alternating Generator. John D. Hilliard, Jr., Bluefield, W. Va. Filed June 21, 1894.
541,380. Armature for Electric Motors and Generators. James F. McLaughlin, Philadelphia, Pa. Filed Dec. 5, 1891.

BATTERIES, ETC.

541,081. Storage-Battery and Method of Making Same. Nathan H. Edgerton, West Whiteland, Pa. Filed Feb. 27, 1894.
5 1,3 0. Portable Galvanic-Battery Cell. Frank A. Glasgow, St. Louis, Mo. Filed Sept. 18, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

541,077. Telephone System. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Feb. 21, 1895.
5 1,148. Current-Strength Indicator. Percival G. Burgess, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed March 25, 1895.
541,149. Transmitter. John Burry, New York, N. Y. Filed Oct. 23, 1893.
541,152. Distributing-Frame for Telephone-Circuit Conductors. Frank B. Cook, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed Jan. 9, 1895.
541,225. Repeater. Moses G. Crane, Newton, Mass. Filed Aug. 4, 1894.

MISCELLANEOUS.

541,136. Rheostat or Other Circuit-Controller. Charles Willms, Baltimore, Md. Filed Nov. 6, 1894.
541,137. Calcium-Carbide Process. Thomas L. Willson, New York, N. Y. Filed Jan. 16, 1895.
541,146. Electrolytic Process and Apparatus. Henry Blackman, New York, N. Y. Filed July 2, 1 94.
541,147. Process of and Apparatus for Bleaching. Henry Blackman, New York, N. Y. Filed June 28, 1894. Renewed April 27, 1895.
541,1 4. Electric Switch for Railways. Leonard Wheeler, Sioux City, Iowa. Filed June 8, 1894.
541,2 0. Electric Elevator. Rudolf Eickmeyer, Yonkers, N. Y. Filed Oct. 1, 1890.
541,227. Electric Switch. Chimsonovitz P. Elleson, London, England. Filed July 16, 1894.
541,233. System of Electrical Distribution. Charles K. Huguet, New Orleans, La. Filed Jan. 30, 1895.
541,243. Push-Button. Frederick W. Manger, Brooklyn, N. Y., assignor to Huebel & Manger, same place. Filed Oct. 1, 1894.
541,2 7. Electric Stop-Motion for Engines. Eugene C. Myrick and George C. Doeg, Providence, R. I. Filed May 23, 1893.
511,332. Insulator. James M. Patterson, Springtown, Tex. Filed April 10, 1895.
541,341. Electric Alarm Signal and Indicator for Trolley Railroads. Jacques A. Buisson, New Orleans, La. Filed April 2, 1895.
541,399. Electric Train-Signal. Edward J. Devine, Port Arthur, Canada. Filed Dec. 11, 1894.

ELECTRICITY.

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EDITORIAL NOTES.

The Institute Meeting at Niagara. Last week witnessed what in some respects was the most successful meeting thus far in the history of the American Institute of Electrical Engineers. By way of attendance it exceeded by nearly 100 per cent. the largest previous assemblage. The weather was most auspicious throughout the meeting, and the attractions of the Falls themselves added zest and vigor to the expectant visitors. The papers as a whole were not up to the highest standard, and this is one of the two only regretable features of the meeting. While quite a number of the papers were below the high standard of some previous meetings, there were others of such pre-eminent interest as to have fully justified the trip had there been nothing else to round out the programme. There was, however, an event which will go down to history as one of the prominent landmarks, not only in electrical development, but in that broader one of engineering science, and the Institute may count itself fortunate in being present at the first public turning of the Niagara power plant. This event and the technical details as given by Dr. Sellers and Mr. Stillwell overshadowed every other feature, and will long be remembered by those who were so fortunate as to be present. The Institute will be proud too to include Mr. Stillwell's full report in its Transactions, and in this manner to give it permanent form where it may be studied by electricians the world over.

Another feature of the meeting was exceedingly gratifying, viz., that a greater proportion than ever before of the papers were ready in printed form before the meeting. We have always maintained that this should be required as a condition of acceptance of papers, and are glad that our idea was so nearly attained at Niagara.

One of the most significant features was the discussion following Dr. Emery's paper on the cost of steam power. Both the paper and the discussion were pertinent to the occasion, and substantiated most fully the position which we all along have maintained, viz., that it was *extremely* doubtful if the Niagara Power Company could sell power in Buffalo in competition with locally generated steam power. We believe that most engineers are at heart with us in this belief, and this was evidenced by the fact that in the discussion referred to the question was *not* could it compete in Buffalo, but could it compete in Niagara Falls with locally generated steam power. But whatever our views are as to the commercial practicability of the Buffalo-Niagara transmission scheme, that does not deter us from admiring the perfect engineering feat as such, which is now an accomplished fact. No one is more ready than we to praise the skill and engineering talent that have given the world this most perfect example of applied science. As an engineering triumph, and in its boldness, it is almost unique, and those whose names are intimately associated with it will go down to history in a way that will make their descendants justly proud.

* * *

The Independent Telephone Movement. No one could have attended the recent meeting of independent telephone men at Pittsburg without being absolutely convinced of the genuineness of the movement and its strength. This first meeting was a great educator, and we trust the Association formed there will not lose sight of the important fact that its first mission is to spread intelligence. Other objects should be only incidental. But ELECTRICITY sees no reason for preaching to these gentlemen. The conduct of the whole movement has so far been admirable, and is in striking contrast to the somewhat similar attempts to form various associations or combinations among other elements in the electrical trade. During the first session or two the inexperienced listener would have got the notion that any union was impossible. There seemed to be nothing but the expression of entirely discordant views. Yet this was the essential preliminary of ever getting together on one common ground. After every man "had his say" it was found there was one common platform on which every man in the telephone business, outside of the old company, could stand with two solid feet.

There was little argument as to the qualifications for membership, and it was the almost unanimous sense of the members that every man or concern making and selling any particular part of a telephone system should be eligible upon payment of the regular fee. This is as it should be. There are to-day no less than 175 to 200 such concerns, and while they are competitors in business they have several points of interest in common. It is to be hoped that the broad views which have so far characterized the proceedings will continue in practice.

The American Bell Telephone Company is, of course, here to stay, but it is essentially contrary to the spirit of American progress and independence that a field so vast as that of telephony, with all its possibilities, should remain in the hands of any one, ten, or twenty companies.

The field is almost unlimited, and will not be fully cultivated for years to come. It is worthy of all the thought, brain and energy which can be brought to bear upon it, and its full development would be impossible if dependent upon one company.

The imperative first step to insure success is to convince local capitalists that the telephone exchange business is safe, profitable and permanent, and to show to tens and hundreds of business establishments and house-owners that individual telephone outfits are safe to buy and economical in the service performed. It will be ELECTRICITY's pleasure to spread this information.

* * *

The "Engineer's" Blindness, or What?

In our issue of June 12 we made casual reply to an editorial of the *Electrical Engineer* entitled "Buffalo Blindness." The Buffalo *Express* devotes over a column of its editorial page to a review of these "casual" remarks of ours, and concludes as follows: "*Its* (ELECTRICITY's) *contemporary is in duty bound to defend itself, and unless we mistake its temper, that defence will be a vigorous one.*" The Buffalo *Express* evidently doesn't know the *Electrical Engineer* or it would not expect it to do *anything* vigorously. Not even to such a severe arraignment as that which we published can the *Electrical Engineer* reply vigorously. Here is the reply that our contemporary makes: "Since our recent editorial was written on 'Buffalo Blindness,' referring to the unfortunate position in which Buffalo had placed itself with regard to Niagara power, important changes have taken place in the situation, more than justifying the views we then ventured to express, and which *we still venture to hold*, despite the abuse, scorn, contumely and vulgarity heaped upon our devoted heads." Now, isn't that vigorous?

There is an old saying that there are none so blind as those who will not see. It makes no difference that we point out to our contemporary that *none* of the schemes mentioned as living examples of commercially successful transmission of 20 *miles* or *over* are equal to that distance, it "still ventures to hold" that they are. It makes no difference that the records show that at the Frankfort-Lauffen transmission the power cost five times as much when delivered at Frankfort as it could be generated locally for by steam—our contemporary "still ventures to hold" that it was a commercially successful experiment. It makes no difference that we point out that in the 16-mile transmission to the Tomboy mine the delivered power competes with locally generated steam power with coal at $20 per ton, and that we endeavor to show that such a competition is commercially a different problem from that of transmitting 20 miles and competing with steam generated from coal at $1.50 to $2.00 per ton—our contemporary "still ventures to hold" that it is not.

When we ridicule the *Engineer's* idea that $18 per annual H. P. is *low*, that paper considers it *abuse*. When we dismiss the idea that our friend Huntley or the Buffalo General Electric Company could not furnish arc lights at $50 per annum if given the mechanical power *free*, the *Engineer* considers it *scorn*, and it *is* scorn.

When we analyze one by one the *Engineer's* statements upon which it bases its whole argument, and show that they are each wrong, it considers it *contumely*, and it is right. When we refer to the stockjobbing feature of the Niagara land scheme, we are accused of *vulgarity*, and if truth-telling is vulgarity we plead guilty. But our contemporary says that since its editorial was written "important changes have taken place in the situation." Does it refer to the newspaper yarn, to which it innocently gave publicity, that Tesla had discovered a means of transmitting current from Niagara without loss by means of pipes containing a salt solution? No, it does not mean this; it means that some of those most closely interested in the land sale feature are trying to frighten people away from Buffalo by proposing to give Buffalo the go-by and transmit their power *further*—to the embryo town of Depew.

One thing has indeed happened since the editorial in question, and that seems to corroborate quite fully our suggestions of caution in regard to some features of the Buffalo franchise. There has been a meeting of the Power advisory committee of Buffalo, and before this Mr. Rankine, of the Niagara Company, has explained why his company cannot fix a maximum price for power delivered. It is because "We are not going to sell or distribute any power ourselves even to Niagara Falls, but intend to organize and capitalize a company to conduct our business here, and we want authority to transfer our franchise to them."

At last we have a candid confession that should forever set at rest the advisability of every precaution before the city commits itself to a franchise that is to be bandied about to the highest bidder irrespective of his responsibility.

The above reason is given why the Niagara Company will not agree to a stipulation restricting the sale or transfer of the franchise should it get it, but it is certainly also a *very* good reason why the Niagara Company should *not* get it.

We insist upon it that the only *rational* basis on which the city of Buffalo can consider the granting of a franchise is upon a maximum charge for power delivered, and a knowledge that it is dealing with principals. We very much question whether under the conditions of cheap power, labor and supplies which obtain at Buffalo, and the enormous fixed charges which stand in lieu of coal at Niagara, the delivery of power at Buffalo can be made a commercial success. If it can be, the Niagara Company must convince the capitalists who are to undertake the supply of the fact before they will invest. If these capitalists can be convinced that there can be a profit, then they will be willing to name a minimum price which will yield them that profit. The Niagara people have certainly given no figures as yet to the public which show that power can be delivered at a profit. On the contrary, the figures that they have given show just the reverse as far as they show anything at all.

Should the Niagara-Buffalo transmission scheme prove a commercial failure, as we are convinced it will, it will give the business of electrical transmission of power the blackest eye it has ever had. It will give it a set-back from which it will not recover for twenty years. If the scheme is to be a success, then those who have been projecting it these many years must have some figures upon which success can be based. Why don't they publish these figures? Why don't they state what advantages will accrue to Buffalo by the delivery of the power there? Why don't they state what they will give in return for the franchise which they seek? If they require assistance to enable them to sell power at a figure that will be advantageous to Buffalo, why don't they state what assistance they will need, and at what figure they will sell in case they receive such assistance? The city of Cincinnati spent nearly thirty million dollars in a railroad to tap the Southern railroad system because she saw it would be an advantage to do so. Buffalo might well grant a large subsidy if by so doing she could be assured of adequate returns from Niagara power.

Those who ought to know best say they can't state what advantages they can offer. They ask the city of Buffalo to give them an exclusive franchise—for what? Confessedly, that they may sell it to Tom, Dick or Harry—for what? Apparently that the city of Buffalo, if it is to have electric light and power at all, must buy of them, or those whom they shall authorize to furnish it, upon payment of due tribute. To our minds the whole thing looks very fishy. We would like to think otherwise. Let us have figures and FACTS.

Under the Searchlight.

Views and Opinions on Timely Topics.

A Signal Disappointment.

Shrewd Investors Did Not Heed "Electricity's" Warning.

(New York Sun, July 1.)

Next to Cordage, the most signal disappointment to confiding investors has been the General Electric. As recently as April, 1893, the $30,000,000 common stock of this company was paying dividends of two per cent. quarterly and sold at 108, having previous to that time brought 114. The $4,250,000 preferred stock was not to be had, except on rare occasions, it being closely held at over par as an undoubted seven per cent. security by people who could afford to disregard the fluctuations of the market. The company stopped paying dividends in August, 1893. The common stock is now quoted at about 36, and the preferred stock at about 70. When dividends will be resumed nobody ventures to predict. The peculiar feature of the collapse is that, like that of the West Shore Railway ten years or more ago, it caught many of the shrewdest and most experienced operators in the country, besides a vast number of smaller fry, who were allured into buying the stock by the favorable opinion of it expressed by J. Pierpont Morgan, D. O. Mills, T. Jefferson Coolidge, Frederick L. Ames and H. L. Higginson. These gentlemen showed their faith by their purchases, but those who suffered by following their example very unreasonably insist on holding them accountable for their losses. One, even, was driven insane by his misfortune in this respect, and the wailing of others over theirs is, even to this day, unabated.

* * *

No Uncertainty Whatever About Our Staying Qualities.

C. E. Lucky, President. J. C. Duncan, General Manager.
F. J. Milligan, Secretary.
PEOPLE'S TELEPHONE AND TELEGRAPH COMPANY,
KNOXVILLE, TENN., June 25, 1895.

To the Editor of ELECTRICITY.

DEAR SIR: Herewith I hand you a check for $2.50. Please send your paper to my address.

I take it on account of its present independent attitude, but how long this will be I assume it is uncertain.

The *Electrical World* is a paper I have taken during the entire time of its publication, but regret to say, as many others, that this and the *Engineer* are supporters, in my opinion, of the Bell Telephone Company.

It does not, however, injure us in any way in our telephone enterprise, as we have the business here and are going to hold it. Yours truly,

J. C. DUNCAN.

* * *

OUR data in regard to the transactions of the Northwest General Electric Company have been finally completed, and we shall present the first installment of the story in our issue of July 17. The series will be interesting and instructive, and we bespeak for it the careful consideration of all those who desire the purification of this trade.

* * *

THERE is no doubt that there is a strong desire on the part of the G. E. management to move from Schenectady. The officers of this company are very like prima donnas and actresses—they thrive on press notices and pine without them, and in no way apparent at present could so much talk be created as by centralizing all the works at—Depew, for instance. The Vanderbilt-Morgan party have invested a couple of millions in land there. If they gave the G. E. a bonus of a million or two, and moved a few other easily controlled establishments there, they could add 15,000 to the population of Depew almost in a night, and quadruple the value of their real estate. We guess Schenectady, Lynn and Cleveland will lose the G. E. Works.

THE TELEPHONE WORLD.

Independent Telephone Men Combine.

THE TELEPHONE PROTECTIVE ASSOCIATION FORMALLY ORGANIZED.

Enthusiasm and Harmony at Pittsburg.

At the sessions of the Telephone Protective Association of America held at Hotel Duquesne, Pittsburg, on the 25th ult., the work of formulating the constitution was completed and officers and directors elected for the ensuing year.

The constitution is a brief document, but it makes no ambiguous statements touching the purpose and objects of the Association. The objects are thus defined: "Mutual protection from unjust legal and other attacks by owners of alleged telephone and cognate patents tending to impair the lawful business of members of this association; to discourage litigation between members of this association by providing methods of arbitration."

All persons and corporations interested in the objects of the Association shall be eligible to membership upon payment of membership fee of $25 and approval of application by the Executive Committee.

The officers of the Association shall consist of a president, first, second, third, fourth and fifth vice-presidents, secretary and treasurer, who with twelve directors shall constitute the Board of Directors, all of whom shall be elected at the annual meeting of the Association.

The duty of the Executive Committee, which consists of the president and the first and second vice-presidents, shall be to manage all legal interests of the Association and provide for the defence of suits against its members and to fill all vacancies in the Board of Directors.

Section 9 defines the course of procedure in defence of suits as follows:

> "Whenever the Association shall receive information of the bringing of a suit for infringement of any telephone patents, it shall at once examine into the case as far as practicable and may call a meeting of the Board of Directors, who shall provide for the means to defray the expenses of such litigation as they shall deem proper under the circumstances.
>
> "The annual dues shall be $25, to be paid on the 1st of July each year. Members in arrears for three months shall not be entitled to any privileges of membership.
>
> "The president may call a meeting of the Board of Directors at any time, and upon the request of any two vice-presidents shall call a meeting to be held at Hotel Duquesne, Pittsburg, within ten days after such request is made. The annual meeting will be held at Niagara Falls September 1."

The following officers were elected:

President—J. E. Keelyn, Western Telephone Construction Company, Chicago.

First Vice-President—J. R. Johnson, Viaduct Manufacturing Company, Baltimore, Md.

Second Vice-President—S. J. Turnbridge, Utica Fire Alarm Telegraph Company, Utica, N. Y.

Third Vice-President—E. S. Wallace, Columbia Telephone Company, New York.

Fourth Vice-President—J. G. Ihmsen, Keystone Telephone Company, Pittsburg.

Fifth Vice-President—Lipman Levy, The Anthony Company, Cincinnati, O.

Secretary—Paul W. Bossart, Minneapolis, Minn.

Treasurer—P. C. Burns, American Electric Telephone Co., Kokomo, Ind.

Directors—Arthur F. Boardman, National Telephone Manufacturing Co., Boston, Mass.; E. A. Katlin, Mason Telephone Co., Richmond, Va.; P. L. Spooner, Standard Telephone and Electric Co., Madison Wis.; E. B. Seeley, E. B. Seeley & Co., Philadelphia, Pa.; Thos. McCubray, Tucker Electrical Construction Co., New York; —— Kuhn, Clamond Telephone Co., Philadelphia, Pa.; Jas. D. Randall, Florida Telephone and Construction Co., Memphis, Tenn.; Frederic Harrington, Union Electric Co., Cleveland, O.

Executive Committee—J. E. Keelyn, Chicago, Ill.; J. R. Johnson, Baltimore, Md.; S. J. Turnbridge, Utica, N. Y.

Four more members, making twelve in all, are to be added to the directors named above. These were selected at the Pittsburg meeting, but were not to be formally added to the list until it can be ascertained whether or not the parties selected desire to serve.

James K. Hammill, of Newark, Ohio, secretary of the Ohio Telephone Exchange Co., was present at the Pittsburg meeting with a proposition for a joint meeting of the Protective Association and the independent telephone exchange companies to be held at some central point some time in July. This idea was given birth at a meeting of the Ohio Telephone Exchange Co., held at Columbus, June 7th, when it was resolved to call a meeting of all the independent companies throughout the United States for the purpose of organizing a National Association. In the formal call issued by President James M. Thomas and Secretary James K. Hammill, the purpose of this association was defined as follows: "To combine the interests of all the independent telephone companies throughout the United States for the betterment of the telephone service, long distance telephone lines, and for the mutual protection of the users of telephones, etc."

Mr. Hammill stated at the Pittsburg meeting that the invitation also included the manufacturers of telephones and telephone appliances, and more, they were asked to make an exhibition of their apparatus at the proposed convention in a suitable hall to be provided for that purpose. In addition, it was requested that the manufacturers contribute $25 each to the National Association for the purpose of defraying the expenses of this meeting.

Mr. Hammill's proposition was duly considered and the conclusion was reached that all the purposes and objects sought by the proposed National Association of exchange companies could best be attained through membership in the Protective Telephone Association. Invitation was therefore extended to all such companies to become members.

NOTES.

The choice of Mr. P. C. Burns, of the American Electric Telephone Company, Kokomo, Ind., as treasurer was a wise one. Mr. Burns is one of the old-timers in telephony, and his election will inspire confidence that in the important matter of finances the Association's interests will be well guarded.

Judge Wallace, now of New York though formerly of Ohio, happened in Pittsburg just in time to be of great service to the other members in formulating a plan of action acceptable to everyone.

Mr. S. S. Stout, who spent thirteen years of his life in the Patent Office, is in a position to give valuable assistance on points of patent law and historical data bearing upon the business.

Mr. J. R. Johnston, of the Viaduct Company, who has undoubtedly given as much thought to the knotty problems connected with the work of the Association as anyone, is an enthusiastic believer in the full success of the plan.

It was a general subject of regret that the National Company of Boston was unable to send a representative, but at the next meeting Mr. Leatherbee can no doubt be counted on to take an active part.

A general popular misapprehension is that this Association and the opposition movement generally is made up of newcomers in the business. This is far from the truth, nearly every man engaged in the movement has been familiar with the business from the beginning. They are not handicapped by lack of knowledge. They know telephony thoroughly both in its technicalities and commercial applications. They know what patent claims are valid and those that are not. They do not propose to be organized trespassers or infringers of good patents. They know that superior telephone service can be given outside of the Bell and allied patents, and have already demonstrated that fact.

A conspicuous feature of the meeting was the absence of abuse or even criticism of the Bell people. The general sentiment was that the past was dead, and every man should turn his face squarely to the future in confidence and security that a wide and fertile field is open.

Mr. J. E. Keelyn is well equipped to supply the Association with good information as to the history of the art, and it is to be regretted that he was not able, for lack of time, at the Country Club dinner, to show, as he intended, prior use of the telephone by the Aztecs.

TELEPHONE PROGRESS IN OHIO.

The independent telephone exchange development in Ohio continues steadily. The Ohio Telephone Exchange Company, that State organization of the new telephone exchange companies, was formed but two months ago, and has already a membership of twenty-five companies located at the following towns and cities in that State: Columbus, Cambridgeboro, Circleville, Lancaster, St. Mary's, Zanesville, Findlay, Delaware, Van Wert, Lima, Wapakonita, Norwalk, Plain City, Fostoria, Tiffin, Upper Sandusky, Bellefontaine, Middletown, Marysville, Mount Vernon, Chillicothe, Newark, Defiance and Mansfield.

Of the above named places the following have exchanges now in actual operation: Findlay, Norwalk, Marysville, Mount Vernon, Chillicothe, Newark and Defiance. At Mansfield the plant is being constructed, and will shortly be ready for operation. The Newark exchange has 300 instruments connected and is giving highly satisfactory service.

President Eckert of the Western Union Telegraph Company denies the statement that his company had fallen out with the Bell Telephone Company and was about to compete with it for long distance telephone business. There was no thought by the Western Union management, he said, of going into an independent telephone business or of buying control of the Bell Company in New York, that is, the Metropolitan Telephone and Telegraph Company.

The board of public affairs at Little Rock, Ark., has reported an ordinance granting a franchise to the Little Rock Telephone Company.

Defense of Hart and McDonald.

United Electric Securities Co. Defeated at New Orleans.

The case of the United Electric Securities Co , asking for the appointment of a receiver for the Louisiana Light Co., came up at New Orleans on June 24.

The main points in the affidavits for plaintiff have already been printed in ELECTRICITY.

Excepting the affidavit of M. J. Hart, which is almost identical with that of Mr. R. T. McDonald, the following are the chief affidavits offered in reply:

Mr. McDonald's testimony was to the effect that the Louisiana Electric Light Company was organized in 1889, and succeeded the corporation known as the Louisiana Electric Light and Power Company. The organization was brought about by the Fort Wayne Electric Company. The Louisiana Electric Light and Power Company had become involved in debt beyond its means to pay its liabilities, amounting to between $325,000 and $400,000, a large part of which it owed to the Fort Wayne Company. There was a general understanding that the corporation should be reorganized with a capital stock of $500,000, and that $700,000 in bonds should be issued on the same. The debts of the old corporation were to be assumed and paid. The stockholders, at their option, were to be given stock in the new company, upon which dividends of 6 per cent. were to be guaranteed by the Fort Wayne Company. All property rights of the old company were to be transferred by the instrumentality of liquidators to the new company, and the Fort Wayne corporation was to take $425,000 of the stock to be issued and a sufficient number of bonds at 90 cents on the dollar to pay the debts of the said old company, and should afterwards, from time to time, take the remainder of the said bonds at the same price, as the money should be needed for the extension of the plant and the equipments, except those which should be taken by the stockholders of the old company in exchange for their stock, and convey to said new company the exclusive right to the use of electrical inventions covered by the patents owned by the Fort Wayne Company in New Orleans, which agreement was carried out by the incorporation of the Louisiana Electric Light Company and the issue and delivery of the stock and bonds according to the understanding aforesaid. It was pursuant to this arrangement that the $425,000 of the stock of the Louisiana Electric Light Company was issued to the Fort Wayne Company; $54,000 was issued to the stockholders of the Louisiana Electric Light and Power Company and the remainder, $21,000, still remains unissued. Of the bonds, approximately —— were taken under the arrangement by the stockholders of the said company and the remainder were taken under the same arrangement by the Fort Wayne Company. At this time half of the $425,000 of stock was turned over to the Thomson-Houston Company in the course of business dealings. The same stock subsequently passed into the hands of the United Electric Securities Company, of Portland, Me. *Affiant believes the Thomson-Houston Company owns nearly all the stock in the United Electric Securities Company.* The delivery from the said Fort Wayne Company was with the understanding that the stock was not to be transferred upon the books of the company, but should continue to stand in the name of the Fort Wayne Company.

The organization of the Louisiana Electric Light Company was promoted by the Fort Wayne Company for the purpose of securing the large debt due it by the Electric Light and Power Company, and continuing in the city of New Orleans a company which would be able to carry on the electric light and power business. These arrangements were all carried out in full; the debts of the company were paid, and the stockholders who presented their stock for exchange received therefor either stock or bonds as had been agreed. There has been no issue since except to the New Orleans Traction Company, and it was fully aware of the conditions under which the issue was made.

The United Securities Company knew that the stock issued to them was a part of the $425,000 and that it had been issued for patents and considerations aforesaid.

At that time the Thomson-Houston Company owned a controlling interest in the Fort Wayne Company and the transaction by which the Fort Wayne Company reorganized the old Louisiana Electric Light and Power Company was approved by the said Thomson-Houston Company. *If it was illegal, the stock complainant owns is a part of it, and is likewise illegal, and gives him no right as a stockholder in the Louisiana Electric Light Company.*

Concerning the tower company, Mr. McDonald's testimony shows that Mr. M. J. Hart secured a franchise from the city in 1887 to erect iron towers upon which the wires were to be strung. When the Louisiana Electric Light and Power Company was organized, it was understood that the towers and tower business was to be transferred to it. The work of constructing the towers was carried on by the Star Iron Tower Company, of Indiana, a corporation owned and controlled by the Fort Wayne Electric Company, and largely with money advanced by the Fort Wayne Company. The costs of the foundations, etc., were paid by M. J. Hart. All this was done with the understanding that the business was to be turned over to the Louisiana Electric Light Company as soon as it was in condition to pay the money advanced. The understanding was consummated in 1894, when the Louisiana Electric Light Company agreed to take an assignment of $480,000 par value of the stock of the New Orleans Tower Company, the whole authorized capital of the tower company being $500,000, and to pay the claim of the Star Iron Tower Company for twenty towers, amounting to $103,900, to pay affiant $25,000 and M. J. Hart $26,100 for money advanced in foundations and other expenses. On account of the agitation then going on to remove the electric wires from the street it seemed feasible and practicable to put them on towers, as conduits for underground wires were difficult to put in on account of the water in the soil under the city.

With reference to the $50,000 voted to the Fort Wayne Company by the directory of the Louisiana Electric Light and Power Company, Mr. McDonald testifies that the Edison Electric Company, of New York, was a creditor and had brought suit against the Louisiana Electric Light Company for patents, all of which promised to be disastrous. The Edison Electric Illuminating Company, of New Orleans, had the exclusive right to the use of the incandescent lights, and to prevent disastrous litigation the Edison Company, of New Orleans, was purchased by the Fort Wayne Company, the sum of $363,000 being expended in cash; $65,000 of outstanding debenture bonds were assumed, and a floating debt of $20,000 also assumed in the purchase. As the Edison Company could have closed up the Louisiana Light Company and stopped its incandescent business, the Fort Wayne Company was actuated to make the purchase aforesaid. The sum of $50,000 paid to the Fort Wayne Company was a small amount, as $150,000 was demanded by the stockholders of the Fort Wayne Company, they feeling that even this sum was no more than should be paid on account of the benefits accruing to the Louisiana Company from the purchase of the Edison Company.

In purchasing the Edison Company's stock it was the intention that the Louisiana Light Company should acquire the same. It agreed to take the $200,000 of the stock of the Edison Company. The United Electric Securities Company afterwards purchased $200,000 of the bonds of the Edison Company. Fifty thousand dollars of said bonds were afterwards sold by the Fort Wayne Company to the Thomson-Houston Company, and by them to the United Electric Securities Company.

Affiant says that there has never been a time when the Louisiana Company has not been indebted to the Fort Wayne Company. Its plant has been maintained and value imparted to its securities by the Fort Wayne Company. Affiant has considered the interests of the two companies identical; that the only way the Louisiana Company could prosper and keep up its plant was to increase its business, and the only way the Fort Wayne Company could protect its large interests at stake in the Louisiana Company was to render it such support as would enable it to protect its credit and meet the conditions of successful business. During the panic of 1893 the affiant carried the Louisiana Company along by his individual exertions, pledging his personal credit to the sum of $400,000.

With the exception of the contract with the traction company, the Louisiana Light Company has met the expectations of the directors.

Concerning the charges in the bill of complaint that the affairs of the company have been conducted unlawfully, and that there has been a maladministration of the same, the affiant declares that he has managed its concerns to the best of his ability, and that he has given time and labor to promote its interests without receiving a cent of compensation, all his traveling expenses, etc., being paid by the Fort Wayne Company.

Oscar T. Crosby, an electrical expert and former manager of the Edison Company, testified as to the machinery of the Louisiana Company. He avers that the towers were durable and strong, and capable of being used to great advantage for stringing wires, and also gave evidence of the profits of the electrical business with the percentages charged for the use of patents by different concerns and other technical matters relative to the conduct of a plant like the one operated by the Louisiana Electric Light Company.

The affidavit of C. A. Coffin, of the General Electric Company, was read, wherein it was set forth that the issue of $425,000 of stock to the Fort Wayne Company was not paid in cash, but in patent rights and for other considerations. They have a real, but not a fixed value. The $50,000 paid by the Louisiana Company to the Fort Wayne corporation for purchasing the Edison stock and saving the Louisiana Company from law suits on the use of incandescent lights was a small immunity, in consideration of the value of the purchase to the business of the Louisiana Company. The iron towers, he declares, would be of great value to the light company in case they should have to remove their wires from the streets, as from the character of the soil in New Orleans he knows that the establishment of conduits would be impracticable.

THE PETITION DENIED.

On June 28 the petition of the United Electric Securities Company and the New Orleans Traction Company for the appointment of a receiver for the Louisiana Electric Light Company was denied by Judge Pardee.

He ordered, however, that the affairs be conducted in statu quo by the present officers, under the supervision and control of the Court, until the annual election for directors in February, 1896.

R. T. McDonald vs. Receiver Grant.

Mr. R. T. McDonald has won in the action he brought against Hugh J. Grant, receiver of the St. Nicholas Bank, to recover certain bonds of the Louisiana Electric Light Company given originally as collateral for a loan from the Madison Square Bank.

In 1893 the Madison Square Bank gave its note to the St. Nicholas Bank, and as collateral one of McDonald's notes for $50,000, and certain bonds of the Louisiana Electric Light Company. When the St. Nicholas Bank failed, McDonald tendered the amount of his note with interest, and asked for the surrender of the bonds. Receiver Grant declined.

The Madison Square Bank, which had also failed, put in a claim to the bonds held by the St. Nicholas Bank, claiming its right to hold them until the entire indebtedness of the three notes was disposed of.

Justice Stover disposes of Receiver Grant's contention with the brief comment that the unsoundness of his argument that he can hold the bonds as collateral for other indebtedness needs no discussion.

The Accumulator Company Wound Up.

The affairs of the Electrical Accumulator Company have been wound up by a master's sale authorized by the Court. The principal assets of the company were 321,117 shares of the Electric Dynamic Company's stock and 18,000 shares of stock of the Electric Storage Battery Company. The Electric Dynamic stock, with a claim of $270,000 against the company, brought $125. Nine hundred shares of Electric Storage Battery stock brought $27.50 a share and the remainder $24 a share.

Personal.

Mr. Henry Sachs (Kaliske) has resigned his position as general manager of the Beacon Vacuum Pump and Electrical Company of Boston. For the present Mr. Sachs's address is 21 Harcourt street. All those who have had the pleasure of doing business with this gentleman since his entry into the electrical field will hope to see him again engaged in active business in this trade.

Max A. Berg, secretary of the Wallace Electric Company, has resigned his position as an officer of that company to take effect July 1. Mr. Berg will take a brief rest, and no doubt will become associated with the electrical industries again in the near future.

A. I. E. E.

TWELFTH GENERAL MEETING.

A Large Attendance at Niagara Falls—The Great Power Plant and Fine Weather Unite to Make This a Memorable Meeting—A Relic of the Past.

[STAFF REPORT OF ELECTRICITY.]

Too often has the pessimistic mind had seeming justification in claiming that the elements, the times and all of those other uncertain factors which go to make up the algebra of human affairs have conspired against the fulfilment of the "best laid schemes o' mice and men," but once in a while the conspiracy seems to be turned against the pessimist and "all nature smiles," and with it the optimist. Such was the case at the Niagara meeting of the Institute, which was held during June 25, 26, 27 and 28.

The one event which by reason of its supreme interest threw all others in the shade was the opening for the first time to public gaze of the great Niagara power plant—the fruition of the best thought and labor, of the best engineering talent of two continents, for going on six years of time. The Institute was fortunate indeed in the opportunity which was afforded to witness the first public exhibition of the turning of the great turbine, shaft and dynamo, which bids fair to mark an epoch in commercial electrical development of equal importance to that of the Frankfort-Lauffen transmission from an experimental aspect.

It was a substantial compliment to the Institute also that the Niagara Power Company should extend this invitation to the first dress rehearsal to that body of men who more than any others are interested in the grand achievement in preparation for which they had been so long engaged. This was indeed the principal loadstone which attracted the crowd to the Falls. The Falls themselves, always attractive and entrancing, were of secondary interest to the professional men on this occasion, for they came not to see this mighty power mocking at man's impotency, but to see the most conspicuous example in all history of the triumph of mind over matter.

To those less scientifically inclined the Falls themselves, the Gorge and the mighty Whirlpool and rapids were a sufficient incentive to take the trip, and when added to these kind Providence also vouchsafed weather that was faultless and superb, the conditions for a successful meeting were all but complete.

Reduced rates on all railroads centering at Buffalo or Niagara and a reduction in the usual hotel schedules had been arranged for, and the combination of the unusual attractions at the Falls and a reduction in the expense usually attending the trip brought out by far the largest attendance that has ever been attained at an Institute meeting. The attendance last year at the Philadelphia meeting reached the at that time high-water mark of 125. At Niagara there were 202 registered on the books of the secretary. In addition to these there were many others who did not register—doubtless enough to bring the attendance up to 250.

The headquarters of the Institute were at the Cataract House—a hostelry well known to old visitors at the Falls—and it was in the large parlor of this hotel that the sessions were held. The arrangements were in general excellent, but there was one miscarriage that marred the aspect of an otherwise perfectly appointed affair. It had been announced in all the electrical papers, on the authority of the special committee of arrangements, that the rates at this hotel had been reduced for the occasion to $3 per day. When the bills came to be paid the charge was $3.50 per day. It seems that a loophole was left in the contract with the hotel of which the proprietors availed themselves to the fullest extent. The agreement was that the rates should be $3.50 per day for three days or $3 for four days—the committee assuming that the time referred to length of the meeting and that those attending for a less period would have the benefit of the reduction. The majority of those attending arrived in time for breakfast on Tuesday and left before dinner on Friday, making three and a half days. The hotel proprietors claimed that the $3 per day rate only included those who stayed four days, and therefore charged those who stayed three and one-half days the $3.50 rate. Figuring this up, bills were presented for $12.25, so that those who did not scrutinize their bills closely paid 25 cents more for three and one-half days than they would have been required to pay had they taken another meal and remained another night.

This practice on the part of the proprietors of the Cataract House reminds one of the days we supposed were past and gone, viz., when everyone who went to Niagara expected to be cheated and came away without being disappointed. It seems that the committee of arrangements relied too much on the honor of those with whom they had to deal. In the future the contract should be made so explicit as to be incapable of evasion. This incident, regrettable as it was, may serve a useful purpose, however, in leading others either to avoid business transactions with those who need watching or else to leave no loophole by which they may ultimately be the losers.

Opening Session.

The opening session was called to order a little after 10 o'clock on Tuesday morning by Dr. Louis Duncan of Baltimore, the newly elected president of the Institute, who after a few preliminary remarks introduced the Mayor of Niagara Falls. The latter in a brief address welcomed the members and guests of the Institute to the "Electric City," as Niagara Falls now calls herself.

The first paper on the programme was one by Walter E. Harrington, of Camden, N. J., on "Properties of Fuse Metals When Subjected to Short Circuits."

This paper elicited considerable discussion, the general purport of which was to show that the treatment of the subject had little practical value because of the omission in the consideration of many factors which might have a controlling influence in practical use. The final conclusion at which the author arrived, "that fuse metals are under no circumstances to be considered in the light or nature of a protection," was vigorously attacked, and it was quite apparent that the author did not have the sympathy of his audience.

Mr. Harrington had gathered together the results of numerous tests on fuse wires of different materials and capacities, and from these constructed an equation which he believed was expressive of a law. One of his critics pointed out that this supposed new law was simply Ohm's law, and that since it did not involve the element of time (an essential in the discussion of all problems involving the generation and dissipation of heat in conductors) it was of no assistance or value.

Mr. Steinmetz followed with a paper on the "Theory of the General Alternating Current Transformer." This was a general statement of the alternating transformer in which was included the static transformer, viz., that form in which the primary and secondary are stationary with regard to each other, and the alternating current motor and dynamo in which the two are movable with regard to each other. Considering these different machines as but variations of a type, he showed how their functions depended upon the ratio $\frac{\text{secondary}}{\text{primary}}$ frequency, or slip.

Representing this by k and the primary frequency of E. M. F. by N, then the secondary frequency would be k N. viz., the E. M. F. induced per secondary turn by the mutual flux would have to the E. M. F. induced per primary turn the ratio k.

Where $k = 0$ it meant a synchronous motion of the secondary.

Where $k < 0$ there was motion above synchronism, viz., the secondary driven by mechanical power.

$k = 1$ represented standstill.

$k > 1$ represented backward motion of the secondary, viz., motion against the mechanical force acting between primary and secondary (thus representing driving by external mechanical power).

A general equation for alternating transformers was ennunciated, and it was shown how by simply assigning different relative values to the various terms involved it became the equation for the alternating current stationary transformer, the alternating current motor or the alternating current generator.

The last paper of the morning session was read by Clarence E. Gifford, of Jamestown, N. Y., on a method of "Location of Grounds in Armatures, Fields, etc."

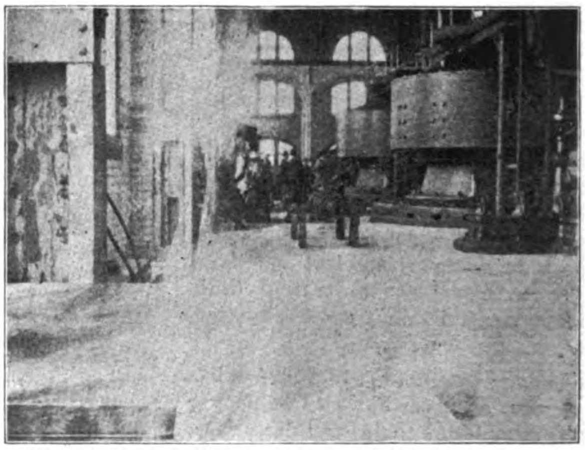
This described a very simple method of detecting grounds, preferably by means of the telephone, or where the noise will not permit of this by means of a dead-beat reflecting galvanometer, a milli-voltmeter or some other form of delicate and rapid working visual indicator, the principle involved being in reality that of the Wheatstone bridge—the two paths around the windings of the armature, if that be the part tested, constituting the bridge. The method is applicable to the detection of a single ground or of more than one either in armature or field. The details of this simple method do not permit of abstracting, and the paper will, therefore, be given in full in a later issue.

Tuesday Afternoon.

Tuesday afternoon had been set aside for the great event of the meeting, viz., a visit to and inspection of the great Niagara power plant and the other developments accessory to the same. Arrangements had been made for carriages at reduced rates, and at about half past 2 o'clock the members and invited guests started on the drive. These works are located about a mile and a half up the river from the crest of the Falls, upon an artificial canal or sluiceway. This latter taps the river above the Rapids and brings the water to the wheelpits over which the power house is erected. It is 1,700 feet in length, 250 feet wide at its junction with the river and has an average depth of 12 feet.

In the old hydraulic plant, which has been in existence since 1861, the water of the river above the Rapids is carried in an open canal 4,400 feet long to a basin near the edge of the cliffs below the Falls, and from this basin the water was drawn for the various mills situated along these cliffs, the necessary fall being obtained most cheaply by carrying the water in pipes down to the wheels located part way down the cliffs, and the waste water was discharged directly into the river from below these wheels. In the present instance, however, it was necessary, should the power house be located at its present position, to create an available fall at this point and to provide a tail-race by which the water, after it had passed the wheels, could be discharged into the river below the Falls. For this purpose a tunnel was started near mean low water mark in the face of the cliff just below the new suspension bridge.

THE NIAGARA POWER HOUSE.


SNAP SHOT OF DYNAMO IN MOTION.

This tunnel extends in a direct line to the wheelpits under the power house, a distance of 7 000 feet. The section of the tunnel is very much that of a horseshoe, having a maximum height of 21 feet and a maximum width of 18 feet 10 inches. The area of a cross section is 386 square feet, and with a fall of 6 feet in 1,000 feet will give the water a maximum velocity of 26½ feet per second, or a little less than 20 miles an hour. The tunnel is lined throughout with brick, that used in the invert or floor being vitrified in order to better withstand the scouring action of the swift current.

To give an idea of the magnitude of this undertaking, it may be stated that over 1,000 men were engaged for more than three years in the construction of this tunnel, which called for the removal of more than 600,000 tons of rock and the use of more than 16,000,000 bricks for lining; 19,000,000 feet of timber, 60,000 cubic yards of stone, 55,000 barrels Portland and 12,000 barrels natural cement, and 26,000 cubic yards sand were used in construction. While these figures are small compared with those that pertain to dozens of our longer railroad tunnels, this is by far the largest undertaking ever attempted for purely power purposes.

At the point directly beneath the power house the vertical distance between the level of the canal and the tunnel level is 178 feet. A vertical shaft or slot of this depth was dug here, and the turbines which drive the great dynamos are located near the bottom. The water is carried from the canal to the wheels in steel pipes 7½ feet in diameter. The wheels, which are turbines, are vertical, 5 feet in diameter, made of bronze, and each capable of delivering to the shaft 5,000 H. P. They were designed by Faesch & Piccard, of Geneva, but built by the I. P. Morris Co. (Cramps) of Philadelphia. They are of the Fourneyron type, each unit consisting of two wheels, the upper one being inverted and the water discharging from the penstock between the two. By this arrangement the downward pressure on the lower wheel is counterbalanced by the upward pressure on the upper wheel. The weight on the steps or bearing of the water column, 136 feet high, is therefore obliterated.

These wheels will each discharge 430 cubic feet of water per second, and with a pressure of 136 feet of fall and making 250 revolutions per minute will, with an efficiency of 75 per cent., give 5,000 H. P.

The guide of each wheel has 36 buckets and the wheel itself 32.

When it is understood that previous to the designing of these wheels the largest turbine ever constructed had less than about 1-6th the capacity of these, it will be realized how bold an undertaking it was on the part of the designers to guarantee the performance under very unusual conditions of such an enormously greater structure.

Further than this, it was necessary that the shaft be carried to the surface, where it was originally intended that it should carry an enormous fly-wheel for the facility of better governing of speed. Both the weight of the shaft and the fly-wheel had to be provided for. In order that the shaft might be sufficiently rigid to withstand the torque required to deliver 5,000 H. P. at a speed of 250 revolutions and at the same time be as light as possible, it has been made in the form of a tube of sheet steel, 3-8th inch in thickness and 38 inches in diameter, except at points where it passes the journal bearings or guides, where it is 11 inches in diameter and solid.

Still the weight is enormous, and if not provided for, the friction due to this weight of the shaft on its lower step or bearing would be sufficient, if not to actually melt it down, to cause a great deal of trouble. The upward pressure of the water against the turbines, therefore, was made to bear this weight, so that the shaft and the weight which it bears on top are practically supported by the column of water which also transmits to it its power.

One of the most difficult of all feats of accomplishment with water wheels is proper governing of speed where the load varies rapidly between wide limits, as it is particularly apt to do in electrical transmissions for certain purposes. The specifications for these wheels required that a governor should be provided that in connection with the fly-wheel would keep the speed constant within two per cent. under ordinary conditions of operation, and not to allow it to vary more than four per cent. should the work done be suddenly increased or diminished by 25 per cent. The governing mechanism was also designed by Faesch & Piccard, and how well it answers the requirements is shown by a test made a few days before the meeting, when at 250 revolutions and an output of 5,300 H. P., 3,000 H. P. was suddenly thrown off entirely. The result was an increase of only 18 revolutions, or only about 7 per cent., with a change of load amounting to over 56 per cent.

These wheels were installed under the personal supervision of Mr. R. Baumann, the official representative of the designers, Faesch & Piccard, of Geneva, Mr. Clemens Herschel, formerly of Holyoke, being the general hydraulic engineer.

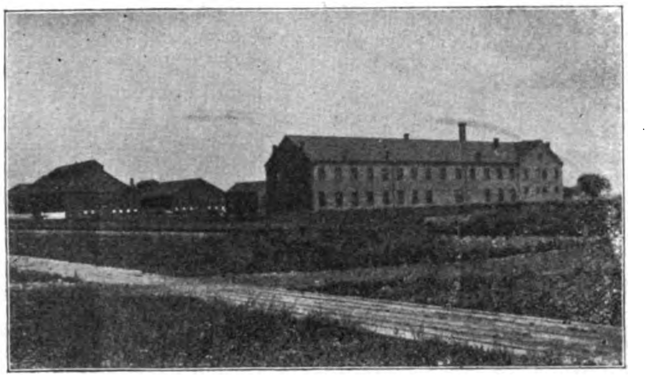
It has been stated that it was originally intended to place a fly-wheel upon the upper end of the shaft. Prof. Forbes, however, designed a type of generator in which the revolving part, which in this case is the fields, constitutes the fly-wheel.

All of the electrical and controlling mechanisms are in the power house, above ground. This handsome building, a view of which, taken by our artist on the day it was opened to the members of the Institute, is presented, was built, after designs by Messrs. McKim, Mead & White, by the contracting firm of James Stewart & Co., of St. Louis and Buffalo. It is a very ornate building of massive limestone without, and for a height of six feet from the floor lined inside with enameled brick. Above this, the interior is lined with ordinary brick coated with white enamel paint. Within this building, lighted by windows on three sides, the engineers were ushered to witness the first public test of this stupendous feat of combined mechanical, electrical and hydraulic engineering, a feat which in magnitude was beyond all precedent, and which for this reason put the very science of engineering to the test. Probably no more appreciative or critical audience of equal size could have been gathered in any part of the world. There were those present who would have detected the slightest flaw in the mechanical construction; there were others to whom any miscalculation in regard to the hydraulic part would at once have been apparent, and still others who would have criticised the electrical features had they been in anyway out of tune; but the moving structure itself would have been its own severest critic, for had any detail been out of harmony with the whole, whether it were mechanical, electrical or hydraulic, there would have been discord.

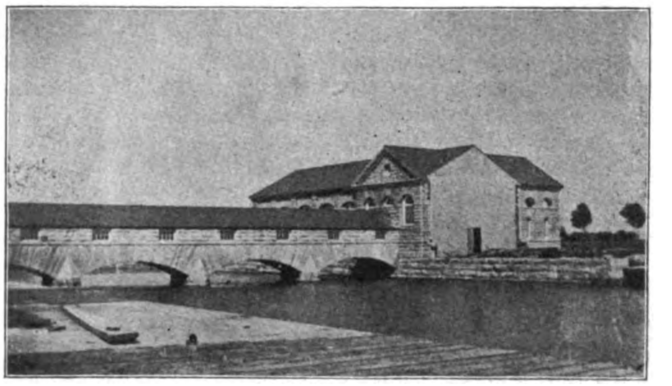
With the full knowledge of the difficulties of the task which the engineers had been severally and collectively called upon to solve, knowing full well the enormous size of the units involved, the mind instinctively prepared itself for some ocular and audible manifestation commensurate therewith. The noise of a boiler shop would not be out of proportion to the magnitude of the power that we knew was being generated. The puffing of a dozen locomotives would have indicated to the lay mind more nearly the exertion that a single unit was capable of putting forth; but it is not the labored poem or the halting delivery that result from finished art. Outward manifestations of power are manifestations of weakness, manifestations of ill-directed effort —of wasted energy. We saw there none of this. Though we saw there a mass of metal weighing 80,000 lbs. revolving at a rate of 250 revolutions, at a peripheral speed of 9,300 feet per minute, producing a fly-wheel effect of 1,274,000,000, the only sound heard was the siren of the turbines 140 feet below. Not a tremor was felt, and it was difficult to realize that that smoothly spinning top whose hum only was heard was at that very time operating a water rheostat load of 1,500 K. W., or a load equal to the rated capacity of the great Intramural railway generator at the World's Fair—the largest generator constructed in this country up to that time.

Our artist took a snap shot of the generator in motion, which is herewith reproduced. It is probable that this is the first picture ever presented of this most interesting event.

As shown in the engraving, there are two of the generators already erected. The one in the foreground has not yet been put up to speed, and was not shown in operation during the meeting of the Institute. The machine in the distance, somewhat dim in outline, is the one that was shown in action, and at the time the shutter was sprung was revolving at its full, all but noiseless speed, and carrying a load equivalent to 50,000 sixteen candle power lamps, for at the time of exposure a load of 5,800 electrical H. P. was put upon the machine.



PITTSBURG REDUCTION COMPANY'S WORKS.



BRIDGE AND TRANSFORMER HOUSE.

In the center of the power house is a large raised platform 57 feet 10 inches long, 18 feet wide and a little less than 8 feet high. Upon this were placed the controlling instruments. At the time of the visit of the engineers the instruments in use were merely temporary expedients, but one of the switchboards was in place though not connected up. We are so apt to associate large and complicated switchboards with large power installations that the mind involuntarily pictures to itself something enormous in this line in connection with the Niagara power plant. It was doomed to the same disappointment in this respect as it was in the outward manifestation of power in the dynamo, for the switchboard is simplicity itself. There are but four levers visible, viz., two main switches, one field-circuit breaker and one field switch. There is also a rheostat wheel by which the rheostats in the field circuits are controlled.

These switches are controlled by levers which actuate the switches proper below the platform by means of pneumatic devices working at a pressure of 125 lbs. per square inch.

The measuring instruments proper are an indicating wattmeter, an ammeter and a voltmeter for each of the two circuits coming from the generator. This is the switchboard by which 5,000 H. P. are controlled and measured, and an additional one for each additional generator put into position will constitute the equipment of the entire plant.

In order first that there need be little loss of energy in the switchboard appliances, and second that there need be no danger from shock, the currents actually handled form but a small proportion of those coming from the generator. Thus the voltage, which at the terminals of the generator is intended to be 2,000, is reduced by transformers to $\frac{1}{20}$ of this before it goes to the switchboard, and the current is in like manner reduced to $\frac{1}{20}$ of its value on the line. The amount of energy actually handled on the platform is therefore but $\frac{1}{400}$ of that generated, and the pressure will normally scarcely exceed 100 volts. It is estimated that at full load the energy lost in this way will not exceed as a maximum 50 watts or $\frac{1}{15}$ of a horse power in an output of 5,000 or over.

The size of each switchboard is 30 inches in width by 45 inches in height. The instruments above referred to, including the indicating wattmeter and voltmeter and the integrating wattmeters used in connection with the feeder circuits (these latter not located on the switchboard platform), are all new and designed especially for this installation by Mr. Oliver B. Shallenberger, consulting electrician of the Westinghouse Company. They are guaranteed to be accurate within 1 per cent.

In the southeast corner of the power house is located the water-rheostat, by which the load on the generator was varied for testing and exhibition purposes. At the far end of the switching platform, but on the floor, is located one of the two rotary transformers by which the alternating currents generated by the dynamo, after having been reduced in potential by static transformers, are to be rectified for the excitation of the fields. At present this is not in use, a direct current from a 75 K. W. direct-current generator, located about 200 yards from the power house, being used for this purpose temporarily.

At the near end of the building is a small electric elevator by which a few of the visitors—three at a time—descended into the depths of the wheelpits. To most of those who undertook the trip it was a most novel experience, but to those who in the past have been familiar with mines it simply recalled old experiences. It was an interesting experience however, though wet, for it gave a better idea of the hydraulic system than could otherwise be obtained. Your correspondent made the descent on two different days, and on one occasion attempted to obtain a photograph, but the dim light of the electric lamps, though sufficient to disclose to the eye the magnitude of the abyss, was insufficient to make an impression upon the sensitive plate.

From one corner of the power house, carried on stone arches across the canal, is a long, narrow gallery connecting it with the transformer house on the further side. An exterior view, given herewith, shows this bridge and the transformer house beautifully. Another view shows the interior of the gallery with the supports upon which will rest the various cables coming from the power house to the transformers. Still another view shows the interior of the transformer house. This latter is entirely empty at present, but it is here that the static transformers will be located by which the current for distant transmission will be raised to the proper voltage. All of these views were taken especially for ELECTRICITY on the occasion of the visit of the members of the Institute to the power house.

After the tour of inspection, of which the above is but a too brief and inadequate account, the visitors re-entered their carriages and by special invitation visited the new works of the Pittsburg Reduction Company, the Carborundum Company and the newly erected Niagara Paper Mill. These three buildings are located about 2,000 feet away from the power house and are the first customers of the Niagara Power Company. The paper mill is already in full operation, has constructed a wheelpit of its own, and draws its water independently from the Niagara River. It delivers its waste water, however, into the Niagara Power Company's tunnel by means of a branch tail-race 7 feet in diameter. It becomes a customer by purchasing the right to use the tunnel as a tail-race for its wheels, and is the first to get into practical operation.

Not far distant from this are the buildings of the Pittsburg Reduction Company and the Carborundum Company, which have contracted for electrical power. The two buildings are shown as they appeared on the day of the Institute's visit—the farther building being that of the Pittsburg Reduction Company. This latter company, which will be the first to start, has contracted for 2,000 H. P. The static transformers for the reduction of the voltage and the rotary transformers for rectifying it for electrolytic purposes are all installed, and everything appears in readiness to start the moment the Niagara Power Company turns the current on. The visitors were admitted into the converter room, but the remainder of the building was closed. In the converter room there are 8 static transformers of 200 K. W. each, which receive the primary currents of 2,000 volts by means of cables connecting them with the power station and carried in underground conduits, and transform them down to equivalent currents at 115 volts. These transformed currents are then led to 4 large rotary transformers which convert them into direct currents and raise their voltage again to 160 volts—the pressure required for the production of aluminum by the Hall process. There are also two large Sturtevant blowers operated by direct current motors—the whole equipment being made by the General Electric Company.

The Carborundum Company's building, shown on the right in the engraving, was not open for inspection, and it is stated that the machinery is not yet in place. This company has made a contract with the Power Company for 1,000 H. P., which it is intended to increase from time to time as the growing business demands.

All three of these establishments are built upon land leased from the Power Company or one of its co-ordinate organizations. In order to afford facilities for the great industrial city which this company hopes to build up around its power house, it has acquired. under one name or another, some 1,500 acres of land chiefly along the river front, which it proposes to lease as mill sites to future customers. As a further facility, it has constructed a railroad, called the Niagara Junction Railway Company, by which the establishments leasing mill sites will be placed in ready rail communication with all the trunk lines coming into Niagara Falls. Nor have the operatives been forgotten. On a part of this property comprising 84 acres the company has erected a model industrial village yclept *Echota*, which has been beautifully laid out into streets, supplied with electric cars and electric lights and water to each house. Houses for about 50 families have already been erected, and many of these are already occupied. The rents of these vary according to size from $9 to $30 per month, including electric light and water. In addition to these, there is a hotel and some stores, and the city of Niagara Falls has erected a handsome and commodious two story and a half brick school house. This village was inspected by those of the members who chose, and then carriages were taken for the Cataract House, where dinner was eaten preparatory to the evening session.

The accompanying map shows, by means of shaded areas, the tracts of land acquired by the Niagara Power and allied companies, and also their relative locations with regard to the city. The old hydraulic canal, which has so long done service, is also shown, together with the property owned by the Niagara Hydraulic Company along the cliffs of the lower river.

TUESDAY EVENING SESSION.

The feature of the evening session was the inaugural address by the newly elected president of the Institute, Dr. Louis Duncan, of Johns Hopkins University, Baltimore. He took as his theme "The Substitution of Electricity for Steam in Railway Practice." He was greeted by a large and appreciative audience of both ladies and gentlemen. An abstract of his address will be found elsewhere in this paper.

The session closed with the reading of a paper by Elihu Thomson on "Compounding Dynamos by Armature Reaction," which will also be printed in full and therefore requires no comment here.

WEDNESDAY MORNING SESSION.

"Electric Power in Factories," by Dr. Francis B. Crocker and Messrs. Benedikt and Ormsbee, of New York, was the very appropriate title of the paper which opened the second day's proceedings. This was followed by one by Mr. Steinmetz, on "Some Features of Alternating Current Systems," which was a non-mathematical discussion of the relations between the various polyphase systems and the so-called monocyclic, the apparent aim of the paper being to show that the so called monocyclic system is not a polyphase system.

The last paper of this session was one by Profs. Dugald C. Jackson and S. B. Fortenbaugh of Madison, Wis., on "Some Observations on a Direct Connected 300 K. W. Monocycle Alternator."

This elicited some criticism, chiefly as regards the sufficiency of the data presented.

WEDNESDAY AFTERNOON.

For the afternoon arrangements had been made for an excursion down the river to Queenston and up to Chippewa, on the Niagara Falls Park and River Electric Railway. Two trains of two cars each were placed at the disposal of the visitors, and a most enjoyable trip was taken to the most important places of interest, including the Cantilever and Railway suspension bridges, the Whirlpool Rapids and the Whirlpool itself, Brock's Monument and the historic ground of Queenston, Ont., below the Falls, and the Horseshoe Falls, Dufferin Islands and Chippewa, above.

The double tracked railway runs all the way along the edge of the cliffs below the Falls and afforded an admirable birdseye view of the lower river. It was a trip which all enjoyed and one well worthy of the time required to make it.

WEDNESDAY EVENING SESSION.

The first paper of the evening was one by Dr. C. E. Emery, of New York, on "The Cost of Steam Power—II." It will be remembered that in 18 8 this gentleman gave the Institute a most elaborate paper on the same subject which has since been quoted by nearly every writer who required statistics on the cost of steam power. In the earlier paper the author considered the cost of power generated under various conditions in 500 H. P. units.

With the approaching completion of the Niagara power plant, with its enormous units of 5,000 H. P., there has been a popular demand for an estimate of the cost of steam power on a similar scale by which comparisons between the costs of water and steam power on this scale might be made. It was to meet this demand that Dr. Emery prepared this paper, showing the cost of steam power on a basis of generating 20,000 H. P. He considered the cost under various conditions with the following results:

20,000 H. P. operated continuously every hour in the year, based on a consumption of 1.25 lbs. coal per indicated H. P. hour; cost of coal $2.24 per ton; engine efficiency assumed at 92.3 per cent.	$27.84
Allowing 5 per cent. of original cost for dividends and $1 00 per H. P. added for general business expenses	31.94
On the above basis, but allowing 10 per cent. for dividends	35.54

The next estimate was on the cost if the operation was variable, viz.:

a 20,000 H. P. 10 hours per day,
b 12,000 H. P. 10 hours per day,
c 5,000 H. P. 4 hours per day,

or a total of 63.8 per cent. of the maximum. Under these conditions he finds the cost to be $33.14, $37.74 and $41.84.

The third estimate was on the cost of power generated for only 10 hours a day. This he finds to be $15.17, $19.52 and $23.12.

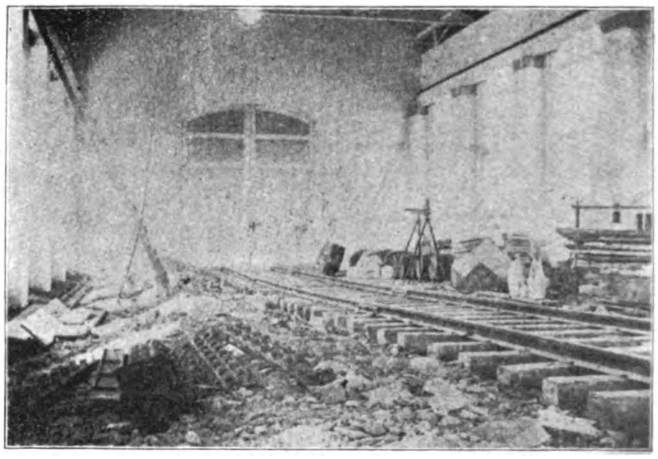
The author then went on to show how large a factor in the cost of power the fixed charges were, both in steam generated and in water power. In the estimate on the 10 hour basis the interest, taxes and cost of renewal amount to 48 per cent. of the total cost, which is given as $15.17 per year. The cost of steam power per H. P. per year from large units for 10 hours a day, without considering the above items, would therefore be only $7 89, "which," he said, "is the cost to be compared with the price of power from an external source when the items above referred to are excluded in each case as they are in the popular discussion of the subjects."

This paper gave rise to a most spirited discussion, much of it, however, by parties who misapprehended the facts or were unfamiliar with the author's earlier paper. It was a most significant fact, however, that during all of the discussion the practicability of transmitting the current to Buffalo to compete there with steam power was not once broached—the entire discussion being confined to the question as to whether or not the Niagara Power Company could compete in Niagara with locally generated steam power.

THURSDAY MORNING SESSION.

Mr. George Herbert Winslow read a most interesting paper on the Pomona (California) plant, entitled "Long Distance Power Transmission at 10,000 Volts." This paper described in detail a transmission from San Antonio Creek to Pomona, Cal., a distance of 13¾ miles, and another to San Bernardino, a distance of 28¾ miles. The motive power is the Pelton wheel. Step-up and step-down oil transformers are used with a 10,000 volt transmission current on a No. 7 B. & S. gauge wire. The San Bernardino line, which is the longest transmission now in opera-

INTERIOR OF BRIDGE GALLERY.



INTERIOR OF TRANSFORMER HOUSE.

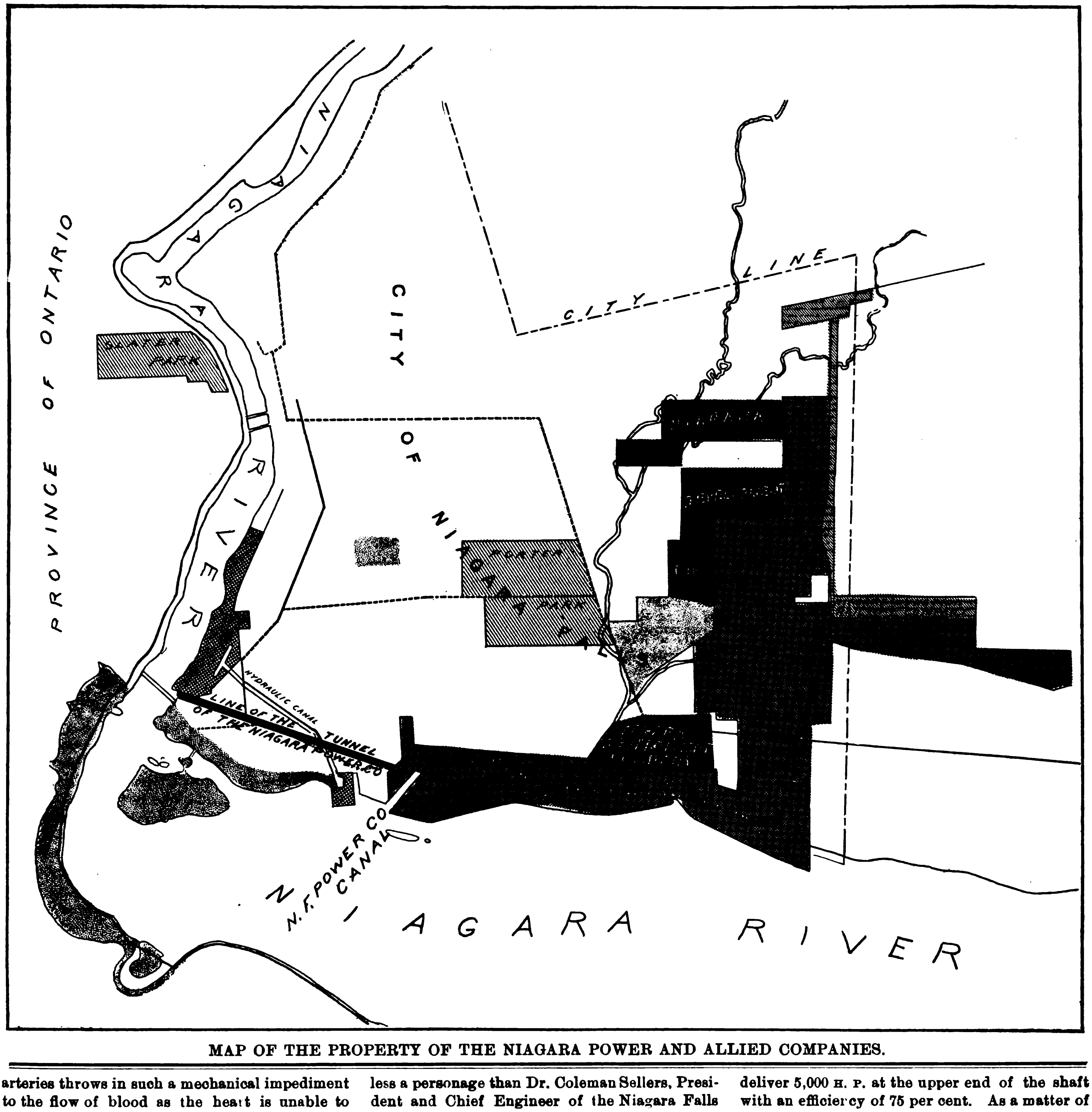
tion, is used for lighting purposes solely and competes with locally generated steam power produced from coal worth about $8 per ton.

Dr. Albert M. Bleile of Columbus, O., then read a paper "On the Cause of Death in Electric Shock," in which he held that death was not caused by the disintegrating effect of the current upon the brain and nerve tissues, as held by some writers, but that it was entirely due to the fact that the current produces a contraction of the arteries through an influence on the nervous system, and that the constriction of the arteries throws in such a mechanical impediment to the flow of blood as the heart is unable to overcome, and that where drugs are given to counteract this effect much larger doses of electricity than the ordinary can be borne.

These conclusions were reached from a number of experiments on dogs, the details of which are all given in the paper.

THURSDAY AFTERNOON.

The afternoon had been set apart for individual trips to the various points of interest about the Falls, and the visitors divided themselves into parties of twos and threes or more, and scattered as their individual tastes dictated. Your correspondent had arranged for another view of the great power plant, in order that he might avail himself of a more favorable opportunity of inspection than can be afforded when a crowd is present. He was given every opportunity of informing himself of the details of this magnificent monument to engineering science, his cicerone for a portion of the time being no less a personage than Dr. Coleman Sellers, President and Chief Engineer of the Niagara Falls Power Company. Dr. Sellers, who stands among the very first mechanical engineers of the world to-day, has been identified with the project from almost the start. He was the only American represented on the Niagara International Commission which invited and passed upon competitive plans and estimates for the great undertaking, and it is to him more than any other one man that is due the perfection of mechanical detail so conspicuous throughout the plant as a whole. In company with Mr. R. Baumann, the representative of Faesch & Piccard, the designers of the turbines, and under whose personal charge their erection has taken place, your representative witnessed the stopping and starting of the great dynamo. This was a spectacle not witnessed by many, and especially interesting as showing the perfection of mechanical detail which has been attained. Speaking particularly of the wheel and shaft, Dr. Sellers stated that the specifications required that the wheel should deliver 5,000 H. P. at the upper end of the shaft with an efficiency of 75 per cent. As a matter of fact the efficiency was considerably greater, and he would be surprised if it did not reach as high as 79 per cent. This is a most remarkable efficiency under the circumstances, but the length of time during which the machine continued to revolve after the water had been practically cut off indicated such an extremely low friction factor that the writer was fully prepared to believe even these remarkable figures.



MAP OF THE PROPERTY OF THE NIAGARA POWER AND ALLIED COMPANIES.

THURSDAY EVENING.

The paper by Mr. Stillwell on "The Work of the Westinghouse Electric and Manufacturing Company for the Cataract Construction Company," which it was known was to be a technical description of the electrical part of the Niagara power plant, had been announced for Thursday morning, but for various good reasons was postponed until the evening. In preparation for the occasion, which was looked forward to as *the* event of the literary portion of the meeting, additional chairs were provided in the large parlor.

An unexpected surprise and pleasure was in store, viz., an address from Dr. Sellers, who, perhaps better than any one else, was fitted to rehearse, first, the history of the movement which had resulted in the plant that was now in operation, and second, to give a brief description of the mechanical engineering problems that had been met and successfully solved.

Interesting and important as these were, we cannot give space to them here, but must refer the reader to *Cassier's Magazine* for July—the Niagara Power number, in which these are given in detail by those whose names will ever be associated with the undertaking. And here it may be proper to notice one of the many courtesies extended to the members of the Institute by the Cataract Construction Company, viz., the presentation with their compliments to each member of the Institute present of a copy of this magnificent number of *Cassier's*, which had been issued from the press in advance especially for this purpose.

MR. STILLWELL'S PAPER.

Mr. Stillwell's paper was an abstract of the official report of the Westinghouse Company, who constructed and installed the electric plant, to the president of the Niagara Construction Company, and as the full report will be published later, but a few points will be referred to here.

Speaking of the credit due for the plant as a whole, the author stated that although it must be gratifying to Americans that the system adopted had been developed by an American company, Switzerland, the land of water powers, had contributed the turbine designs; Great Britain was represented in the excellent general form of the dynamo, which was proposed by Prof. George Forbes, and indirectly in the work of Hopkinson, Kopp, Thompson, Mordey and others, through their careful study of the underlying principles of electrical machinery. "Perhaps no country is more largely or more creditably represented," he said, "than Sniljan Lika," referring to Nikola Tesla, whose two-phase system is the one employed exclusively in the plant.

The frequency of the current is 25 cycles per second. This is a compromise between that specified by Prof. Forbes and that which the Westinghouse Company at first suggested. By means of rheostats controlling the field circuits of the generators, the potential of the current delivered is adjustable up to the limit of 2,400 effective volts. Until transmission over great distances is undertaken, the normal potential will approximate 2,100 volts. Currents intended for transmission to long distances, as for example to Buffalo, will pass from the switchboard through lead covered cables in the power house subway and the bridge to the transformer house. There it will enter the step-up transformers, be raised to 20,000 volts for transmission, and transformed down again at the further end to potentials suitable for local distribution.

He stated that it is not intended to attempt to supply incandescent lights directly, because 25 cycles per second is rather low for such purposes. For this purpose motors would be driven directly, and these drive direct current generators. For power purposes, however, the frequency selected was admirably adapted. If the demand for light should become sufficient to warrant it, it was possible that a certain number of generators of higher frequency might be advisable.

The following data were given:

Height of generator, from bottom of bed plate to top of the floor of bridge, 11 feet 6 inches.

Diameter of bed plate, 14 feet.

Diameter of outside of revolving field ring, 11 feet $7\frac{1}{8}$ inches

Each generator delivers 5,000 electrical H. P. and requires 5,150 H. P. delivered through the turbine shaft to drive it under full load. Exclusive of the bridge, which has no electrical function, the entire machine could be placed in a room 15 feet cube.

Weight of each generator is 170,000 pounds, of which about 79,000 pounds are in the revolving element.

The speed is normally 250 revolutions per minute, and the fly-wheel effect, as before stated, is 1,274,000,000.

He referred to one prominent feature of the plan of construction adopted, viz., that the magnetic attraction between the centrally located stationary armature and the revolving exterior ring tended to counteract the strains due to centrifugal force. If the usual plan had been adopted, of revolving the armature inside of the field, the magnetic pull would be added to the centrifugal force.

He stated that at full load a heat equivalent of about 100 H. P., representing the loss in generator due to magnetization of the iron and the resistance of conductors, was generated in the machine, and to dissipate this special ventillating arrangements had been devised. Grooves cast in the hubs of the supporting spiders also permitted of water circulation to cool the bearings.

The armature core is built up of thin sheets of mild steel, No. 30 B. W. G., and to secure free circulation of air is divided horizontally into seven equal sections, separated from one another by one inch brass castings containing ample ventillating channels. Each layer of the core consists of eleven segments, so placed that the joints are staggered. These sheets are punched out of large sheets of best quality, .015 of an inch thick, by steel dies, and afterwards thoroughly annealed. The ring thus built up is tied together by 66 bolts of nickel steel carefully insulated from the core.

The armature conductors consist of copper bars $1\frac{1}{32}$ by $\frac{7}{16}$ inches in section. Two of these bars, carefully insulated, are placed in each of the 187 slots around the periphery of the armature core. The conductivity of the bars used is above 100 per cent. by Matthiesen's standard. In the case of the second generator the conductivity of the copper furnished by the Washburn & Moen Manufacturing Company is 102.6 per cent. The insulation used is chiefly mica, and was subjected to tests in the shop of 15,000 volts, and again at Niagara of 6,000 volts.

In regard to the revolving parts of the generator, which in this case is the field, he said the most interesting part of it was the great field magnet ring. This is of nickel steel forged in one piece by the Bethlehem Iron Company, who guaranteed that it should have a tensile strength of not less than 70,000 pounds per square inch and an elongation of about 25 per cent. in two inches. They had done better than this, for in tests over 82,000 pounds tensile strength and over 27 inches elongation were obtained with one test piece. The magnetic qualities of the ring were found, by careful tests, to be no less remarkable than the physical tests.

The pole pieces, which are of mild, open hearth steel, cast by the Midvale Steel Company, are wound with rectangular section conductors. The weight of each pole piece with its bobbin is 2,800 pounds. The factor of safety against rupture by centrifugal force of the ring with pole pieces and bobbins attached, of which there are twelve, when at full speed is nearly 4.

In testing the magnetic qualities of the ring the ring as a whole was tested by a method devised by Mr. Chas. F. Scott, who has done so much in connection with these large generators. It was also tested by sample by the Ewing method as well as by the permeameter method.

The final tests of the machine gave the following results:

Maximum loss in field copper..............	15 H. P.
Loss in armature core.......................	60 H. P.
Loss in armature conductors..............	30 H. P.
Total..	105 H. P.

Total mechanical, electrical and magnetic losses are given as 155 H. P. In order that 5,000 H. P. shall be delivered to the circuits it is necessary that 5,155 H. P. be applied to the machine. Dividing 5,000 by 5,155 gives almost exactly 97 per cent. as its efficiency.

The above is but the briefest abstract of all that Mr. Stillwell said, but it must suffice for the present. Both Dr. Seller and Mr. Stillwell illustrated their remarks by means of lantern projections which enabled the audience to follow their words more closely.

Among those who have contributed largely to the success of the electrical part of this installation and, to whom great credit is due, are Dr. Sellers, Prof. Forbes, Prof. Rowland, and Messrs. Stillwell, Albert Schmid, C. F. Scott, Philip Lange, O. B. Shallenberger, B. C. Lamme, E. C. Means, H. P. Davis, Sigfried, Wright, Boegel, W. F. Lamme, Beinitz, Alberger, Mirault, Friedlander, Strauss, Mould and Parks, also Mr. De Courcy May of the Cataract Construction Company.

FRIDAY MORNING.

On Friday Dr. Emery's paper on "Alternating Curves" was discussed. In his paper the author developed a system for formulating and integrating the values of instantaneous watts applicable to curves of different shapes, which include an approximate sine curve as a special case. It was argued that such a system should avoid the necessity of using "equivalent" values and enable the distortions of alternating curves to be explained directly by formulating the conditions which produce the same instead of considering arbitrary "harmonics," and the development was along these lines. Among other conclusions arrived at was that the most desirable curve for lighting purposes would be a rectangle, if that were practicable, and for power purposes the parabola. This latter conclusion was at variance with generally previously accepted views.

In the discussion of this paper, which was quite spirited, the generally expressed opinion was that the author's method of discussing alternating current curves was *not* an advantageous one and that by avoiding the sine curve with its harmonic modifications one of the most characteristic features of the subject discussed was eliminated.

Mr. Franklin Leonard Pope's paper on "Notes on the Reconstruction of a Small Central Station Plant" in the absence of the author was read by the secretary. This paper was an account of how the author had at small expense reconstructed an old station and thereby greatly widened its field of usefulness. It is a paper which will interest many station men and should be read in full.

The session closed with an excellent paper by W. L. R. Emmet, of Schenectady, N. Y., on "Existing Commercial Applications of Electrical Power from Niagara." This was a full description of the interesting electrical installation at the works of the Pittsburgh Reduction Company by the General Electric Company which has already been referred to.

ELECTRIC POWER IN FACTORIES AND MILLS.*

BY F. B. CROCKER, V. M. BENEDIKT AND A. F. ORMSBEE.*

INTRODUCTION.

The application of electric power distribution to the operation of factories and mills, including the driving of the various machines and other apparatus, is the latest and one of the most important problems towards which attention is now being directed, the question being one of extreme prominence both from an economical as well as from an engineering standpoint.

In comparing two or more different systems of power distribution, the fundamental basis of comparison is generally that of dollars and cents. This is certainly correct as far as it goes, but unless a very decided difference be found between the costs of running under the various systems, it may be found that other factors enter, factors which cannot be estimated in dollars and cents, namely, questions of desirability and convenience. Without considering any tests whatever, there are several exceedingly advantageous points in the use of motors in factories which are almost self evident, such as: 1. Clear and unobstructed passages and head room, the latter facilitating the use of traveling cranes. 2. Ease of shifting the tools from place to place, possibly necessitating the placing of a starting box, and the putting up of a little extra wire, as compared with the inconvenience and trouble of setting up and adjusting a line of shafting, hangers, belts, etc. 3. The economy due to the ability to run a single tool without necessarily starting the whole factory or at least a complete section. 4. The running expense is entirely stopped when the tool is shut down. 5. The absence of the drip of oil from overhead shafting. 6. The tools may be placed at any desired points almost regardless of the distance. 7. It is not necessary to arrange the tools parallel as in the mechanical system. 8. A wider range of speed is possible. 9. Less damage caused by a fuse blowing than by a belt slipping off in case of accident or excessive load.

Considerations like the above have great weight in deciding a question such as that under discussion, and there is no doubt whatever that in most cases they rise to such prominence that they warrant a complete change from the old system to the new, even though there is no gain in economy or increased output. In most cases, however, it has been conclusively shown that considerable saving and increase in production is obtained, one test showing a very considerable percentage of increase in the output. The partial, if not the complete, displacement of the old method by the new is only a question of time, and it was the appreciation of this fact that induced the authors to undertake the determination of the power actually required to run the various tools and machines as used in ordinary practice.

HISTORICAL NOTES.

The subject is a comparatively new one, not dating back further than about 1890, hence the history of the subject is necessarily short. About five years ago motors were in operation in the works of the Thomson-Houston Company at Lynn, the Crocker-Wheeler Company and the C. and C. Company. Shortly afterward the great German works of the Siemens & Halske Company and the Allgemeine Elektricitäts Gesellschaft began using motors to operate sections of their factories. From that time to the present the use of motors has extended rapidly, until now they have been adopted in many factories all over this country and to a less extent abroad.

PRACTICAL TESTS.

In the tests which follow, the power required to drive the tools was obtained by placing an ammeter in circuit of the motors running the various machines and groups of machines, and taking readings every few seconds, the frequency of the readings depending upon the nature of the tool and the work it was doing. The potential was practically constant at 110 volts, not varying more than one or two per cent. The first tests were made at the factory of the Crocker-Wheeler Electric Company at Ampere, N. J., and the machines tested and the results obtained were as follows:

1. *Large Boring Machine.*—This machine was driven by a 1½ H. P. motor, speed 1,200 R. P. M., mounted directly on the frame of the tool, the reduction in speed being obtained by the use of gearing. During this test, which lasted three hours, the machine was used for turning down a commutator for a 100 H. P. dynamo. The average current drawn was 8.8 amperes, representing 1.28 H. P. at 110 volts. Before the run was finished, the speed of the tool was increased by changing the combination of gears, and during this time the power required was 1.48 H. P. When the machine was started from rest, the rush of current was considerable, the average being 17.75 amperes, representing 2.6 H. P. It will be seen that this motor is well suited to the machine, the average load being very close to the rated power of the motor.

2. *Drill Press.*—A drill press was run by a 1 H. P. motor, speed 545 R. P. M., mounted on a shelf at top of press and belted down to countershaft at bottom and thence up again to main shaft of machine, thus securing a reduction of the speed. This machine was boring the faces of the cast steel pole-pieces of a 10 H. P. motor, two cutting tools being used. The test lasted 4 hours and 40 minutes and during this time the pole-pieces for three motors were bored. The first run covered 1 hour and 10 minutes and the average current was 2.92 amperes, representing .48 H. P. It required 15 minutes to replace the completed pole-piece by another one. This second piece required 2 hours and 32 minutes to finish, and the average amperes was 2.82 or .41 H. P. This time it required 17 minutes to replace the piece and then the machine ran only 23 minutes until closing time. The current for this short run was 2.81 amperes, representing .41 H. P. The total length of time the machine was running was 4 hours and 5 minutes. Therefore power was supplied to the motor 86 per cent. of the time of the test.

3. *Drill Press.*—This machine was similar to the one preceding, but the work was different, namely, drilling half inch holes in cast-iron bearings. The average current was 2.86 amperes, which represents .42 H. P.

4. *Drill Press.*—This tool was the same as the other two and the work consisted in boring the inside of cast-iron bearings. The average in this case was 1.9 amperes or .28 H. P. It will be noticed that in the case of these three machines a motor of one-half H. P. would be of ample size to do the work.

5. *Punch Press.*—This was a small punch run by a 1 H. P. motor mounted on the base of the machine and belted to its heavy fly-wheel. The speed of the motor was 700 R. P. M. This tool was punching slots in sheet iron disks for a 10 H. P. armature, there being 28 slots in each disk. The motor was turned off every time a disk was replaced, but it did not come to a dead stop as the inertia of the fly-wheel was so great. Readings were taken every five seconds and the time of turning on and off the current was noted. The test lasted 57 minutes, during which time the current was turned on for 35 minutes and 45 seconds, or 62.7 per cent. of the time. The average current was 4.86 amperes, equivalent to .71 H. P. The rush of current at starting varied from 7 to 15 amperes, depending upon the haste of the workman in turning on the starting box.

6. *Gang Drill.*—This tool was driven by a 1 H. P. motor, 1,000 R. P. M., mounted with vertical shaft in frame of the machine and belted directly to the three drill spindles. The material drilled was cast-iron and the sizes of the holes were ¼ in. and ⅜ in. The average of the readings taken was 4.75 amperes or .7 H. P. When the drills were running free the motor took 3.5 amperes. Thus the power required to overcome friction was 74 per cent of the power used while drilling.

7. *Group of Two Machines,* 1 *Lathe and* 1 *Milling Machine.*—This group was driven by a 3 H. P. motor, belted to a short line shaft, from which belts ran to the countershafts above the two machines. The average current was 10.04 amperes, the power being 1.48 H. P. In this test special attention was paid as to which machine happened to be running free, cutting, etc., with the results given in the following table:

Class of Machines and Work.	Amperes.	H. P.
Milling machine running free—lathe at rest	5.67	.836
Lathe machine running free—miller at rest	7.23	1.065
Both running free	10.	1.47
Milling machine cutting—lathe running free	10.33	1.52
Lathe cutting—milling tool running free	14.42	2.12
Both tools cutting	15.4	2.28
Cutting rate increased on the lathe	17.8	2.61

8. *Group of Six Machines, consisting of* 1 *Milling Machine* (*small*), 2 *Lathes* (10 *or* 12 *inch swing*), 1 *Grindstone*, 1 *Drill Press and* 1 *Small Punch Press.*—The last named tool was not run at all during the test and the grindstone ran continuously. This group was run by a one H.P. motor, belted to the usual ceiling line shaft. The average current required to drive these machines was 5.86 amperes, representing .86 H. P. Thus this motor ran at about its most economical load.

9. *Group of Seven Machines,* 1 *Planer* (*small*), 1 *Grindstone,* 4 *Lathes,* 1 *Hand-Turning Lathe.*—A 3 H. P. motor was used to drive this group, being belted to a line shaft, the same as in the previous groups. The current was 13.36 amperes or 1.97 H. P. When the entire group was in use 2.65 H. P. was required.

10. *Group of Seven Lathes and* 1 *Grindstone, Driven by a* 3 *H. P. Motor.*—The average current was 9.92 amperes and the power required was therefore 1.46 H.P. The power used by the motor when different numbers of lathes were running is shown by the following table:

Number of Lathes Running.	Amperes.	H. P.
One	7.76	1.14
Two	9.16	1.35
Three	10.69	1.58
Four	12.23	1.8

Thus, in a group like this, it only takes 68 per cent. more power to drive four lathes than it does to run one, the reason being the fact that it probably takes about 1 H. P. to drive the countershafts.

11. *Group of Two Machines, a Large Punch Press and a Large Planer.*—The motor for running this group was placed on the floor and drove a short line shaft on the ceiling by the usual form of belt. The rated capacity of this motor was 7½ H. P., and its speed was 1,350 R. P. M. The punch press did not run during the test. With the planer idle and motor driving the shafting and belting alone the current was 15.5 amperes,

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which represents 2.8 H. P. While the planer was at work the motor required 33.1 amperes or 4.87 H. P. As the loss from friction in the shafting is nearly constant under the variation of load, the power required to overcome this friction was 47 per cent. of the total power used. When the bed of the planer reversed from its slow cutting stroke to the comparatively rapid return stroke, the current increased to 52 amperes, showing an expenditure of 7.6 H. P. for a few seconds. This tool was planing the frame of a 90 K. W. multipolar dynamo, the material being cast-iron.

12. This group was a very large one, consisting of 20 machines—8 lathes, 4 milling machines, 3 planers and shapers, 2 grindstones, 1 vertical shaft grinding machine and 3 small tools. The motor in this case was rated at 10 H. P. at 750 R. P. M. A Thomson recording wattmeter was placed in the circuit of this motor for one afternoon. At the end of this time the wattmeter showed a total of 17,854 watt hours used, and as the time was five hours, the average power was 3,571 watts or 4.78 H. P. The average number of machines running was 13, most of the lathes being in use the greater part of the time. An ammeter was inserted in the circuit of the motor for a few minutes and it was noted that the work was very steady, the current not varying more than 3 or 4 amperes at any time.

13. A group of five machines run by a 3 H. P. motor was next tested. Of these five machines one was a lathe with 17 inches swing and 8 feet bed, one was a slotter, and the other three were lathes of 12 or 14 inches swing. The average amperes was 7 and the power 1.03 H. P.

14. The last tool tested at this factory was a large new engine lathe, which had been just set up, of 50 inch swing. This tool was driven by a 3 H. P. motor mounted on an iron bracket built in the base of the machine. The motion of the motor shaft is transmitted to the tool by gears, thus doing away with all belts. The work done was turning a 5½ inch steel shaft for a 200 K. W. dynamo, facing the ends, etc., the cut being very light, as the work was only preliminary. The average current consumption was 11.3 amperes. Hence the average power was 1.68 H. P.

The following tests were made in the erecting shop of the De La Vergne Refrigerating Machine Company, Port Morris, N. Y.:

1. *Planer.*—A large planer, 120 inches between posts, by 108 inches high, by 22 feet bed was driven by a C. and C. motor of 15 H. P. The voltage employed was supposed to be 220, but due to an incorrect station voltmeter the actual potential only averaged 190 volts on the morning of this test. The average current was found to be 20.08 amperes, which at 190 volts represents 5.11 H. P. At the reversal from the cutting to the back stroke the current increased to 85 amperes, equivalent to 21.65 H. P. The power required during the cutting stroke was 4.76 H. P., while on the return stroke the average was 5.73 H. P.

2. *Drill Press.*—A drill press driven by a 5 H. P. C. and C. motor was tested in the afternoon. The potential was raised before this test so that the average was 215 volts. The power required when drilling various size holes is shown in the following table:

Size of Drill.	Amperes.	H. P
Running Free.	3.	.865
½ in.	4.07	1.23
[illegible] in.	4.37	1.26
[illegible] in.	4.6	1.33

3. *Corliss Cylinder Boxing Machine.*—This tool was driven by a 10 H. P. C. and C. motor and was boring the brass boxes, 6¾ inches diameter, of the main shaft bearing of a large ice machine. The average current was 14.47 amperes, representing 4.17 H. P. at 215 volts.

In order to place the results in a more convenient form the following table of average powers was compiled:

TESTS AT THE CROCKER-WHEELER FACTORY.

No. of Test	Size of Motor	Number of tools driven by motor	Average Amperes	Average horse power	Remarks.
1	1.5 H. P.	1 boring machine	.83	.23	
2	1. "	1 drill press.	2.25	.40	Less than ½ full load of motor
3	1. "	1 " "	2.36	.42	
4	1. "	1 " "	1.9	.26	
5	1. "	1 punch press.	4.86	.71	
6	1. "	1 gang drill.	4.73	.7	Drilling ¼ in. and ⅜ in. holes.
7	3. "	2 machines.	10.04	1.48	
8	1.5 "	6 "	3.20	.86	All small machines.
9	3. "	7 "	13.36	1.97	
10	3. "	8 "	9.90	1.40	
11	7.5 "	8 "	33.1	4.87	Required 2.8 H. P. to run shafting only.
12	10. "	20 "		4.78	Tested by Watt meter.
13	3. "	5 "	7.0	1.03	
14	3 "	1 engine lathe	11.4	1.68	Light cut taken by tool.

TESTS AT THE DE LA VERGNE WORKS.

1	15. H. P.	1 planer	20.08	5.11	Planer 120 in. x 108 in. x 22 ft. Voltage 190.
2	5. "	1 drill press.	4.07	1.23	½ in. drill. Voltage 215.
3	10. "	1 boring tool.	14.47	4.17	Voltage 215.

The results obtained in these tests show that the power required to drive machine tools has been considerably overestimated, for it will be noted that with a large majority of the tools tested the motor was not more than one-half loaded, and in these cases it was seldom that the load equalled the full power of the motor even for an instant. In the case of the large planer, although the motor was overloaded 50 per cent. upon reversal of the bed, the average load was only one-third of the rated full load. With this machine, however, when the piece of work is very short, necessitating more rapid reversals, the average load will be much nearer the most economical output of the motor.

(To be continued.)

THE SUBSTITUTION OF ELECTRICITY FOR STEAM IN RAILWAY PRACTICE.*

BY DR. LOUIS DUNCAN.

In an address delivered before this Institute in June, 1892, Mr. Frank J. Sprague spoke of the coming development of electricity as supplied to railways, and outlined his views as to the direction of this development. In the last three years great extensions have been made in electrical transportation, and it seems well to review briefly the amount of these extensions and their direction. In this paper I shall consider electric traction as it stands at present, not the possibilities of the future, and will briefly take up the following questions:

1st. Given a railroad system at present operated by steam, will it pay to change entirely to electricity or to make a partial substitution, and how should the change be made?

2d. If entirely new lines are to be built, is it likely that it will pay to equip them electrically? How should they be equipped?

3d. I will describe the equipment of the Baltimore and Ohio tunnel plant, and draw from it what moral I can.

There are two very distinct sides to the question of transportation, the passenger side and the freight side, and their requirements for good service are very different. First taking up the question of passenger travel, the receipts of road are increased by running trains at short intervals and at high speeds, and this is a condition peculiarly favorable to electricity. On an electric line short trains, equally distributed over the track, give a greater station efficiency, and the lowest cost of equipment of both station and line. The cost of train service is somewhat greater, but is compensated by the saving in the other items.

The cost of hauling a given number of passengers between given points by steam is greatly increased when the number of trains is increased, the efficiency is less, and the cost of equipment and of train service is greater. Wellington states that doubling the number of engines for a given traffic increases the cost of transportation about 50 per cent.

On the other hand, if you take up the question of freight traffic, the conditions of greatest economy are reached when trains of a maximum weight are hauled by a single locomotive. In attempting to carry on traffic of this kind by electrical locomotives operated from a central station we find that we are at a great disadvantage because of the irregular service necessitated by the freight traffic and the unequal distribution of the load along the line. Suppose, for instance, that there were two stations supplying the line and that the traffic was uniformly distributed along it, then the capacity of each station would be one-half of the total required capacity. Suppose, however, that the entire traffic was concentrated in one train, then each station would have to have a capacity equal to the total power required for hauling the entire traffic, as the train would be first supplied from one station and then from the other. The line also would have to have a capacity suitable for handling the total traffic. If a number of heavy trains were used, and the traffic was irregular and liable to be congested at one point, as in the case of freight service, then again the capacity of the station would have to be greater than that required to supply one-half of the normal traffic. If we were to decide to transmit the current to a longer distance and to supply all the track from one station, using transformer devices along the line, then the capacity of the station itself would only be that required for the normal traffic of the line, but the transformer devices would have to be sufficient to handle the maximum traffic of the section which they supplied and would have to be given a capacity greatly in excess of the average load in order to supply this energy. We must distinctly bear in mind in considering the application of electricity to steam roads any departure from a uniform distribution of load along the line will increase both the cost of equipment and the cost of operation.

The amount of freight transported per train mile has more than doubled and the expense has decreased more than one-half during the past 20 years. The passengers per train mile, on the other hand, have decreased and the expenses have changed only a slight amount, notwithstanding the greater economies that have been put in force in the interval. Passenger traffic has come in the direction in which electricity is the most economical for transportation; freight traffic, on the other hand, has gone in the direction where electricity becomes most costly.

Suppose, then, the question comes up before the managers of a road as to whether they are to equip their lines to be operated entirely by electricity. It seems to me, as matters now stand, it will not pay trunk lines to change the method of operation for freight traffic, and the question to be considered would be the operating of the lines partly by steam and partly by electricity. Let us consider if it is possible to run the passenger service wholly or partly by electricity. Considering a two track road doing a through as well as a local business, I think we can decide that unless the case be an exceptional one it will not pay to equip the main line electrically. It is necessary that the through express service be continued, and that the freight service be continued, and an attempt to operate the local trains with the through trains could not be successful if there was any considerable amount of through traffic. With a four track road the condition of affairs is somewhat different. If the road operates between cities acting as terminal points for all passenger traffic, as with some of the lines between Boston and New York, then by equipping all four tracks it would be possible to run express service at short intervals on two of the tracks and on the other two tracks to run freight and local trains. At present it would not pay to use electric locomotives operated from a central station for the freight service, but the local service could be operated electrically, and as the speed of the local trains would be approximately equal to that of the freight, there need be no serious interference with the traffic. We would then have express passenger service working under favorable conditions—that is, with a number of trains evenly distributed,—a local service operated under similarly favorable conditions and with no interruption to the freight traffic. If the road, however, is to transport a considerable number of foreign cars, as, for example, the New York Central or the Pennsylvania Railroad, then the condition of affairs for express service would not be so favorable, and the question of the equipment of the tracks for express service would have to be carefully considered. As far as the branch lines go, whether it would pay to partially or wholly substitute electricity for steam depends upon the local conditions. A long branch with a small amount of local traffic it would not pay to equip, but on a short branch with considerable passenger traffic and comparatively little freight traffic such equipment would pay. I find that in 1892 the total number of through passengers carried by the New York Central road was 234,650, while the number of local passengers was 21,978,979. It will be seen that the through traffic is but a small percentage of the total number of passengers, and that the question of preserving the local traffic is of great importance. Now the greater part of this local traffic will in the next few years be taken by the electric roads paralleling the steam roads unless some effort is made either to control the electric roads or to give an equally good service between adjacent towns. This latter is possible using the ordinary steam tracks only when the distances between towns are small and the amount of freight or through traffic is also small.

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* Abstract of Inaugural Address to the American Institute of Electrical Engineers, Niagara Falls, June 25, 1895.

There are certain kinds of local traffic which the steam roads must, to a large extent, lose, and which in the nature of things they cannot regain. In large cities having a considerable suburban traffic the trolley roads, forming as they do a network of lines within the city and extending in every direction into the suburbs, offer advantages with which the steam roads cannot compete. In Philadelphia one of the large steam lines lost so much traffic that it has attempted to regain it by reducing prices and increasing the number of trains. In this effort it has partly succeeded, but at the cost of greater expense and decreased receipts. To counterbalance this loss at central points, railroads may hope by the introduction of electricity to increase their earnings along the lines and on their branches.

As to the nature of the equipment that will be required, it would depend on the work to be done and the branch that is to be equipped. In some cases it might be well to use single electric cars running on the steam tracks between towns and on the local tram lines in the towns. As the speed would be very different in the town and on the railroad line, and as the voltage could also be different, it would be well in this case to use a number of motors on the car, and to use a series parallel controller, the motors being in series for the town traffic. For instance, suppose we wish to run at a maximum speed of forty miles per hour between two towns and it is economical to use 1,000 volts on the line, we could use the motors on the car, running them in parallel on the main line at a speed of forty miles per hour, while in town, with a voltage of 500, we could run them in series at a speed of ten miles per hour. I can hardly imagine a case where the three-wire system could be economically used for such service on the steam lines.

The condition of affairs in electric transportation is at present curious. The trolley companies by extending their lines are working from tramway transportation to through transportation. They are attacking the problem by development from small motors to larger ones. The railroad companies starting with the large units are coming down in the direction of the present trolley systems, as in the case of the Nantasket Beach road, of the New York, New Haven and Hartford Railroad Company. Perhaps in the future they will meet and some standard electrical system will be adopted for the present steam road. I think then that in the case taken up the policy of the road will be to equip those branches for which the conditions are favorable with a trolley, and run comparatively large motor cars capable of drawing one or two ordinary passenger or freight cars as trailers, using the present steam service for their freight traffic when necessary. This will allow the necessary through travel, will give the required local service between towns and will not interfere with the freight traffic.

As for the systems to be used for such service, I believe that at the present moment the continuous current overhead trolley system is the only one that can be selected with a certainty of successful operation. It gives a minimum complication in the way of conveying the current to the cars, it allows a considerable range of speed with a comparatively high efficiency, and our experience with it is such that successful operation could be at once guaranteed. By using different voltages in the towns and on the line both high and low speeds can be obtained. If the line to be operated is very long it might be best to use rotary transformers at different sub-stations along it, the line being supplied by continuous currents from the sub-stations. In fact the three systems that are at present possible are—first, the ordinary direct current system; second, a system in which direct currents are used on the line and rotary transformers supplied by alternating currents are placed along it, and third, a two or three phase system supplying rotary field motors on the cars. In the latter case it would be well to employ different periods in the towns and on the lines.

The second case which I wish to consider is that of roads built for an entirely new electrical equipment, such, for instance, as the elevated roads in Chicago and the underground rapid transit road in New York, or the proposed Washington-Baltimore Boulevard Line. In most of these cases the traffic is almost entirely a passenger traffic, and the conditions are especially favorable for the operation of electricity. Taking first the case of the New York underground road, there will probably be required about 150 trains for local service, each train having five ordinary cars and a motor car. For the express service there would be about twenty-five trains of, say, four ordinary cars with a motor car. For this it would probably be best to use the direct current three-wire system, one of the cars on the train being equipped with motors and acting as a locomotive. With four motors on a car the system would be efficient at all practical speeds, and if desired a large part of the energy could be thrown back on the line when the cars are being stopped. In the case of the local trains a simple calculation will show that a very small part of the total energy expended is used in overcoming the track resistance, while a very considerable part is employed in accelerating the train and afterwards wasted by braking. I have calculated the amount of energy which can be practically saved under the conditions of local and express traffic on the New York underground road, and find that with motors of ordinary efficiency about 45 per cent. can be returned. If storage batteries are used in connection with the central stations, the batteries being located along the line, a uniform load can be thrown on the stations, and their capacity may be reduced to almost one-half as compared with a system in which the energy is not returned, thus greatly decreasing both the expense of installation and of operation. As it is possible at present to obtain batteries with a rapid discharge rate at very reasonable prices, and with a guarantee for repairs that places them well within the limit of commercial calculations, a system of this kind offers some advantages over any other system that could be applied to the operation of the underground road. An alternating current would hardly be economical for this work, as it precludes the possibility of returning the energy to the line, and as the variable speed required makes it uneconomical as compared with the direct current system using, say, four motors with series parallel control. In the case above cited shunt motors would be used, and it would be possible to get a contact with the line that could not under any circumstances be broken. The case of the elevated roads is very similar to the one I have cited, except that in existing structures shorter trains would be used, and the cost of equipment for a given number of cars would be somewhat greater.

The last subject which I wish to take up is the electric plant for the Belt Line tunnel of the Baltimore and Ohio Railroad.

The immense locomotive for the Belt Line tunnel is the first instance of the direct displacement of steam by electricity, and the line over which it is to be operated is the first through steam line to be equipped electrically. Speeds of 60 miles per hour are to be used for the cars outside of the city limits, and within the city limits ordinary speed is to be employed. In this case there is no question of economy in the employment of the electric locomotives, as the plant adds considerably to the cost of operating the road. The Belt Line tunnel runs beneath the city of Baltimore for a distance of one and one-quarter miles, then to the outskirts of town, through open cuts and short tunnels. There is a grade of .8 of one per cent. over almost the entire length of the tunnel proper, while one-half mile beyond it there is a grade of one and one-half per cent. Being in the middle of the town it would have been difficult to provide a satisfactory ventilating plant even supposing that ventilating plants had been successful in other localities, which is not the case. The managers of the Baltimore and Ohio Railroad Company wished to provide a satisfactory service and considered a number of plans for drawing their trains through the tunnel without the annoyance due to smoke and gases. After careful consideration they concluded that electricity was the most satisfactory means to accomplish this.

In this paper I have not indulged in prophecy, nor have I imagined any apparatus or equipment which cannot be bought in the open market. But to me it seems that the present is a crisis in the history of railroading. Up to the present the steam roads have ignored the competition of electric roads or they have fought them. To-day they cannot afford to do either. In a few years electric roads will have absorbed practically all of the local traffic and will begin to cut into through transportation. The steam roads cannot afford this, their only safety is to make of electricity an ally instead of an enemy, and this before it is too late.

The conclusions that I finally reach are these :

1st. The tendency of passenger transportation on the steam lines has been in the direction of the greatest electrical economy, while the tendency of the freight transportation has been in the direction of the least electrical economy.

2d. It will not pay any through line with considerable traffic, having two tracks, to equip their main tracks electrically.

3d. With four track roads, it will pay to equip all of the tracks electrically unless a considerable portion of the business is through passenger traffic.

4th. It will pay all the larger roads either to equip a number of their branch lines electrically or to control competing electric lines.

5th. In order to remain on a dividend paying basis it is imperative that most of the two track lines either build additional tracks or control the electric roads that parallel them.

6th. Believing that ultimately all of the traffic will be done by electricity, it is imperative that the managers of steam roads keep constantly in touch with electrical progress.

(To be continued.)

NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT.[*]

BY FRANKLIN L. POPE.

The financial condition of the smaller central station electric lighting plants throughout the country is at the present time by no means satisfactory, and in too many instances cannot even be truthfully said to be encouraging. A survey of the field shows that very few such plants located in towns having less than 10,000 inhabitants are earning more money than is necessary to meet their operating expenses and to provide for indispensable current repairs. In the State of Massachusetts, in which the operations of all electric lighting companies are by law made a matter of public record, it appears from the latest reports that the aggregate liabilities of the fifty-seven companies operating in that State, including stocks, bonds and floating indebtedness, amounted on June 30, 1894, in round numbers to $14,000,000, nearly all of which stands charged to construction account. The net earnings for the preceding year were $1,000,000, or about 7.1 per cent. on the total investment: a sum obviously quite insufficient to provide for depreciation and at the same time pay a fair dividend on the capital which has gone into the business. But if half a dozen of the larger plants, in cities like Boston, Lowell, Worcester, Springfield, Lynn and Fall River, were excluded from the list, the showing for the smaller plants would be even far worse than it now appears.

Many of these small plants were started at an earlier day than could have been justified by any reasonable estimate of the business then in sight, and now find themselves hampered by inconvenient buildings, and with unsuitable machinery bought at high prices, and encumbered with defective business methods which experience has shown to be wholly inconsistent with the dictates of good judgment.

With the owners of many of these plants it has become a very serious question whether the easiest way out of the dilemma which confronts them may not be to relegate the entire plant to the junk-shop and the scrap-pile, and commence over again with new buildings, modern machinery and improved methods of administration. When the necessary capital is readily forthcoming, there can be no doubt that this would often be the wisest course of procedure, but for obvious reasons, it is one which is not always, nor even usually practicable. The alternative is to remodel the existing plant, bringing it as nearly as may be into accordance with the best modern practice, and utilizing as far as possible the old material, a course which at least has the merit of avoiding an undue expansion of the construction account, in most cases already sufficiently burdensome.

Having been called upon during the past year to advise the owners of a plant of the character above referred to, in reference to certain changes which had been suggested as desirable, and having afterwards been employed in a professional capacity to design the work and superintend its execution, I have thought that some account of what we undertook to do and how we did it might not be without interest to the members of the Institute.

The Great Barrington (Mass.) Electric Light Company was organized and commenced business in 1888. The population of the district intended to be served was about 3,000, and most of the expected consumers were located within 2,000 feet of the point decided upon for the station. This was built of wood in the most inexpensive manner possible, and was placed alongside the railroad for convenience in receiving coal, although at the same time the danger from fire was materially increased. The original outfit was an Edison 3-wire, equipped with a pair of 250-light 110 volt dynamos, and the company commenced business with 281 lights on contract at $10 per year each, wiring free. The center of distribution was 1,800 feet from the station, necessitating over a ton of copper in the feeders alone. Generally speaking, the plant was well laid out, and well built as things went in those days. The two dynamos were belted to a single 80 H. P. Armington & Sims engine. The original cost of the plant was about $16,000. The following year a Schuyler arc plant for street-lighting was added, carrying 35 arcs, nominally of 1,500 C. P., which was run from the same engine and boiler. In 1890, the plant was considerably enlarged by the addition of a second arc machine, a Westinghouse 500-light alternator, and a second engine and boiler of the same capacity as the first. An 80 K. W. Westinghouse dynamo of more modern type was afterwards substituted for the original one.

Upon examining the plant last year, I found the Edison machines carrying on Saturday evenings a maximum load of some 450 lights, while three evenings in the week (with the stores closed) it fell to perhaps half that amount. The two Schuyler machines, with an aggregate capacity of 55 to 60 lights, were carrying about 38 to 40 or an equivalent of that amount, while the Westinghouse machine was seldom as much as half-loaded, carrying a maximum of possibly 500 lights during three or four months of the summer season, and not much more than one-fourth that amount the remainder of the year. Necessarily, with so many dynamos of different types, and with such a variable, yet small average output, the consumption of coal was excessive as compared with the light delivered and paid for.

The street lines, according to the usual practice, were of No. 6 B. & S. weather-proof wire; the poles were of cedar of good size and fitted with pine or spruce cross-arms, with common green glass insulators set upon wooden pins. In consequence of a silly prejudice, which had been fomented amongst the citizens by interested parties against permitting poles to be set in the streets, the wires, in a very great number of instances, had been attached, by cross-arms or brackets, to the trunks of the immense elm trees with which the streets of the town were shaded, a practice which occasioned an enormous loss of current every wet night as well as much irregularity in the performance of the lights. The effect on the trees was by no means salutary, while the appearance was as much worse than that of poles in the streets as could possibly be imagined.

The village of Great Barrington extends for the most part along a single broad thoroughfare for a distance of nearly three miles, and the street-lighting circuits are consequently very straggling. The 1,500 C. P. lamps, which were suspended at intervals of 800 to 1,000 feet, were actually of very little service in illuminating the densely shaded streets.

After a careful consideration of the situation, keeping in view the greatest possible reduction of present and future operating expenses, it was determined the wisest course to pursue would be to consolidate the whole service so that it could be supplied by one dynamo in place of five underloaded ones. In pursuance of this plan it was decided to adopt the two-phase alternating system, at a maximum pressure of 2,100 volts in the primaries, and 105 volts in the secondaries, with a frequency sufficiently low to permit the advantageous use of induction motors if required. It was furthermore decided to abandon the steam plant and to make arrangements to utilize some one of the excellent water-powers which were available within practicable distances. Under ordinary circumstances, I should have hesitated to recommend the substitution of water-power for steam as the sole source of power for the operation of an electric lighting plant. Water-power is an invaluable auxiliary, and when conveniently available for use in conjunction with steam, may often be made to save a very large coal-bill in the course of a year. On the other hand, the excessive fluctuations to which it is subject—which are scarcely realized by those but casually acquainted with the subject—render it in most cases a very uncertain reliance for a business which is compelled to go on, perforce, every night in the year, and which cannot suspend operations, as an ordinary manufactory does, if worse comes to worst, for a week or two at a time. Even a water-privilege which, during ten months of the year, furnishes twice as much power as is needed, and even more, may be expected to fall off during one of the extraordinarily dry seasons, which occur at intervals of from five to ten years, to one-third its usual amount. In such a case an electric plant solely dependent upon water-power would find itself in a most undesirable predicament

In the present instance, the choice of a water-privilege finally reduced itself to two sites, one in the town itself, within half a mile of the center of consumption, and the other at Glendale village, seven miles distant, both situated on the Housatonic River. The privilege first mentioned being already occupied by a woollen factory, only the surplus water was available, but this was known to be quite sufficient for the requirements of the electric company at least nine months in each year, leaving three months to be run by steam. It had the advantage of being close at hand, and was capable of being fitted up at a moderate cost. As to the Glendale privilege, it was necessary to be very sure that the lowest water of a dry summer would give all the power required to run the plant without the aid of steam. Having invariably found the value of a water-power to be greatly exaggerated, not only in popular estimation, but in the opinion of its owners, the matter was investigated with much care. From the official State map of Massachusetts, it was ascertained that the area of the drainage basin of the Housatonic above the Glendale dam was 260 square miles. J. T. Fanning, a leading authority, from an extended examination of the recorded observations on the rainfall and flow of the New England rivers, reaches the conclusion that a water-shed of the area mentioned may be estimated to yield the quantities of water given below:

Cubic Feet of Water per Second per Square Mile.

Minimum (15 days of least summer flow)..........	0.25
Mean (120 days, usually July to Oct. inclusive)....	0.90
Maximum (flood volume)........................	93.00

It will be noticed that the flow in extreme dry weather is less than one-third of that which may be depended upon through the remainder of the year.

(To be continued.)

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[*] A paper presented at the twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

A. I. E. E.

LIST OF MEMBERS AND GUESTS ATTENDING THE NIAGARA MEETING.

Elizabeth, N. J.—Ralph W. Pope, Frank J. Pope.

Hackensack, N. J.—W. J. Hamilton, Jr.

Boston, Mass.—William Brophy, Elihu Thomson, Geo. W. Davenport, E. N. Sanderson, Geo. W. Blodgett, A. V. Garratt.

New York—George F. Archer, Dr. F. B. Crocker, George H. Winkler, Jr., Dr. Walter Lobach, Prof. W. A. Anthony, Dr. and Mrs. M. I. Pupin, Mr. and Mrs. Horatio A. Foster, Dr. S. S. Wheeler, Gano S. Dunn, Max Osterberg, Miss D. Osterberg, James Burke, Mr. and Mrs. Nelson W. Perry, Miss Perry, Percival R. Moses, H. Hobart Porter, Jr., Dr. Chas. E. Emery, A. D. Chandler, Alfred Ely, Ralph McNeill, Frank Bourne, Wm. J. Hammer, R. Pfund, Wm. B. Lester, Chas. A. Tinker, H. M. Swetland, Joseph Wetzler, Prof. C. F. Chandler, J. W. Gilmore, Harry Alexander, Mr. and Mrs. F. Torchio, Miss Alexander, H. Ward Leonard, John L. Kebler, Frank Brewer, H. A. Craigin, C. P. Poole, W. D. Weaver, Jules Usher, Stephen L Coles, R McA. Lloyd.

Brooklyn, N. Y.—Alex. F. Ormsbee, Mr. and Mrs. H. D. Bayne, M. E. Bayne, W. D. Bayne, Miss E. Fraser, Miss G. Fraser, H. M. Davis, A. H Ackermann, A. B. See.

Rochester, N. Y.—Mr. and Mrs. George A. Redman, D. DeLancey.

Baltimore, Md.—Dr. Louis Duncan, J. G. White, W. S. Symington.

Philadelphia—Carl Hering, C. J. Reed, Chas. P. Perot, L. Knowles Perot, Walter E. Harrington, Peter Wright, Coleman Sellers, Wm. C. L. Eglin, Mr. and Mrs. Herbert Lloyd, Miss E. Gumming, Miss Maud Nobles.

Avon, N. Y.—Chas. S. Bradley.

Jersey City, N. J—Mrs. H. R. Wemple, W. J. A. Boucher, Mr. and Mrs W. W. Ker.

Kingston, Jamaica—Horace S. L. Verley.

Schenectady, N. Y.—Chas. P. Steinmetz, Harold Harkinson, E. J. Berg, Eskie Berg, H. G. Reist, T. D. Boyles, W. L. R. Emmet, E. W. Rice, Jr.

Madison, Wis.—Prof. and Mrs. J. E. Davies, S. B. Fortenbaugh

Rutherford, N. J.—Walter M. Petty.

Pittsfield, Mass.—J. D. E. Duncan.

Pittsburg, Pa.—Alex. Jay Wurts, L. B. Stillwell, Chas. F. Scott, E H. Heinrichs, G. H. Winslow, Chas. I. Young, G. H. Blaxter, L. E. Imlay, W. H. Dunlap.

Rhode Island—D. L. Goff.

Halifax, Pa.—A. Fortenbaugh, C. W. Ryan.

Chicago—B. J. Arnold, A. V. Abbott, C. Thordarsen, Fred DeLand, M. E. Rothschild, Maurice Coster, Geo. P. Wisdom.

Lincoln, Neb.—Prof. R. B. Owens.

Ann Arbor, Mich.—Henry S. Carhart.

Newark, N. J.—Harry D. Reed, Edw. A. Colby, J. Martin.

Bridgeport, Conn—Leonard Waldo.

Hamilton, O.—J. B. Cornell, Jr., Mr. and Mrs. C. L. Cornell.

Passaic, N. J.—James S. Alden.

Columbus, O.—A. M. Bielle, Th. C. Dunlap, C. C. Collins, Prof. B. F. Thomas, R. D. McCarter, Jr., F. C. Caldwell.

Champlain, Ill.—B. V. Swenson.

Ithaca, N. Y.—James Lyman, Chas. E. Hewitt, B. S. Lamphear, Prof. A. Macfarlane.

London, Ont.—Mr. and Mrs. Chas. B. Hunt.

Buffalo, N. Y.—A B. Weaver, Frank C. Perkins, F. C. Busch, M. Foltz, Henry G. Stott. J. W. Tillinghast, E. F. Willams, G. C. Wolverton, Thos. H. Feary, Charles Plumb, C. R. Huntley, H. Foltz.

New Orleans—Chas. K. Huguet.

Hoboken, N. J.—George W. Colles, Jr.

Wilmington, Del.—C. R. Van Trump, John L. Hall.

Trenton, N. J.—Wm. Elmer, Jr.

Toronto. Ont.—T. R. Rosebrugh, E. B. Merrill, W. M. Rutherford.

Brattleboro, Vt.—W. G. Fuller, F. Taft.

Erie, Pa.—D. N. McBrier, Bert W. Douglas.

Rochester, Pa.—O. B. Shallenberger, H. B. Shallenberger, T. H. Yawker.

Syracuse, N. Y.—S. R. Gifford.

Fort Wayne, Ind.—F. S. Hunting.

Bridgeton, N. J.—Oberlin Smith.

Niagara Falls—P. M. Lincoln, W. A. Brackenridge, C. C. Burr, J. W. Rogers. J. R. Haskin.

Berlin, Ont.—E. Carl Breithaupt.

Utica, N. Y.—W. W. Nicholson.

Kansas City, Mo.—Edwin R. Weeks, Miss Ruth Weeks.

Springfield, Mass.—H. S. Anderson.

Milwaukee, Wis.—Robert B. Mann.

Marietta, O.—John C. Shedd.

Stowe, Vt.—F. M. Pike.

Jamestown, N. Y.—Mr. and Mrs. C. E. Gifford.

Ovid, N. Y.—John Waring.

Ottawa, Ont.—A. A. Dion.

Detroit—James F. Cummings.

Memphis, Tenn.—H. B. Sweet.

Decatur, Ill.—E. P. Coleman.

Allegheny, Pa.—Prof. R. A. Fessenden, Mrs. Cecil P. Poole.

Vienna—J. Jordan.

Hartford, Conn.—William L. Robb.

T.-H. FINANCING METHODS.

A COMMENTARY.

Bill of Complaint in the Suit of P. D. and J. O. Armour vs. New York Guaranty and Indemnity Company in the Tacoma Railway Case.

P. D. Armour, Jr., and J. O. Armour, who aver themselves to be citizens of the United States and the State of Illinois, bring this their petition and show to the court as follows:

1. The plaintiffs are stockholders in the Tacoma Railway and Motor Company, one of the defendants above named, same being a corporation organized and existing under the laws of the State of Washington, each of your petitioners owning in his own right 200 shares of the stock in the said company.

2. The complainant above named, with the New York Guaranty and Indemnity Company, a company existing under and by virtue of the laws of the State of New York, has caused the above entitled action in this court to foreclose a certain mortgage alleged to have been made by the Tacoma Railway and Motor Company to said complainant, as trustee, on all the property, rights and franchises of said Tacoma Railway and Motor Company, in the State of Washington, to secure a certain issue of bonds of said Tacoma Railway and Motor Company now outstanding and alleged in their bill of complaint in said action, to the amount of $1,350,000.

3. That this said mortgage and bonds which it secures were executed by the said Tacoma Railway and Motor Company, as petitioners are informed and believed and so allege, pursuant to an agreement entered into between a so-called syndicate, represented by one H. L. Achilles and E. N. Costello and said Tacoma Railway and Motor Company, the terms and conditions of which were as follows: The said Tacoma Railway and Motor Company was to create a mortgage of $1,500,000, and to issue bonds in a like sum, to be secured by said mortgage, said bonds to be 1,500 in number and of the denomination of $1,000 each; $25,000 of the face value of the said bonds were to remain in the treasury of said company for future use for extensions and betterments, to be issued as such betterments and extensions took place; $910,000 face value of said bonds to be delivered to the said syndicate at the rate of eighty-five cents on the dollar, said syndicate to receive in addition to said bonds a bonus of 910,000 shares of stock of said Tacoma Railway and Motor Company. As a condition sine qua non to the making of said agreement by said syndicate, the Tacoma Railway and Motor Company was to purchase the Tacoma and Steilacoom Railway at a price of $350,000, $300,000 payable in bonds of the Tacoma Railway and Motor Company and $50,000 in stock of said company. As a part of the purchase price of said company, it was agreed that all the property, rights and franchises, including real estate of the Tacoma and Steilacoom Railway, free from encumbrance, should be transferred to the Tacoma Railway and Motor Company, and that the Northwest Thomson-Houston Electric Company should replace, at its own cost, the present electric motors of the said Tacoma and Steilacoom Railway Company, with others of latest design, the capacity of such motors on each car to be jointly 50 horse power, and to nine cars then in use on said Tacoma and Steilacoom Railway new trucks, and to pay the cost of rebuilding the cars then in use on said road; also that the said Northwest Thomson-Houston Electric Company should build at its own cost and expense, as a part of said railway, a spur line from a point near the center of section 10 in Pierce County, Washington, to some point on Puget Sound, the length of said spur to be one and three quarter miles; also that the Northwest Thomson-Houston Electric Company should exchange the then three 80 horse power railway generators in use in said railway for one 370 horse power generator, the Tacoma Railway and Motor Company to pay the difference in cost, amounting to $2,767.00, also that the Northwest Thomson-Houston Electric Company should take back the present steam engine used by the Tacoma and Steilacoom Railway Company, and allow the Tacoma Railway and Motor Company $3,500.00 for same.

4. That all of the bonds represented by complainant in this action and secured by mortgage, now attempted to be foreclosed, were issued under and pursuant to the agreement hereinbefore set out, and were issued to the said Northwest Thomson-Houston Electric Company, and are now held and owned by said Northwest Thomson-Houston Electric Company, or to its successors or assigns, and as such are held by the successors and assigns of said company, are held by persons and corporations having full, complete notice of the infirmities attending the execution and issuing of said bonds and mortgages as hereinbefore set out.

5. That the said agreement and the bonds and mortgage issued, executed and delivered pursuant to it were and are fraudulent and void, and ineffective to charge to the said Tacoma Railway and Motor Company, because of the following facts:

(*a*) The agreement entered into with the so called syndicate was so entered into pursuant to fraudulent and corrupt conspiracy and agreement between one Paul Schulze, the then president of the Tacoma Railway and Motor Company, and the officers and agents of the said Northwest Thomson-Houston Electric Company for the benefit of the last named company, and to enable the last named company to acquire and negotiate bonds of said Tacoma Railway and Motor Company for much less than their nominal face value and much less than their actual value, and to secure the payment of same by mortgage of all property, rights and franchises of said Tacoma Railway and Motor Company. The said Paul Schulze, prior to the execution and delivery of said bonds and mortgages, acting corruptly and in collusion with the said Northwest Thomson-Houston Electric Company, falsely represented that said H. L. Achilles and E. N. Costello were agents and representatives of the syndicate to deal with the company and to furnish the moneys then needed by it, amounting to $600,000, when in truth and in fact the said Achilles and Costello were not agents or representatives of any syndicate, but were figureheads, not representing any one, but permitted the said Schulze to use their names as a friendly act to him, and the said dealings were wholly with said Paul Schulze himself, he being the sole and only representative of the syndicate and acting in that capacity as the agent of the Northwest Thomson-Houston Electric Company, all of which was unknown to the said Tacoma Railway and Motor Company, or its Board of Directors, except the said Schulze; and the said Schulze at the same time acted as the president of the Tacoma Railway and Motor Company and as one of its directors in the making of the contract with the said syndicate. The said Schulze further represented to the Board of Directors of the Tacoma Railway and Motor Company that its financial condition was desperate, and that the acceptance of the proposition of the said syndicate was necessary to save the said company from bankruptcy, and that the said proposition was fair and just, and advantageous to the company, and that the properties of the said Tacoma and Steilacoom Railway Company were worth the sum for which it was proposed to purchase the same; which said representations were false, in that the said deal was essential to save the said company from bankruptcy, but money could have been raised to save the company without the extraordinary sacrifices involved in the proposition of the so-called syndicate, and in that the properties of the Tacoma and Steilacoom Railway Company were not worth the sum of $350,000, or any sum in excess of $60,000; and the said proposition was not an advantageous one for the said Tacoma Railway and Motor Company, but in fact amounted to a sacrifice of the bonds of said company for about 50 cents on the dollar of their face value, and amounted to giving to the said Northwest Thomson-Houston Electric Company a bonus of the stock of the said Tacoma Railway and Motor Company to the amount of $141,000.

(*b*) That the debt created by the said agreement and by the execution and delivery of the said bonds and mortgage exceeded the indebtedness permitted by the by-laws of the said Tacoma Railway and Motor Company, in that said indebtedness was limited by said by-laws to $45,000 per mile of double track electric railway, to $30,000 per mile of single track electric railway, to $100,000 per mile of single track cable railway, to $150,000 per mile of double track cable railway, $10,000 per mile of single track horse or steam motor railway, $15,000 per mile of double track horse or steam motor railway, and that the mileage of said Tacoma Railway and Motor Company at that time was as follows: 1.6[illegible] miles single cable, 5.9[illegible] miles double track electric, 1[illegible].24 miles single track electric railway, and that the mileage of said company was increased by the purchase of said Tacoma and Steilacoom Railway property only to the extent of about twelve miles of single track electric railway, and the total indebtedness authorized and created by said lines under and by the by-laws was only the sum of $1,155,000. That the said by-laws and limitations therein and thereby placed upon the right of said Tacoma Railway and Motor Company to create an indebtedness was well known to said Northwest Thomson-Houston Electric Company and to its officers and agents at the time of entering into the said agreement and the execution and delivery of said mortgage and bond and the making of the mortgage.

(*c*) That under and by virtue of the Constitution of the State of Washington corporations organized under its laws and in said State are forbidden to issue any bonds or other obligations except for money or property received or labor done, and are forbidden to issue stock except to bona fide subscribers therefor or to their assigns, and all fictitious increase of stock or indebtedness is declared void. That under and by virtue of said agreement a fictitious issue of stock to the amount of $141,000 was made and the stock was delivered to the said Northwest Thomson-Houston Electric Company under and in pursuance of said agreement, and that the bonds of the Tacoma Railway and Motor Company, under and in pursuance of said agreement, to the amount of $1,2[illegible]0,000, were executed and delivered to the said Northwest Thomson-Houston Electric Company, and that the said Tacoma Railway and Motor Company received therefor money and property to about the value of $800,000. That the said transaction constituted a fraud on the Constitution of the State of Washington and the laws thereof, and the bonds and stocks issued pursuant thereto were and are absolutely void and of no effect and constitute no just or valid charge against the Tacoma Railway and Motor Company.

6. That the said Northwest Thomson-Houston Electric Company subsequent to the said transaction consolidated its organization and its property with the General Electric Company, a corporation, as your petitioners are informed and believe, organized under and by virtue of the laws of the State of Massachusetts, and the said bonds and stock are now held and owned by one or the other of said companies, but a portion of said bonds has been pledged by said companies as collateral security for a loan or loans of money made to them, but the holders of said collateral bonds have and are chargeable with notice of all the infirmities connected with their issue and delivery. That the bonds or stock delivered as heretofore alleged and by virtue of the same said companies had representation since the said issue on the Board of Directors of the Tacoma Railway and Motor Company, and the same constitutes a valid charge in favor of the said Tacoma Railway and Motor Company against the Northwest Thomson-Houston Electric Company and the General Electric Company for the face value of said stock, and the Tacoma Railway and Motor Company is entitled to an equitable offset to the amount of said bonds, to wit, $141,000, against a recovery on the bonds now held by said companies or either of them.

7. That neither the syndicate represented by the said H. L. Achilles and E. N. Costello, nor the said Northwest Thomson-Houston Electric Company, have complied with the terms and conditions of the said agreement concerning exchange of machinery, repairs of cars and building of additional track, and that the said Paul Schulze, fraudulently and collusively with the Northwest Thomson-Houston Electric Company, has undertaken to release them from the obligations to comply with the said terms and conditions and without requiring any consideration whatever from them to the Tacoma Railway and Motor Company for such release, and that the said action constitutes a fraud on the Tacoma Railway and Motor Company, perpetrated collusively between the said Paul Schulze and the Northwest Thomson-Houston Electric Company, and that the said Tacoma Railway and Motor Company has been damaged in the sum of $75,000 by failure to carry out the terms and conditions of said agreement as aforesaid, and that the said sum constitutes an equitable offset against any bonds held by said Northwest Thomson-Houston Electric Company or said General Electric Company.

8. That immediately after entering into the agreement with the so-called syndicate and the execution of said bonds and mortgage, 1,250 of said bonds, amounting to $1,250,000, were delivered and passed from the hands of the Tacoma Railway and Motor Company. That it was provided and agreed in the mortgage executed to secure said issue of bonds that the remaining 250 of the bonds, amounting to $250.000, should not be delivered out of its hands or the hands of its trustee except for paving or for building additional tracks and equipping the same, or for the purpose of additional equipment for the track already built, or for the purchase of additional rolling stock, or for making other extensions or additions to the property of the Tacoma Railway and Motor Company; yet petitioners allege that within one year thereafter an additional sum of $100.000 of said bonds was delivered to said Northwest Thomson-Houston Electric Company or its successor the General Electric Company, without any additional paving having been made, without any additional rolling stock having been bought, or any other extensions having been built or any additions having been made to the property of the said Tacoma Railway and Motor Company, all of which was well known to the corporations receiving the additional issue of bonds, and with the knowledge on the part of said corporations that the said issue was not only in violation of the terms of said mortgage securing the bonds, but was in violation of the by-laws of the Tacoma Railway and Motor Company; and petitioners now aver that the said bonds are now held by the said General Electric Company, and they aver on information and belief that the same were delivered without any consideration passing to the Tacoma Railway and Motor Company for them, but whatever consideration passed was passed to the said Paul Schulze as an individual, and all with the knowledge of said Northwest Thomson-Houston Electric Company and the General Electric Company.

9. Petitioners allege that by reason of the facts aforesaid the Tacoma Railway and Motor Company has an equitable offset against the said Northwest Thomson-Houston Electric Company and the General Electric Company and their successors and assigns with knowledge to the amount of $746,000, and that the amount due on said bonds ought in equity and good conscience to be reduced by said sum; and if the facts as aforesaid were properly pleaded in this action in this court and shown to this court by proof, said issue of bonds will be reduced by said sum of $746,000.

10. That all of said transactions took place without the knowledge or consent, or procurement, or acquiescence of your petitioners as stockholders in said company, and that it was only within the last few weeks that your petitioners became acquainted with the facts aforesaid and with the infirmities attendant upon the execution and delivery of said bonds and mortgages.

That your petitioners have applied to the Board of Directors of the Tacoma Railway and Motor Company and to the stockholders of the said Tacoma Railway and Motor Company at a meeting of the said stockholders to defend against the foreclosure of said mortgage and for the rendition of judgment upon the bonds aforesaid upon the grounds hereinbefore set forth, and have urged upon the board of said directors and said stockholders' meeting that they set up the facts aforesaid, both defensively and by cross bill, for the purpose of conserving the rights of said Tacoma Railway and Motor Company and its stockholders in the premises, but that both said board and said stockholders' meeting declined to do so except partially, to wit, to the extent of alleging that in making said deal with the so-called syndicate the said Schulze acted collusively with the said Northwest Thomson-Houston Electric Company; but your petitioners allege that whether it be true or not the said Schulze perpetrated a fraud upon the company in the respect aforenamed, and that the act of the said company in creating so large an indebtedness—larger than permitted by its by-laws—and in making an issue of its bonds and stock so largely fictitious, as herein alleged, constitutes a fraud upon the stockholders of said company, and one of which they have a right to complain in a court of equity, and that they have a right to set up in this action, for the purpose of invalidating the whole or in part, as the case may be, the mortgage executed by the said Tacoma Railway and Motor Company and the bonds which the said mortgage secures. And petitioners allege that the refusal of the said company to plead and prove the matters aforesaid constitutes a fraud in equity upon the said stockholders of said company and gives them an equitable right to appear in this action as partners defendant, and allege each and every and all of said defence.

Therefore your petitioners now come and move the court for an order admitting them into court in these causes as partners defendant with leave to plead or answer to the bill of complaint and the facts as herein set forth by way of defence or cross bill as they may be advised, and such other and additional facts as may appear against the right of the complainants in this action to the relief sought, and as in duty bound they will ever pray.

TURNER, GRAVES & WOLF,
Solicitors and Petitioners,
Spokane, Wash.

General News.

What is Going on in the Electrical World.

Beaumont Tex.—The project of building an electric railway in this town is being seriously considered by some of the leading business men.

New York.—Amos J. Cummings has been removed from the Subway Commission and Thomas L. Hamilton appointed in his stead.

Helena, Mont.—The Capital Electric Lighting Company, which has the contract for lighting the city, is putting in a complete new plant.

Cleveland, O.—A preliminary survey is being made of the route for the proposed electric road from Cleveland to Medina, a distance of thirty miles.

Hibbing, Minn.—An electric light plant, to be managed in connection with the water plant, is one of the improvements contemplated by the authorities of this village.

Petersburg, Va.—John C. Robertson, representing Northern capitalists, has applied for a franchise to build an electric road between Manchester and this city.

Hastings, Neb.—The Hastings electric light plant has been sold under foreclosure of a mortgage of $13,000 held by Adam Cook, Jr., of New York. The plant was bought in by Mr. Cook for $10,000.

Saratoga, Wyo.—An electric railway is projected between this city and Wolcott Station, on the line of the Union Pacific Railway, a distance of twenty-two miles. A roadway has been graded for part of the distance.

Kokomo, Ind.—Messrs. Snow & Avery, of this city, who have a franchise for the construction of an electric railway from here to Greentown (10 miles), are receiving bids for grading and tracking and will award the contract August 1.

Dowagiac, Mich.—The Round Oak Stove Works at Dowagiac have discarded steam as a motive power and substituted electricity, conveyed by wire from La Grange, five miles distant, the generators being driven by water power.

Lexington, Mo.—At the recent special election there was an overwhelming vote cast in favor of an electric light plant, and when the result was known the people were wild with enthusiasm. There were bonfires, fireworks and music by the band.

Atlantic City, N. J.—The Brigantine Beach Railroad has been sold under foreclosure proceedings to George H. Cook, acting for the Holland Trust Company of New York. It is reported that the road will be changed to an electric trolley line.

Nyack, N. Y.—The Nyack Traction Company, of which F. R. Bain, of Poughkeepsie, is president, and Congressman B. B. Odell, of Newburg, a director, will begin the construction of an electric railway between Nyack and West Nyack in a few days.

Berlin, Conn.—It is thought probable here that the Middletown and New Britain branches of the Consolidated road to this junction will be equipped with electricity as a result of the tests of substituting electricity for steam on the Nantasket Beach branch of the road.

Independence, Mo.—The city council has granted a franchise to Walton H. Holmes and others for an electric street car line in the most important thoroughfare in the city. Mr. Holmes is identified with the Kansas City and Independence Rapid Transit Railroad.

Guntersville, Ala.—A company of Boston men who are putting in a plant at Columbus City, Marshall County, for the manufacture of electric appliances, have on foot now a scheme to build a single track elevated electric railway from Guntersville to Scottsboro.

Seneca Falls, N. Y.—An electric road connecting Seneca Falls and Romulus is being quietly agitated, to tap the Lehigh at the latter point. The proposed route lies in a beautiful, thickly populated section of Seneca County, and its advocates believe it will be a paying investment.

Mellette, S. Dak.—The firm of W. B. Potter & Company, owning mills at Mellette, Beresford and Wakanda, and electric light plants at Mellette and Beresford, has been dissolved by mutual consent. It is succeeded by the Northern Waterworks and Power Company, a corporation recently organized under the State laws.

Greensburg, Ind.—Local capitalists are canvassing the advisability of building an electric railroad between Greensburg and Clarksville, twelve miles from here, by way of Kingston. B. S. Sutton and K. M. Hord, of Shelbyville, and others interested in the Oldenberg and Batesville electric road, are the promoters of the enterprise.

Chicago.—The Ferris wheel has been moved to a permanent location on North Clark street, where grounds have been purchased for a pleasure resort. An electric fountain larger than any hitherto seen in Chicago will be one of the attractions. The grounds will be illuminated by 100 arc and 400 incandescent lamps.

Rondout, N. Y.—The Rondout and Eddyville Railway Company has made application to the commissioner of highways of the town of Ulster, Ulster County, N. Y., for permission to construct and operate a street surface railway, to be operated by either horse-power or electricity, beginning in Rondout and extending to Eddyville.

Mexico City, Mex.—It is rumored that a concession has been granted to a French company with a capital of 20,000,000 francs to introduce electric force into this city. The company expects to furnish 20,000 horse-power, taken from waterfalls in the State of Puebla, 125 miles distant. A German electrical concern is also developing plans for supplying electrical energy to this city.

Humboldt, Tenn.—Several prominent and wealthy citizens of Alamo, the county seat of Crockett County, are organizing a stock company for the purpose of building an electric railroad from Alamo, via Gibson Wells, to Humboldt. The line will be about eighteen miles in length and will pass through the richest farming lands in the State. The power plant will be located at Humboldt.

Williamstown, Md.—The town council has granted a franchise to Powell Evans to erect poles and wires in this town for lighting and power purposes in connection with his scheme for transmitting electricity generated at a plant to be established at dam No. 4 or 5 on the Potomac River. Several mills and other industries here propose to receive motive power from the electric line.

Batesville, Ind.—The town council has granted right of way to the Batesville and Oldenburg Railroad Company and the road between Batesville and Oldenburg will now be pushed to completion as rapidly as possible, after which it will be extended to Osgood, sixteen miles south, thus connecting the Baltimore and Ohio and Big Four railroads. Later on the road will be extended to Brookville. The gentlemen interested are capitalists of Shelbyville and Batesville, B. S. Sutton being president of the company.

Middletown, N. Y.—The Middletown-Goshen Traction Company and the Middletown-Bloomingdale Electric Railway Company have been consolidated under the title of the first-named company. The roads form a continuous line. The capital stock of the new corporation is $400,000 and the directors are James C. Hinchliffe, of Paterson, N. J.; Benj. H. Throop, William B. Rockwell and M. J. Wightman, of Scranton, Pa.; Charles H. Smith and William B Bryce, of Middletown, and William S. Grant, Jr., Philadelphia, Pa.

Ottawa, Can.—A bill to incorporate the International Railway Company, which proposes to construct and operate electric railways in Western Ontario, with Hamilton as a central point, has passed the railway committee of the House. The bill empowers the company to bond the road to the extent of $20,000 per mile of single line and $6,000 per mile additional for double track, and also authorizes it to lease the railway to the Canadian Pacific, Canada Southern or New York Central, and to acquire the franchises and properties of electric lines now in operation.

Elkton, Md.—Preparations are being made for building the dams on the Susquehanna River at Conowingo, where the Susquehanna River Electric Company proposes to establish a great electric plant. The fall of water obtainable at that point is sufficient to produce several thousand horse power, which it is proposed to transmit by means of electricity to Baltimore and other places. The Electric Company is in possession of undisputed water right and land on each side of the river and can utilize them in the distribution of buildings, piers, and whatever constructions are necessary.

Philadelphia.—All the assets of the Electrical Accumulator Company were sold in this city under foreclosure proceedings on the 27th ult. Most of the assets were bid in by L. F. Potts. The sale wound up the affairs of the Accumulator Company, which was incorporated in New Jersey five years ago with a capital of $5,000,000, full paid, for the purpose of manufacturing accumulators and electrical storage batteries. The plant of the company is situated at Newark, N. J. The company became financially embarrassed some time ago and was reorganized, but the reorganization was not effectual.

Newark, N. J.—It is stated that a company will be incorporated in a few days to carry on the manufacture of an apparatus for lighting railroad cars by electricity. The apparatus was invented and patented by Charles Wachtel, of the Wachtel Electrical Company of Newark. The device consists of two storage batteries for each car which will not in any way be connected with each other. Electricity will be generated by the revolution of the wheels in whichever way they are going—backward or forward. Everything works automatically, and when the batteries are fully charged the connection with the wheels ceases. The whole will be operated by a button switch and each car is lighted separately.

Washington, D. C.—At a recent meeting of the Washington and Great Falls Electric Railway shareholders the offer of Stilson Hutchins to purchase the $100,000 6 per cent. gold bond issue, part of the $500,000 issue authorized, was accepted. The following directors were elected: J. P. Clark, S. T. G. Morsell, C. A. Maxwell. J. V. N. Huyck, Smith Pettit, F. H. Stier and W. E. Lewis. These elected J. P. Clark president, S. T. G. Morsell vice-president, Lee Hutchins treasurer and W. E. Lewis secretary. The contract for the construction of the road will be let and work commenced at once.—The various companies interested in plans to build an electric road from Washington to Baltimore have combined their interests under the title of the Columbia and Maryland Railway Company, which includes the Eckington and Soldiers' Home system in Washington, forming the Washington end; the Baltimore and Washington Turnpike Company and the Edmondson Avenue, Catonsville and Ellicott City Company, which forms the Baltimore end of the system. The officers of the Columbia and Maryland Company are as follows: President, Thomas M. Lanahan; vice-president, B. N. Baker; treasurer, Ernest McElroy; secretary, R. Stanley Carswell; general manager, W. Kelsey Schoepf. The capital stock is to be $4,000,000, and the limit of bonds authorized to be issued is $6,000,000.—Strenuous efforts will be made in the next Congress to induce the Government to appropriate enough money to establish an electric plant at the Great Falls of the Potomac on lines similar to but less extensive than those in use at Niagara Falls. The prime mover in this project is Col. Elliott of the Corps of Engineers, lately retired, who declared that for $750,000 a plant could be put in which would supply enough electricity for the uses of the Government in Washington to more than make up its entire cost in one year.

Telephone and Telegraph.

S. B. Kinard intends to construct a telephone system at Jackson, Ga.

The Postal Telegraph Company expects to have its lines into Decatur, Ill., in about three weeks.

A new telephone company, incorporated by Geo. J. K. Phillips, Thomas Moore, Representative Moore of Bethel, A. J. Horsey and J. D. Marvil, will establish a line at Sharpstown, Md.

Wm. C. Muncell has been granted an exclusive franchise for five years to operate a telephone line connecting Crede, Col., with the various mines in Mineral County.

John Dunfee, Frank H. Hiscock and associates, who purpose establishing a branch of the Mutual Automatic Telephone Company in Rochester, have applied to the city council for a franchise.

A movement is on foot at Gorham, N. Y., to establish another telephone system in that section.

The New York and Philadelphia Telephone and Telegraph Company has applied to the common council of Trenton, N. J., for permission to erect poles and wires in that city.

The Little Rock and Home Mutual telephone companies have applied to the city council of Little Rock, Ark., for franchises. The Southwestern Company (a Bell concern) is actively opposing the application.

The Phœnix Telephone Company has made propositions to the Board of Works of Indianapolis for a franchise to establish its system in that city which are so favorable to the city that their acceptance seems probable.

Two new companies have applied for telephone franchises in Syracuse—the Automatic Telephone Company and the Palmer Telephone Company, of which A. W. and M. C. Palmer are the projectors. The council, it is said, looks with most favor on the petition of the Automatic Company.

The New Orleans Telephone Company has been granted a franchise for that city and is actively engaged in getting subscriptions. It has already a large number of subscribers on its list and is making inroads on the patronage of the Bell Company.

The United States Telephone Construction Company opened their rooms in the Bullitt Building, Philadelphia, on Wednesday last, for the purpose of affording the public an opportunity of inspecting their new "M and B" telephone and the Gould-Smith switchboard. A large number of visitors witnessed the working of the instruments and apparatus, and were favorably impressed by the simplicity, convenience and efficiency manifested in their operation. Experts pronounced the system superior to the Bell in several important respects.

The stockholders of the Montauk, Orient and New York Telegraph and Telephone Company met at Cutchogue, L. I., on Thursday last, and by a majority vote decided to sell out to the New York and New Jersey Telephone Company (Bell). The Montauk Company was formed to compete with the other in the telephone business of a large section of Long Island.

At Oskaloosa, Iowa, the superintendent of the Iowa Telephone Company (Bell) went quietly among his subscribers a few days ago and informed them that his telephone service would be free until further orders, but it was too late as most of the subscribers had signed contracts with a new company which was to open an exchange July 1.

Among the incorporators of the Home Telephone Company of Sioux City, Iowa, are P. H. Johnson, A. H. Hazen, A. F. Pall and F. W. Lohr.

The Central District and Printing Telephone Company, which operates the telephone lines centering in Pittsburg, has commenced the construction of a new line between Pittsburg and Washington, by way of Chartiers Valley.

The city council of Trinidad, Col., has granted a franchise to a new telephone company composed of citizens and business men of the city, who will establish and operate a separate system of telephones over the city in opposition to the Bell or Colorado Telephone Company.

The Commercial Telephone Company is introducing a new telephone service into Oakland, Cal., in opposition to the Sunset, and has already over 300 contracts. It proposes ultimately to cover the entire county. It is managed by Oakland and San Francisco business men. Ernest R. Smith, general manager of the Commercial Company for Alameda County, has been in consultation lately with the directors of the Capital Telephone Company at Sacramento in reference to forming connections with that company and city.

The Automatic Telephone and Electric Company of Illinois, licensee for the Strowger Automatic Telephone Exchange, Chicago, report having closed contracts and are now installing an exchange of 5 0 subscribers at Bloomington, Ill. The construction is being pushed vigorously, and it is expected that the plant, with 350 subscribers, will be in operation by the 1st of August. The same company also report the Automatic exchanges at Laporte and Michigan City, Ind.; La Grange, Ill.; Ypsilanti, Mich.; Albert Lea, Minn.; Perry, N. Y., and in fact all exchanges operating under this system, as giving perfect satisfaction.

The Harrison Telephone Company has been organized at Detroit, Mich., with the following incorporators: O. W. Shipman, C. P. Collins, R. A. Brett, Albert Pack, C. B. Hubbard, W. L. Holmes and Charles Flowers. The directors' board comprise the same gentlemen. The capital stock of the company is $600,000 and 4,500 telephones have been subscribed for. The articles of incorporation will be filed at once as the common council has granted the company a thirty-year franchise which will probably be accepted.

The *Times Herald* of Chicago is entitled to the honor of having first used the telautograph in furnishing press dispatches. That paper on the 20th ult. published photographic fac-similes of a number of messages in the identical handwriting of the author, sent to it that night from prominent men who were in attendance at the Republican League Convention at Cleveland. The test, says a prominent electrician, "was a most successful one. The instrument worked perfectly over a circuit 430 miles long. The ordinary telegraph circuit is only about 500 or 600 miles, automatic repeaters being used where the distance is greater. No repeaters were used in the *Times-Herald* test between Cleveland and Chicago, and the work of the instrument was a surprise, even to those connected with it. The longest trial heretofore given the telautograph was between Paris and London, the test being a private one." When Prof. Gray first conceived the idea of the telautograph, it is said, he had no idea of ever using it for long-distance work.

A dispatch from Webster City, Iowa, states that "that section of the State is being honeycombed with cheap telephones since the demise of the Bell Telephone Company. Lines are now in course of construction from Clear Lake west through Garner, Britt, Algona, Emmettsburg and Spencer on the Chicago, Milwaukee and St. Paul Railroad. From Britt they will work north and south, going north to Albert Lea and south to Humboldt. They make connections at Clear Lake and Humboldt with the Iowa Union lines, and will thus put Humboldt within the reach of nearly every important town in the State by telephone."

Siemens & Halske in the Northwest.

The Electrical Engineering Company of Minneapolis has taken the Northwestern agency of the Siemens & Halske Company, and will, no doubt, handle the business with their accustomed vim and energy.

"American" Incandescent Lamps.

Mr. A. L. Reinmann, formerly superintendent of the Sawyer-Man Electric Company, has accepted a similar position with the American Electrical Manufacturing Company, St. Louis, and has already entered upon his duties. Mr. Reinmann is well and favorably known as one of the best incandescent lamp makers in the country, and the addition of his methods and recent improvements to those of the American Company, which have a most enviable reputation, ought to and doubtless will, produce incandescent lamps of exceptionally high grade. The American Company takes great pride in the quality of its output, sparing no efforts or expense, and the engagement of Mr. Reinmann is in line with its determination to produce the best.

A Canadian Lamp Test.

For some months past Charles F. Stilwell has been engaged in testing all the prominent lamps manufactured in the United States as well as in Europe for the benefit of Stilwell & Company of Hamilton, Ontario. Mr. Stilwell was well fitted for this work, as he has been prominently identified with the history of the art since Menlo Park days, and established the Edison Canadian factory, remaining as manager for the Canadian General Electric lamp factory until quite recently.

His test of efficiency, sustained brilliancy and life resulted in the selection of the Imperial Incandescent Lamp, in which choice the manufacturer, the Bryan-Marsh Company, take excusable pride, especially since their lamps were not furnished by Messrs. Stilwell & Co. direct but were procured without the knowledge of the makers through a Canadian customer, thus showing the results with an average product as against carefully selected lamps of some competitors.

Messrs. Stilwell & Co., as a consequence of their investigation, will hereafter handle the Imperial Incandescent Lamp in Canada, and it may be gratifying to the trade in general to know that they did not desire a cheap lamp, contending that the future demand would be for a good lamp, in which the first consideration was great care in the manufacture, even if the first cost was thereby somewhat enhanced.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Albany, N. Y.—L. G. Perry, architect, will furnish plans and forms of proposals for the wiring of the State Armory buildings in this city. Proposals may be sent by mail to or delivered in person, up to noon July 8, at the office of the Adjutant-General.

Atlantic City, N. J.—The city council has passed an ordinance providing for the erection of a city hall, to cost $ 00,000.

Baltimore, Md.—The George Bauernschmidt Brewing Company will probably erect a large modern saloon and restaurant, cor. Holliday and Fayette sts.

Belvidere, N. J.—The trustees of the First Presbyterian Church are considering the question of lighting the edifice by electricity.

Boston, Mass.—H. Reed Whipple, the well-known hotel man, has plans for a ten story hotel building on the block bounded by Tremont, Boylston, Tanworth and La Grange sts.; estimated cost $1,000,000.

Brooklyn, N. Y.—W. H. Reynolds will erect a four story brick flat, north side of Park Place, west of Washington ave.

Deckertown, N. J.—The Newburgh Electric Railroad Company has bought Pine Point at Orange Lake, and will erect a $10,000 hotel building there.

Depew, N. Y.—Plans have been prepared for a manufacturing building here, in which 700 or 800 men will be employed. Mr. Kingsley, president of the Real Estate Exchange, Buffalo, can probably give information.

Elizabeth, Pa.—The parsonage to be erected for the M. E. Church will be wired for electric lighting.

Fall River, Mass.—Preparations have been completed for the erection of a new hall for the Y. M. I. A. Society.

Goshen, Ind.—Architect M. L. Smith & Sons, 75 Home Bank Building, Detroit, have prepared plans for the remodelling and enlarging of opera house in Goshen. Electric lighting, opera chairs, etc.

Jersey City, N. J.—The Hudson County Republican County Committee has decided to erect a club house on Pavonia ave., near the Five Corners Plans for the structure have been approved.

New Bedford, Mass.—Nat C. Smith has just completed plans for an elegant dwelling house, to be erected for F. P. Hawley, to be located northwest cor. of County and Willis sts.

New Orleans, La.—A. Canter has prepared plans for a store and residence to have electric lighting and steam heating; also for a dwelling for H. Pitard, to have incandescent lighting, etc.... Mazureau Raynes has prepared plans for residence for E. Howard M. Caleb, to have incandescent lighting.

New York City.—Boehm & Coon, the builders, who now have in course of construction at Washington Square and Washington Place a seven story fire-proof store and loft building, are making preparations to build a similar structure on the plot adjoining the Washington Place front. The new structure will contain modern equipments, including electric wiring and apparatus.... John Kehoe, the builder, will erect a seven story store and loft building on northeast cor. of Broome and Wooster sts.

INCORPORATIONS.

The Southern Electric Construction Company, Richmond, Va.—to construct and equip telephone plants and exchanges, electric light plants, and do a general electric business. Capital stock, $25,000. President, J. M. Cullingworth; vice-president, C. E. Wingo; secretary and treasurer, G. S. Maxwell.

The Hamburg and Portland Telephone Company, Hamburg, Ark.—to construct a line from Hamburg to Portland, a distance of 35 miles. Capital stock, $8,000. Incorporators: J. D. Pugh, Charles M. Woodward, J. H. Pryor, T. R. Pugh and T. B. Savage.

The Badts Multiphase Electric Railway Company, Chicago, Ill.—to promote, build, buy and sell electric railways, and manufacture, buy and lease supplies, apparatus and patent rights therefor. Capital stock, $1,000,000. Promoters: Wm. A. Aylsworth, Jas. C. Essick, Adolph Gray.

The Sheboygan Light, Power and Railway Company, Sheboygan, Wis.—to deal in light and power and operate an electric railway. Capital stock, $200,000 Promoters: George B. Matten, J. M. Saemann, F. L. Saemann, Sheboygan.

The Wall Street Electric News Agency of New York City—to collect and distribute commercial, financial and other news and conduct publications, and to transmit and collect news by machines. Capital stock, $50,000. Directors: F. W. Keutgen, R. J. Welsh and O. B. Goldsmith, of Brooklyn.

The Huntington Improvement Company, Huntington, Ore.—to deal in real estate, lumber, live stock, general merchandise, acquire water works, electric light and power plants, mills, grain elevators, railroad bridges, flumes, and to do a general brokerage business. Capital stock, $20,000, with privilege of increasing to $100,000. Incorporators: Robert M. Steel, John Aiken and Fred. Williams.

The Cascade Electric Light and Power Company, Cascade, Dubuque County, Iowa—to erect a plant for furnishing electric light and power. Capital stock, $7,000. Incorporators: D. M. Finley, L. P. Freeman, J. A. Hayes, H. L. Denner, J. W. Betty.

The Mt. Winans, Westport, Lansdowne and Meeter's Park Railway, connecting those places by an electric railway with Baltimore, Md., has been incorporated. Capital stock, $75,000. Incorporators: Dr. Wm. H. Crim, S. J. Carr, of the Carr-Lowery Glass Company; Wm. F. Porter, of Johns & Porter; Brosius Reed, George S. Kiefer and George A. Meeter, all of Baltimore.

The Idaho Springs and Bellevue Mountain Tramway Company, Idaho Springs, Col.—to build and operate an electric railway. Capital stock, $60,000. Incorporators: James W. Swem, Milo H. Slater, James A. McClurg and Ed. Lachner.

The Bullard Electric Company, Chicago—to manufacture electric apparatus. Capital stock, $25,000. Incorporators: Charles W. Bullard, Aubert S. Bullard and Carl E. Kammeyer.

The Albany District Telegraph Company, Albany, N. Y.—to construct and maintain telephone and telegraph lines in Rensselær and Albany counties. Capital stock, $20,000. Directors: Selden E. Marvin, D. Cady Herrick, James H. Manning, Henry E. Hawley, Frederick W. Newman, William F. Wieser and John J. Wieser. The new corporation is the result of the consolidation of the American District and Capital District Messenger services.

The Ladoga Electric Light and Power Company, Ladoga, Ind. Capital stock, $9,000. Promoters: S. F. Kyle, H. E. Daugherty, Wm. M. Rhods.

The Centerville Light, Heat and Power Company, Centerville, Ia.—to furnish gas, electric light, heat and power. Capital stock, $65,000. Promoters: D. C. Campbell, W. G. Clark, Jas. R. Wooden, W. M. Peatman, C. P. Campbell, Centerville, Ia.

The Pittsburg, Arlington Heights and St. Clair Street Railway Company, Pittsburg, Pa.—to build an electric street railway. Capital stock, $21,000. Promoters: C. E. Owens, Patrick Ridge, Michael Ridge, Pittsburg.

The Electric Protection Company, Dallas, Tex.—to manufacture and sell electrical or other devices for protection from unlawful intrusion of vaults, safes, etc. Capital stock, $50,000. Promoters: Chas. Goldstein, Henry Hirsch, W. H. Garritson, all of Dallas.

The C. J. Field Company, New York—to conduct an electrical and mechanical consulting and engineering business. Capital stock, $4,000. Directors: Cornelius J. Field, of Brooklyn; Frank Bourne, of Mount Vernon, and John W. Gilmore, of New York City.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JULY, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.20 P. M.	2	3.30 A. M.
2	11.50 "	3	3.30 "
3	......	..	......
4	12.30 A. M.	4	3.30 "
5	1.30 "	5	3.30 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	8.00 P. M.	9	10.30 P. M.
10	8.00 "	10	10.50 "
11	8.00 "	11	11.10 "
12	8.00 "	12	11.30 "
13	8.00 "	13	11.50 "
14	8.00 "	15	12.10 A. M.
15	8.00 "	16	1.00 "
16	8.00 "	17	1.20 "
17	8.00 "	18	1.40 "
18	8.00 "	19	2.30 "
19	8.00 "	20	3.30 "
20	8.00 "	21	4.00 "
21	8.00 "	22	4.00 "
22	7.50 "	23	4.00 "
23	7. 0 "	24	4.00 "
24	7.50 "	25	4.00 "
25	8.30 "	26	4.00 "
26	9.00 "	27	4.00 "
27	9. 0 "	28	4.00 "
28	9.50 "	29	4.00 "
29	10. 0 "	30	4.00 "
30	11.00 "	31	4.00 "
31	11.00 "	Aug. 1	4.00 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JUNE 25, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

541,730. Conduit Electric Railway. Edward Ebl, Cedar Rapids, Iowa. Filed July 5, 1894.

541,796. Trolley-Finder. James P. Taylor, Fort Worth, Tex. Filed March 12, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

541,460. Electric-Arc Lamp. Albert W. Smith, Washington, D. C. Filed April 25, 1895.

541,491. Repairing Incandescent Lamps. Joseph Mohrle, Munich, Germany. Filed Jan. 25, 1895.

541,541. Carbon Electrode for Electric-Arc Lamps. Salomon Heimann, New York, N. Y., assignor to Leopold Katzenstein, same place. Filed Oct. 5, 1894.

541,603. Electric-Arc Light. Edgar A. Edwards, Cincinnati, Ohio. Filed Sept. 19, 1894.

DYNAMO ELECTRIC MACHINERY.

541,500. Electrical Controller for Motors. Oscar H. Pieper and Alphonse F. Pieper, San Jose, Cal. Filed April 30, 1894.

541,542. Automatic-Working Rheostat for Starting Electric Motors. Frank E. Herdman, Winnetka, Ill. Filed Nov. 24, 1894.

541,543. Automatic-Working Rheostat for Starting Electric Motors. Frank E. Herdman, Winnetka, Ill. Filed Nov. 24, 1894.

541,5[illegible]. Electric Motor. Frank E. Herdman, Winnetka, Ill. Filed Nov. 27, 1894.

541,5[illegible]5. Electric Brake-Controller. Frank E. Herdman, Winnetka, Ill. Filed Dec. 18, 1894.

541,604. Alternating-Current Motor. Rudolf Eickemeyer, Yonkers, N. Y. Filed Sept. 23, 1891.

541,615. Transmission of Power by Alternating Currents. Fred. S. Hunting, Fort Wayne, Ind. Filed Jan. 19, 1895.

541,641. Electric Motor. William J. Still, Toronto, Canada, assignor to Charles Riordon, same place. Filed Aug. 9, 1894.

541,798. Device for Removing Resistances in Starting Electric Elevators. George H. Whittingham, Baltimore, Md., assignor to the Automatic Switch Company of Baltimore City, of Maryland. Filed May 24, 1894. Renewed Feb. 18, 1895.

MISCELLANEOUS.

541,459. Combined Insulator and Fuse-Holder. Charles F. Scott and Harry P. Davis, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, same place. Filed July 16, 1894.

541,465. Electrolytical Process and Apparatus. Claude T. J. Vautin, London, England. Filed June 26, 1894.

541,467. Method of Preventing Electrolysis of Pipes Under Ground. Harold P. Brown, New York, N. Y. Filed Dec. 10, 1894.

541,471. Electromagnet. Fred B. Corey, Boston, Mass. Filed April 15, 1895.

541,497. Electric-Elevator Apparatus. Francis B. Perkins, Boston, Mass., assignor to the National Company, Chicago, Ill. Filed Dec. 15, 1892.

541,50 . Code Signaling Device. William Rymer, Detroit, Mich. Filed July 2, 1894.

541,549. Automatic Electric Gas-Lighter. William N. Jaskey and Edward S. Else, Logan, Utah. Filed Aug. 20, 1894.

541,552. Protector-Casing for Underground Electric Conductors. John A. Kingdon, London, England. Filed Aug. 9, 1894.

54 ,608. Electric Switch. William P. Hancock, Everett, Mass. Filed Feb. 7, 1895.

541,719. Burglar-Alarm. Charles M. Clark, New York, N. Y. Filed April 12, 1895.

54 ,723. Electric Gas-Lighter. John L. Creveling, New York, N. Y. Filed Jan. 21, 1895.

541,724. Thermo-Controlled Electrical Heater. Levitt E. Coster, Dayton, Ohio. Filed Dec. 22, 1894.

DESIGN.

24,427. Casing for Electric Controllers. Jonathan P. B. Fiske, Alliance, Ohio. Filed Jan. 10, 1895. Term of patent 7 years.

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EDITORIAL NOTES.

Electric Power in Factories and Mills. The paper of Messrs. Crocker, Benedikt and Ormsbee on this subject, the first portion of which we published last week, has an extreme educational value in this, that there is therein tabulated the results of actual practice, apparently very carefully worked out and presented in a form convenient for reference. Such a paper is of no less value to the practising engineer than to the manufacturer who is contemplating the equipment of a new factory, for the figures given will serve as a precedent upon which to base future economies in similar and allied installations. We well remember how, in the earlier days, before such economies had been demonstrated, and when actual figures were scarcely attainable, with what incredulity even conservative estimates of the economies that would result from a substitution of electric motors for systems of belts, shaftings and pulleys was received. The writer was called upon in 1890 to make such a report for a very large industrial establishment in the West. This establishment covered several acres of ground and comprised some half dozen separate buildings to which power was delivered. There was a somewhat centrally located steam generating plant from which steam was carried in underground conduits to separate steam engines in the different buildings, and from them the power was distributed by long lines of shafting and belting to the different machines in the same building, and in some cases to machines in the smaller outlying buildings. There were two lines of shafting, exceeding 300 feet in length each, and numerous others of shorter length, and much of the heaviest work was of an intermittent character. The conditions favorable to the substitution of electricity were very pronounced, but our duty was to give the probable economies a numerical value.

A careful determination of the condensation losses in the steam transmission, the indication of the engines, an approximate determination of the belt and shafting losses, and a consideration of the effect of the intermittent character of the various loads, together with a reference to the company's books as to the actual cost of its then service, led us to believe that with the proposed substitution the operating expenses of the whole establishment chargeable to power account would be reduced by 30 per cent. According to our most careful calculations there was still a considerable margin of safety, and we felt fully justified in making this report. Although subsequent events have fully demonstrated the conservatism of our report, it is noteworthy that one of our largest manufacturers of electrical machinery, although they sent one of their own experts to verify our report, refused to guarantee any economy and lost the contract simply because of the absence of such data at that time as are presented in the paper under review. This company *believed* that our report was conservative, but lacked the courage of their convictions which such experimental data as we now have would have supplied.

A better knowledge of the actual power consumed by a tool such as is here given, and an appreciation of the effect of intermittence of action of the various machines upon the load factor of the establishment, will doubtless conduce to the much wider introduction of the electric motor than it has hitherto enjoyed. An appreciation of these facts, too, may lead to more satisfactory arrangements with central power stations by which both the producer and user of power may be ultimately benefited.

It is a noteworthy fact that most of those using power even in considerable quantities have a very exaggerated idea of the amount they are actually using. We know of power companies in the West that are making money, and benefiting their customers too, by undertaking to operate by electrical means, for a lump sum less than the proprietors have been operating them for, the establishments which they seek as customers. The method of doing business is something like this: An agent who appreciates the facts brought out in the paper under review goes to an establishment and looks it carefully over. From his knowledge of machinery he knows that if everything is put in good order 100 H. P. on an average will operate the whole shop. He finds a maze of belts and line shafting, the latter perhaps out of true. The engine, a 200 H. P. unit, itself perhaps out of alignment and rickety, is barely able at full load to turn a wheel. He asks the proprietor what power he requires to run his establishment, and is answered that 200 H. P. is barely enough, and it costs him, he says, $100 per H. P. or $20,000 per year for power to run it. The agent then makes a proposition something like this: "If you will put your machinery in order, or let me do it for you at your expense, I will supply you 200 H. P., or enough to run your establishment, for $75 per H. P." The proposition is accepted, and both the power company and the customer are benefited—the customer, because he gets the same net power for $15,000 that formerly cost him $20,000, and the power company because it gets $15,000 for what the establishment really needs, which seldom exceeds 100 H. P.

The figures here given may illustrate an exaggerated case, but the principle will hold good in many cases, especially where smaller units are employed, and we believe that herein is indicated a profitable course to pursue for our central lighting stations who desire to keep their machinery profitably employed during the daylight hours. The present method of charging for power at lighting meter rates is almost prohibitory. If half an ampere hour is charged for at 1 cent, a H. P. hour costs 18 cents. For 8 hours a day and 300 days the bill would be over $300 per year per H. P. Even those using very small units can generate power locally by steam at but a fraction of this, and only those who do not care to go to the expense and trouble of installing a steam or gas engine become purchasers at all. But among these smaller users of power doubtless there are few who can generate it at less than $100 per annum. Would it not be policy for the central station man, after looking over such establishments, to offer to supply them for a stipulated sum based upon what it has previously cost the establishment to produce it locally? In many cases contracts could doubtless be made at a lower price than it could be locally generated for, on the condition that the power supply should be cut off during the hours of maximum lighting load.

We believe that some such plan might prove highly beneficial, both to the producer and the consumer, and is well worth trying at any rate.

* * *

The Print You Stole, oh Stevie Cole. *Electric Power*, through the personality of its staff, Messrs. Foster, Osterburgh and Davis, concocted and carried out a most brilliant scheme at Niagara by which it was hoped to add materially to its already large list of subscribers. This scheme was to have a large group picture taken of the members of the Institute present on this memorable occasion, and to offer copies of it as a premium for new subscribers. The whole thing was done at its own expense. The picture was unusually good, many new subscribers were obtained on the spot with cash down, and the negative brought to New York on Friday night for printing. But Mr. Coles left Niagara the day before, and in the next issue of the *Review* there appeared a half-tone reproduction of this same picture—some days in advance of the issuance by *Electric Power* of its own copies. Messrs. Foster, Osterburgh and Davis regard this anticipation as ——, and they are too full for utterance. "Electricus," however, comes to their assistance in a pretty but reproachful poem which appears in another column.

* * *

Financiering or Swindling? There appeared in last Sunday's *Mercury* a page or so of interesting matter in regard to the General Electric Company, accompanied by a cartoon which, while conceived in a fine sense of humor, will not be considered funny by the widows and orphans and small shopkeepers of New England who have lost their little all by investing in the local electric lighting and railway securities with which the T.-H. and G. E. Companies flooded every financial institution in that section. One half of this cartoon represents a street car drawn by a pair of mules in the street of the hamlet of Sleepy Hollow. On the scene is a G. E. promoter telling the owner of the road how to get rich, to wit: by adopting electricity and bonding his road—"We will float the bonds." Next is a forlorn farmer, resting on his hoe for a moment while the trolley car from Sleepy Hollow to Never-make-a-city passes through his fields. The query is raised, Who pays for it?

This is the query which was raised by every thoughtful man in this business when the great financial scheme of Mr. C. A. Coffin first became conspicuous, when it became almost impossible for conservatively managed concerns to sell apparatus on a cash basis, even at a price 20 per cent. lower than that obtained by the T.-H. schemers, who took bonds in return—who not only took bonds but who begged for bonds, who preferred bonds to cash, who would take bonds on anything, and who were advised by Mr. Coffin that he could sell any kind of bonds, in any quantity, if they did not cost more than 60.

Mr. Coffin's answer to the query was always about in this strain: "These bonds have 15 to 20 years to run, and many things can happen in that time. I expect the wonderful development in the business to pull us through."

We do not think he expected anything of the kind. He no doubt *did* expect the scheme to last a little longer. He hoped, of course, that the roads financed would at least pay interest on their bonds until such time as he was safely out of the way. He was, however, actuated by no higher motive than the burglar or the bank thief, who knows the enormity and the penalty of his crimes but who always hopes to escape detection.

While the cartoon to which we have referred was intended for ridicule, it represents (barring poor artistic work) just exactly the scheme which Mr. Coffin carried into effect, and which he was weak-minded enough to suppose could last for ten or fifteen years.

In the last annual report of the G. E. Company there appears a complete list of the company's holdings in various local properties to which the Coffinesque scheme of financiering was applied. The list is a long one. We have taken from it *every street railway* property mentioned, investigated the status of the various companies, and present the tabulated results for the consideration of the public. Part only of the total issue of these local securities is held by the G. E. Company, the rest having been transferred to the various financiering companies, and many millions at par value have been unloaded upon ignorant and trustful investors in New England and elsewhere who had no suspicion that the former Quaker leader would turn into a cold-blooded and calculating swindler in less than ten years.

We are preparing now a similar statement of the lighting companies, and it is already apparent that the showing made by the railway companies is not at all an unfair standard by which to judge the entire financiering plan. Its results have been the same to whatever business applied. Indeed it could not have been otherwise. There are laws of health which no man can ignore without paying the penalty, and there are just as certainly laws of business which no corporation can violate without suffering the sure punishment.

The casual reader may suppose that this woful result could not have been foreseen. This is not the truth. Not one week passed after Mr. Coffin's scheme was launched but he was warned of the inevitable end. Whatever the public or the local street railway people themselves may have thought of the possibilities of the application of electricity, the sound men in this trade early knew the limitations as to economy in operation, and it took no wise man to know that where there were no people there could be no fares collected.

No man in the trade *knew* more about this than C. A. Coffin. He had made a study of the subject.

Fortunately, ELECTRICITY's deductions from the table submitted, and from the other well-known results of the infamous plan, are not without the support of the highest authority on street railway finances and capitalization. In his recent book, "Street Railway Investments," Mr. E. E. Higgins, who has perhaps given the subject more attention than any other man in the country, lays down a few general laws as to capitalization and the possibilities of success, which are worthy of full credence, except that Mr. Higgins has erred on the side of liberality towards the railway companies. We will make a few comparisons of the Coffinesque scheme of capitalization with the laws which have been found by examining hundreds of street railway properties to be safe. Our readers can carry the comparison to every railway property in the G. E. list, and they will find that *every single system was capitalized from 100 to 900 per cent. above what it should have been.*

Considering cities of 15,000 to 25,000 inhabitants, the author, while admitting that an occasional system is apparently profitable, says:

"When we remember that the charges for maintenance will increase from year to year as the new track and equipment wear out in service, and when we realize how small is the total of net earnings, we cannot but fear that the latter will dwindle to the point of disappearance."

And further:

"None of the securities are worth the consideration of investments of other than local capitalists, who may be able to give personal time and care to the management of the properties."

Out of the forty properties in the G. E. list part of the securities of which have been foisted upon the public and part upon the G. E. stockholders by the perfidious management as assets, twenty-one are in towns of less than 25,000 people—overcapitalized and worthless at best.

For towns of from 25,000 to 35,000 people Mr. Higgins finds that the limit of capitalization warranted is $12.50 per capita. This would allow for the Little Rock system a capitalization of $322,500 instead of the $800,000 placed upon it on Mr. Coffin's advice, and for Pueblo $306,250 instead of the $1,200,000 under which it was wrecked.

In towns of 35,000 to 50,000 the allowance is $15 per capita, giving the Los Angeles road $750,000 against its present burden of $9,000,000. No wonder it is in the hands of a receiver, and that every purchaser of the securities has lost nearly all of his investment

In larger cities it is found that from $15 to $25 per capita is reasonable. This basis would have given to the Rochester system $3,345,000 against its present bonded debt of $5,000,000 and $4,121,500 of stock, or over $9,000,000, all told.

Can the purchasers of such securities as appear in this list realize the situation, see how they have been duped, without a feeling of resentment? Is it any wonder that a journal like ELECTRICITY, in its endeavor to be true to the best interests of the trade it represents, inveighs against the conduct of our large manufacturing companies and against those responsible for the policy of those companies?

The wonder is that those who have committed these crimes are still allowed to appear in association with men who value their reputations as representative business men.

To show the desperation and thoroughness with which this scheme of floating worthless bonds was worked, it is only necessary to say that in the proscribed list of cities between 15,000 and 25,000 in population—91 in number—81 have been supplied with street railway systems, and 80 per cent. of the total mileage is electric; of the 35 cities between 25,000 and 35,000, all have systems, and 75 per cent. of the mileage is electric.

The full results of the swindling scheme are not yet apparent, but no man can give careful attention to it without reaching the conviction that every railroad property financed by the T.-H. or G. E. Company must ultimately end in a receivership, a scaling down of the capital, and in infinite loss to the unfortunate dupes who were misled into purchasing the securities; further, that the financing companies are themselves built upon a watery foundation, *and must fail*; that the G. E. Company itself is driving with absolute certainty to a disastrous and disgraceful wreck, and that no power known to the commercial world can save it.

Of the forty roads in the table compiled, one has not been discovered—the Alamo Electric Street Railway Company. Mr. F. P. Fish says it is in San Antonio, and perhaps it is. No record of it, however, is found in any of our books of statistics, and a gentleman in San Antonio writes us he never heard of it. Twenty-six are in the hands of receivers, or have defaulted and escaped a receivership temporarily.

Of the total mileage of the roads listed 764 miles are in the hands of receivers against 214 of solvent companies. The capitalization of the bankrupt properties is $78,[illegible]46,00[illegible] and of those which have so far averted a confession of insolvency $18,673,500.

The record is a black one, and is without one palliative feature. It is exceeded in magnitude in the case of steam roads, but not in baseness.

Justice moves slowly, but those responsible for the sale of these millions of spurious securities, with the consequent depreciations and sufferings entailed upon innocent purchasers, can not escape.

ELECTRICITY will not rest until they are driven from the electrical field in disgrace, their places filled by men who will labor for different ends.

Under the Searchlight.

Views and Opinions on Timely Topics.

A LAW went into effect in Illinois on July 1 requiring companies incorporated after that date to pay a tax on their full capitalization, whether resting upon money, patents, wind or water. Among the new and promising enterprises which hastened to secure incorporation papers the last week before the law took effect were the following:

Name.	Capitalization.
Inter-Ocean Electric Railway Company	$200,000,000
Chicago Giant Electric Motor Company	15 ,000,000
Cosmelectric Company	10,000 000
Elliott Magnetic Electric Company	1,000,000
Chenoa Electric Light and Power Company	15,000

We advise Chicago investors to put their money into the latter concern in preference to the others.

* * *

THE first number of Prof. Barrett's journal bore on the title page the inscription: "J. Allan Hornsby, M. D., Managing Editor." In the second issue the M. D. is omitted. Why? We understand that the erudite Doctor received his degree from the St. Louis Medical College, and he should not be ashamed of it.

* * *

Well Treated Abroad.

Frank Mason Will be a Major-General When He Returns.

(From the N. Y. World.)

London, July 6.—Capt. Mason, who has charge of the police telegraph system at Brooklyn, N. Y., has been having a good time in London. The officers of Scotland Yard have extended him every courtesy.

* * *

WE HAVE received many requests from constituents to publish further particulars in regard to Prof. John Poo-Bah Barrett's career, and as to his connection with various companies selling supplies to the city of Chicago—transactions in which he is said to figure on both sides. We are advised, however, that he is soon to be deposed from his official position, which will remove any interest that now attaches to him as a public man. We suppose we may look for a new book soon after his retirement, or a serial in the *Electrical Journal*, entitled "Reminiscences of a Fireman-Electrician, or The Difference Between Running Wid de Machine and Traveling Wid de Gang."

* * *

The Print You Stole, oh Stevie Cole.

Oh give us back that photograph,
  Said Foster—Oster—Davis;
It is a sin, though you do laugh,
  So give it back and save us—
The print you stole, oh Stevie Cole.[*]

We laid our plans to have it go
  To all our old subscribers,
To gain some new ones, too; also
  To please our advertisers—
The print you stole, oh Stevie Cole.

Our plans are now, alas, upset—
  We owe it all to you—
The photograph *we* paid to get
  Was *scooped* by the *Review*—
The one you stole, oh Stevie Cole.

And Stevie Cole, God shrive your soul,
  And may the Lord forgive us!
We'll yet get square for what you stole,
  Said Foster—Oster—Divvus,
Whose print you stole, oh Stevie Cole.

"ELECTRICUS."

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[*] This is poetic license. The word is by right plural. While it would not be quoting properly to say "carry *coal* to Newcastle," it is claimed by Foster—Oster—Davis that it would be equally proper to "carry Cole to Sing-Sing" as to "carry Coles to Sing Sing." The poet prefers to use the singular, since it rhymes better with stole.

* * *

THE appointment of a receiver for the Schuyler Electric Manufacturing Company ought to result in exposing fully the recent attempts of the G. E people to freeze out the minority stockholders of the Middletown concern. The G. E. Company owns $3[illegible]1,930 of securities in the Manufacturing Company and $50,000 in the Schuyler Electric Company.

* * *

Great Men Agree.

(From the Mail and Express.)

Will it (electricity) drive the locomotive into the round house for the last time, to be broken up and sold for old metal, and are we now listening to the last shrieks of the iron horse, soon to be superseded by the strange-voiced steed of some higher civilization?

Mr. Westinghouse will tell you he thinks so. Russell Sage, who has built a score of railroads, will agree with him. So will T. Commerford Martin, Joseph Wetzler and nearly all other electrical experts of the country.

* * *

WE ARE told that some of the gentlemen importing foreign carbons are *escaping payment of proper duty* through undervaluations. They are not wise. ELECTRICITY'S Searchlight is now turned on the New York Custom House. The penalty is a severe one, and the fine for one offense may easily wipe out the profits of a year's business. Besides, carbons good enough for any service are now made in this country, and ELECTRICITY believes in patronizing home industry.

* * *

ELECTRICITY has an esteemed contemporary in Electricity sired by Electioneer, dam Midnight, and who has made a record of 2:17¾. This was fast time once, but if our namesake does not want to be disowned by us he will need to knock just 12 seconds off his record, and even then he will be several seconds slower than we are.

* * *

The Louisiana Light Company Matter.

(From the Picayune.)

The charges of fraud which were so liberally interspersed in the petitions of complainants receive but little attention at the hands of the court. The Judge admits that there are matters unexplained which have left on his mind impressions that there may have been mismanagement or acts in which some of the active directors represented more their own individual interests than those of the company, and were ultra vires, but the impression was evidently not sufficient to warrant an investigation, for none was made, and it may be considered a victory for the Electric Light Company.

Results of Thomson-Houston and General Electric Financing of Railroad Properties.

STREET RAILWAY COMPANY.	Place.	Population.	Miles Track	Cars.	Capital Stock.	Funded Debt	IN HANDS OF RECEIVER.
Alamo Electric Street Railway Company	San Antonio, Tex.	50	....	....	$ 0 000	.....	ROAD NOT DISCOVERED.
Amsterdam Street Railway Company	Amsterdam, N. Y.	17,300	7.51	10 m., 4 tr.	250,000	$ 00,000	
City Electric Street Railway Company	Little Rock, Ark.	25,800	0	20 h., 23 m., 20 tr.	500 000	800,000	RECEIVER
Dubuque Light and Traction Company	Dubuque, Ia.	30,300	14	18 m., 8 tr.	0 ,000	485,000	RECEIVER.
Elgin City Railway Company	Elgin, Ill.	17, 00	13	13 m., 9 tr.	250,000	186 000	
Fairhaven and New Whatcom (Wash.) Railway Company	Fairhaven & Whatcomb.	8,000	18.5	16 m.	600,000	287 000	
Fort Clark Street Railway Company	Peoria, Ill.	41,000	14	14 m., 20 tr.	250,000	250,000	RECEIVER.
Macon Consolidated Street Railroad Company	Macon, Ga.	22,700	25.75	21 m., 16 tr.	500 000	00,000	RECEIVER.
Metropolitan Street Railway Company	Macon, Ga.	....	....	....	10 ,000	60,000	DEFAULTED.
Ottawa Electric Street Railway Company	Ottawa, Ill.	9 9 0	8	8 m., 4 tr.	100,000	75,000	RECEIVER—Ceased operations.
Overland Railway Company	Nashville, Tenn.	76,100	11	8 m., 10 tr.	10, 00	1 5,000	RECEIVER.
Oxford Lake Line	Anniston, Ala.	9,900	7.5	6 m., 2 tr	175,000	175,0 0	
Pueblo City Railway Company	Pueblo, Col.	24,500	25	21 m., 16 tr.	00 000	500,000 1st 20 ,000 2d	RECEIVER.
Queen City Electric Railway Company	Marion, Ind.	8,700	5	11 m., 2 tr.	180 000	1 0, 00	RECEIVER.
Queen City Railway Company	Dallas, Tex.	33,000	10	18 m.	400,000	350,000	RECEIVER.
Syracuse Consolidated Street Railway Company	Syracuse, N. Y.	88,100	31.75	29 m., 63 bx., 21 op.	1,250,000	1,2 0,000	RECEIVER.
Tacoma Railway and Motor Company	Tacoma, Wash.	36, 00	48	26 m., 5 g.	750 000	1, 00,0 0	RECEIVER.
Twin City General Electric Company	Ironwood, Mich.	7, 00	5 5	4 m	75 000	2 ,000	
Union Street Railway Company	Dover, N. H.	12,700	11	11 m., tr.	150,000	100 000	RECEIVER
Utica Belt Line Street Railroad Company	Utica, N. Y.	44,000	23	32 m., 22 tr.	1 0 000 c. 183 000 p	50 ,000 200,000	RECEIVER
Vancouver Electric Railway and Light Company	Vancouver, B. C.	3,500	7.5	9 m., 1 tr.	800 000	800,000	
Atlanta Consolidated Street Railway Company	Atlanta, Ga.	65 500	63.805	87 m., 10 tr.	2 000 000	,1 , 00	DEFAULTED
Brooklyn Heights Railroad Co. and leased companies	Brooklyn, N. Y.	806, 0	245.2	421 m., 109 tr., 2 0 h.	14,20 ,000	18, 1 ,0	RECEIVER
Chattanooga Electric Railway Company	Chattanooga, Tenn.	29,100	32	30 m., 10 tr.	1,500 000	1,200,000	RECEIVER
Crescent City Railroad Company	New Orleans, La.	242,000	36	....	2,000,000	,465,000	
Hoosac Valley Street Railway Company	North Adams, Mass.	16,000	6	7 m., 6 tr.	0 000	50,000	
Knoxville Street Railroad Company	Knoxville, Tenn.	22,500	17	12 m., 11 tr.	00,000	3 0,000	RECEIVER.
Los Angeles Consolidated Electric Railway Company	Los Angeles, Cal.	50,200	104	4 h., 65 m., 0 p., 0 g.	6,000,000	3,000,000	RECEIVER.
Madison City Railway Company	Madison, Wis.	13,400	8	9 m., 4 tr.	100,000	15 ,000	RECEIVER.
Milwaukee Street Railway Company	Milwaukee, Wis.	01,400	....	115 g.	5,000,000	12,275,000	RECEIVER.
Petersburg Street Railway Company	Petersburg, Va.	2 ,100	3.25	10 m., 2 h.	100,000	100,000	RECEIVER.
Rainier Power and Railway Company	Seattle, Wash.	42,800	8	4 m., 8 tr.	2 0,000	1 0,000	RECEIVER.
Rochester Railway Company	Rochester, N. Y.	13 ,800	77.45	1 1 m., 60 tr.	5,000,000	4,121,5 0	
San Francisco and San Mateo Railway Company	San Mateo, Cal.	1,000	27	37 m.	2 00 ,000	1, 0 ,00	RECEIVER.
Sea Shore Electric Railway Company	Asbury Park, N. J.	4,000	8.25	6 m.	00,000	0 ,000	
Steubenville Street Railway Company	Steubenville, O.	13,300	2.5	5 m.	75,000	50,000	RECEIVER—Road sold
St. Cloud City Street Car Company	St. Cloud, Minn.	7,000	10	8 m.	100,000	12 , 0	
Trumbull Electric Railway Company	Warren and Niles, O.	0,100	7	8 m.	1 0 000	69,000	
West Street and North End Railway Company	Seattle, Wash.	42,800	10	18 m., 1 tr.	1,000 000	3 0,0 0	
Winona General Electric Company	Winona, Minn.	18,000	4	7 m.	1 0 000	00,000	RECEIVER.

LEGAL NOTES.

The sheriff has received an execution for $6,483 against the Lawrence Electric Company, of No. 130 Pearl street, New York, in favor of William Lawrence. F. H. Mollenhauer has obtained a judgment for $1,041 against the company.

In the case of the Millville Traction Company *vs.* Goodwin *et al.*, restraining the defendants from interfering with or obstructing the running of the street cars of the company, Vice-Chancellor Bird, at Trenton, N. J., has filed a decision, ruling that the defendants had no right to obstruct or interfere with the running of the cars. The defendants attempted to move a two and a half story frame house across the street occupied by the traction company, and for 111 feet along it. This would necessitate the cutting of the wires and the stoppage of cars on the street for several hours. There was a great deal of local excitement caused by the affair at the time, and the authorities had to disperse mobs of rioters at the scene several times.

The Postal Telegraph Company obtained control of the main line of the unsuccessful United Lines Telegraph Company, between New York and Washington, which was covered by mortgages of over $1,800,000. Last November the United Lines was sold, but only $300,000 was realized. On the 3d inst. a deficiency judgment for $1,559,886 was recorded against the company in favor of the Farmers' Loan and Trust Company, trustee for John W. Mackay and his associates, who were bondholders. The United Lines Company will now be absorbed by the Postal Telegraph Company.

The General Term of the Supreme Court has rendered a decision in an action brought by Franz Herz enjoining the distribution of $500,000 of gold debenture bonds issued by the Interior Conduit and Insulation Company.

O. S. Platt vs. Bryant Electric Company.

A temporary injunction has been issued against the Bryant Electric Company of Bridgeport in an action brought by O. S. Platt claiming infringement of various patents on switches.

A New Electrical Phenomenon.

The study of crystallization has provided its devotees with many beautiful effects, not to say delightful surprises, and although our knowledge in this direction is not very extensive, every year large accumulations are made to it, especially to that branch known as crystallography. Now amongst those effects which we have referred to as beautiful is the following: At the moment of crystal-forming, some substances emit a flash of light. This can be demonstrated easily. For example, let a glass cylinder be half filled with warm saturated sodium chloride solution, and into it let there be poured an equal quantity of hydrochloric acid (sp. gr. 1.12); then let the solutions be well mixed by stirring with a glass rod, when a bluish-green light will pervade the whole cylinder. Or the two liquids having been carefully poured in so that the one is superimposed upon the other, let the cylinder be suddenly and strongly shaken, when a flash of light will occur. Alcohol may be used in place of the acid, and similar effects may be obtained by the use of potassium chloride or bromide, instead of the sodium salts. So much for the way of producing the phenomenon. Hitherto no one has said much more regarding it than that it is very beautiful and interesting—an obvious sort of conclusion which has at least the merit of being a safe one. But now we find E. Bandrowski coming forward with a theory which, if unassailable, will place this phenomenon in that ever increasing category of what we style "new electrical phenomena." He considers that the light emitted during crystallization is electrical, and is due to the union of electrified ions. If this is true, the light should be more marked in the sudden crystallization of strongly dissociated compounds. And this appears to be the case. —*Electrical Review*, London.

THE SUBSTITUTION OF ELECTRICITY FOR STEAM IN RAILWAY PRACTICE—II.*

BY DR. LOUIS DUNCAN.

THE BALTIMORE BELT LINE TUNNEL EQUIPMENT.

The General Electric Company was confident enough of its ability to successfully equip the road to make a contract with the Baltimore and Ohio Company to haul its trains over the Belt Line, the contract being dependent upon the successful operation of the plant. The total length of the line equipped is about three miles, the extension beyond the tunnel being for the purpose of assisting the freight locomotives to haul their trains up the one and one half per cent. grade on the line beyond the tunnel. There are to be three locomotives and it is calculated that the traffic can ordinarily be handled by two of them. The steam engines are not to be taken off the trains, but hauled through the tunnel by the electric locomotive which switches off at the terminus of the line. To operate these machines a station has been erected which contains 3,000 H. P. of electric generators, and an overhead line has been equipped to transmit current to the locomotives. With respect to the station itself there is little that is novel. There are four 750 H. P. Allis-Corliss engines directly coupled to generators of the same capacity, the generators having a voltage of 600 at no load and 700 at full load. Foundations have been partly erected for a fifth unit in case it is found necessary. The building also contains the lighting plant, having a capacity for 400 arc lights and 4,000 16 C. P. incandescent lights. Provision has also been made for an extension to this lighting plant when the stations for the belt line are erected. There are two incandescent machines and one of them will be used to supply the 1,000 32 C. P. lamps which have been installed in the tunnel. Perhaps the most novel feature of the plant is the overhead structure which is employed. The conditions to be met were peculiarly difficult, and the ordinary under-running trolley was considered impracticable. The tunnel is very low in places and the management of the road decided that the conductors could not be placed in the middle of the tunnel between the tracks. Outside of the tunnel the conductor is still between the tracks, but is elevated to a height of 22 feet, while inside the tunnel it is only 17 feet from the top of the rail. The conductor consists of an iron trough made of two Z bars riveted to a cover plate 12 inches wide, leaving a slot one inch wide between the Z bars. In the tunnel this trough is supported from transverse channel bars secured to expansion bolts which are fastened from the top of the tunnel. There is a double insulation, one porcelain insulator being between the channel bars and another between the channel bars and the expansion bolt. Outside the tunnel the trough is supported as follows: At distances of 150 feet light iron columns with cross trusses are erected, and between these trusses are hung catenaries supplied with a number of suspension bolts. Transverse channels similar to those used in the tunnel are fastened to these bolts and the trough is fastened to the channels. The Z bars are made in lengths of 30 feet, the opposite bars breaking the joints with one another, the lengths being riveted together and then bonded with "Chicago" rail bonds. Suspended on the same transverse beams as the trough are three copper cables of 1,000,000 centimeters area, which serve as feed wires which are connected at intervals with a trough, there being of course one trough for each track. For the return circuit the tracks are bonded as in ordinary railroad work, there being cross bars and at intervals connections with a copper cable of 1,000,000 centimeters area varied in a wooden trough between the tracks. The contact arrangement that is to be used consists of a brass shoe travelling in the trough and connected with a locomotive with a flexible sawbuck arrangement which has a very considerable range in every direction. The current is transmitted to the motors by a copper cable, and in case of the shoe sticking in the trough, a safety pin is arranged to break with any desired strain. Where switches are used there is a tongue worked by the lever which operates the track switch, and which serves to direct the shoe. This structure, although exceedingly massive and expensive, promises to give an excellent contact at all times, and it requires no care from the motorman.

The locomotives are the most massive in the history of either steam or electrical transportation, and the weight, which amounts to 95 tons, is on eight driving wheels, so that the full tractive power of the locomotive will be developed. On each axle there is sleeved a six-pole motor, there being considerable play between the axle and the sleeve, which latter is spring supported from the frame. In this way any heavy blow due to irregularity in the track is taken through the springs, and the wear both of the track and locomotive is reduced. On the armature shaft are projecting arms which move between lugs cast on the wheels, thus allowing the necessary relative motion between the axle and armature.

The situation in the Baltimore Belt Line is this: The station is completed and is being operated daily. One of the locomotives is on the ground, set up and ready to run,* the overhead work is finished with the exception of a short length which was interfered with by a temporary bridge over a cut. The latter has been removed.

If this equipment proves successful it will open a limited but important field for the introduction of large electric locomotives. There are in the United States a number of tunnels, whose operation is anything but satisfactory at present, which can be equipped as the Baltimore tunnel is equipped. Several of them have the additional advantage that they are near the switching yards of the roads, and the same plant could be used for hauling trains through the tunnels and for switching, and not only would the economy of the station be increased, but the substitution of electric for steam switching engines would result in a very considerable saving.

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* From Dr. Duncan's inaugural address to the American Institute of Electrical Engineers, Niagara Falls, June 25, 1895.

* Operated June 27.

Advice to the "Electrical Engineer."

(From the Pacific Electrician.)

ELECTRICITY has called on the *Electrical Engineer* to point out its power plants where electricity is transmitted a distance of twenty miles or over, for both power and lighting purposes. If the *Engineer* will write to the *Lassen County Advocate* at Susanville, Cal., and secure the address of its expert, it may get the information it needs.

Mr. Thomas, the man who has the aerial railway that was invented by a blind man, proposes to construct an electric road, strung on wires from the top of Grizzly Peak to Goat Island.

Probably he will plant an Emme battery on Goat Island, and a Feltz battery on Grizzly Peak, and the resulting excitement (among the stockholders) will create enough energy to operate his cars at a speed of 100 miles an hour. Mr. Thomas's desire to get to the top of Grizzly Peak, and in such fast time, is supposed to be due to the fact that Mr. John Chetwood, a San Francisco attorney, is after him with a judgment of robust dimensions.

NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT.*

BY FRANKLIN L. POPE.

The distribution of rainfall throughout the year should be studied. It is often materially modified by local geographical conditions. The diagram shows that the distribution on the headwaters of the Housatonic is quite different from the normal type of the northeastern region. The same may be true of other rivers

While this investigation was going on, it was discovered that actual measurements of the volume of water in the Housatonic had been made in 1873 by the engineers of the New York Department of Public Works, with reference to its utilization as a future source of water supply for that city. The minimum summer flow was found to be (as given in the engineer's report), 0.34 C. F. per second per square mile. It was also learned that measurements made on several different occasions at Birmingham, Conn., in very low stages of water, gave an average of 0.32 C. F. per second per square mile. It was therefore assumed that Mr. Fanning's estimates were at least on the same side. The greater volume water found by the actual measurements is doubtless due to the fact that there are some 5 or 6 square miles of reservoirs, consisting of natural and artificial lakes, on the upper waters of the Housatonic, which are drawn upon by the numerous mills on the river as an extra supply during the season of drought.

A minimum flow of 0.25 per second per square mile would give at Glendale, 4,035 C. F. per minute. Multiplying this by the weight of a C. F. of water (63.3 lbs.) gives 255,415 foot pounds which, divided by 33,000 gives 7.74 gross horsepower per foot of fall, or a total of 196 H. P. for the 13 foot fall at Glendale. The average efficiency of a good turbine may safely be taken at 75 per cent. which would give 67.9 as the available H. P. during the whole 24 hours, in time of lowest water. In electric lighting, however, the great bulk of work is done within a period of 4 hours (in summer time), and hence it is possible, in case there is sufficient area of pondage above the dam, to increase this capacity by storage at least four-fold, which would raise the limit of minimum available power during lighting hours to 271.6 H. P., an amount which was considered to be ample to meet all the probable requirements of the Great Barrington plant for many years to come.

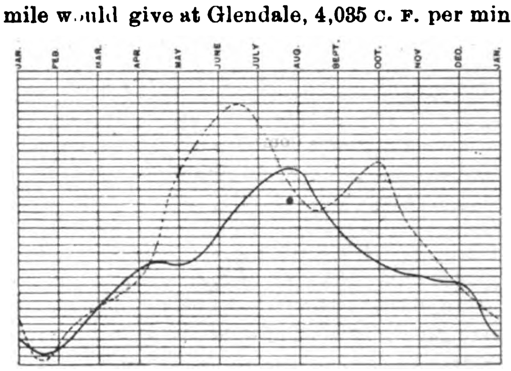

FIG. 1.—Curve of mean annual distribution of rainfall. Full line is reduced observations at Williamstown, Mass., 1816 to 1874. Dotted line is mean of all observations in the Hudson and Champlain Valleys, and Northern and Western New York, aggregate 564 years.

While negotiations were still pending with the owners of the Glendale privilege, and also the one in the village already referred to, overtures were received from a manufacturing company owning a third exceptionally desirable privilege, on the same stream, at an intermediate point considerably nearer than Glendale. This company had only recently completed a new dam, head-gates, raceways, etc., at a very considerable expense, and was willing to lease the complete establishment, including a new McCormick turbine of 325 H. P. and a two-phase Stanley generator of corresponding capacity, at a monthly rental, based upon the actual output as measured in killowatt hours at the dynamo terminals, provided that a certain minimum monthly consumption was guaranteed. With the same volume of water as at Glendale, the fall at this point was 20 feet, assuring at least 417 H. P. at lowest water during lighting hours. All the hydraulic apparatus and appointments were of the best possible construction, and well calculated to insure absolute permanency of operation.

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* A paper presented at the twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

The minimum rental required was somewhat less than the amount of the coal bill of the Great Barrington company for the preceding fiscal year, but while the immediate saving in operating expenses was not large, the acceptance of the proposition would place the company in a position to reduce its rates to consumers, for the reason that its output might be very largely increased without materially augmenting its operating expenses. A lease for a term of years was accordingly closed.

In laying out the plant it was determined to bring the main feeders directly to a distributing station in the village, to be used principally as a convenient headquarters for testing the circuits and controlling the street-lighting service. In laying out the transmission line, a surveyor was employed, and a preliminary line was run directly from the power-house to the distributing station. The air line distance was found to be 5.15 miles. With the assistance of the surveyor, the actual line was then staked out, going directly across country, and keeping as near as circumstances permitted to the transit line. About half the distance, the transit line was found to so nearly coincide with existing highways that the consent of the local authorities was obtained to set the poles along the highway location; the remainder of the route lay principally through uncultivated land of little value, so that a comparatively small expenditure was sufficient to secure a release from all claims for land-damages. This enabled the line to be located with long stretches absolutely straight, avoiding all sharp angles; a very important consideration when heavy wires are used. The poles were of selected chestnut with natural butts, usually set five feet in the ground at maximum intervals of 125 feet. The poles were ordinarily 25 feet long and 8 inches thick at the small end. Shorter poles were sometimes used on elevations and longer ones in depressions, in order to equalize the strain as much as possible. The insulators used were of the large double-bell white porcelain type (German Government standard), and were imported by us from Berlin. The insulator of the top wire is set upon a malleable iron stem 14 inches long screwed into the top of the pole which is tapered to 5 inches diameter and protected from splitting by driving on a wrought iron ring. The tapered part of the pole as well as the top was given a coating of mineral paint mixed as thick as it could be spread with a brush. The insulator of the second wire is carried on a malleable iron gooseneck screwed into a ⅝ inch hole bored in the side of the pole, in such a position as to bring the wires about 16 inches apart. Another hole was bored on the opposite side of the pole, intended to take the gooseneck of the third wire at some future time, leaving the same interval between the second and third wires. The porcelain insulators are fixed to their iron supports by a packing of oakum placed between the screw-threads, which serves to prevent any danger of breakage by expansion or contraction. The line wire is laid in a groove formed in the top of the insulator, except upon the curves and angles, in which case it is tied at the side in a circumferential groove, as is usual in this country. The German method of tying is quite complex, and unnecessarily strong; in case of undue strain, if anything gives way it had best be the tie-wire. We therefore devised a simple tie which was easily and quickly applied, and which has so far served an admirable purpose. We were obliged to string the wires during very cold weather; sometimes as cold as 8 or 10 degrees below zero, and hence it was necessary to strain them very tight. A block and fall and a well-trained horse were used in pulling up, usually six or seven spans of one wire at a time. The hook of the block was always attached to the copper wire, whether bare or insulated, with a chain-knot made of ¾ inch rope. The feeder-wires were of No. 3 B. & S. soft copper, covered with weather-proof "insulation" along the highway (as a concession to enlightened public opinion), but elsewhere bare. The lengths of wire were joined with McIntyre twisted couplings; the unusual strain we had to put upon them occasionally pulled one apart, and this led us, out of abundant caution, to solder them, although this was for mechanical rather than electrical reasons. Only two feeder wires have as yet been strung, providing for a single-phase current from one side of the two-phase generator, but it is the intention to run a third feeder hereafter, which will enable two-phase induction motors to be connected to the same distributing system.

A pair of telephone wires of No. 12 steel were strung below the feeder wires, and these were supported upon small German porcelain insulators on iron goosenecks on opposite sides of the poles. These wires were transposed at intervals of about a mile, in order to eliminate the inductive effects of the alternating current in the feeders. The feeder lines were carried under the railroad at an undergrade crossing by placing the insulators upon iron brackets leaded into stone abutments. The plan of construction above described makes a strong, handsome and durable line, while the insulation of the circuit even in the worst weather is simply faultless.[*]

The system has been planned to deliver the current at the distributing station at a uniform pressure of 2,100 volts. Two distributing centers were fixed upon in the old Edison three-wire network, and at each of these points a pair of large transformers, having a ratio of 20 : 1, were fixed upon a pole, with their respective primaries in series between a pair of branch feeders from the distributing system, and their secondaries were coupled in series in like manner with the neutral wire between them. None of the consumers on the old Edison system knew when the change had been made to the new service from anything they were able to notice in the behavior of the lights.

The next thing done was to reconstruct the street lighting system. In place of the 36 arcs of 1,500 nominal C. P. formerly in use we substituted 126 incandescent lamps of 50 volts and 32 C. P., placed in Iona fixtures projecting horizontally from the poles 14 feet above the ground. The lights, as a rule, were fixed upon every alternate pole, but in the business center, the street being broad, they were placed on each side at intervals of about 250 feet, and staggered so as not to come opposite each other. A Shallenberger shunt cut-out was applied to each lamp. The usual number of lamps in each circuit was 42, although we have since placed, in some cases, as many as 47 in one series without reducing the brilliancy of illumination sufficiently to be noticeable by anyone but an expert. One end of each street lighting circuit is joined to a special feeder leading to the sub-station, where it is connected with the main feeder through a knife-switch. The other end of each circuit is connected to any conveniently located branch feeder of the regular commercial lighting service.

Each lamp circuit has, or will have, a fuse-block and cut-out inclosed in a weather-proof box at each end, where it joins the opposite feeders. These 32 C. P. lamps, when run at full candle power, furnish a most satisfactory illumination and give the streets a very attractive appearance. So far as possible each lamp was located with the aid of a transit and level, so as to get them in absolutely straight lines both vertically and horizontally, a precaution which adds materially to the decorative effect. It is admitted by all that the streets of the town are much more satisfactorily lighted by the incandescents than they formerly were by the arc lamps, while the actual cost to the company is considerably less. The new lamps were cut-in one at a time, on the old arc wires, jumpers being temporarily placed across the terminals until everything was in readiness to discontinue the use of arc machines.

One of the most marked advantages of the series street lighting system, especially when shunt cut-outs are used, is its great flexibility and convenience. For example, instead of placing 40 to 45 50-volt lamps in one series, we may use 20 to 23 100-volt lamps, or if an odd number be required, less than is necessary to make up a circuit, the deficit may be supplied by adding extra shunt-boxes in series at any convenient point in the circuit, until the pressure has been reduced to the required point. From time to time, as new lights are added, these spare shunt-boxes are one after another brought into use in connection with them. Sometimes, also, we temporarily install extra street lights by connecting them in parallel to the secondary mains of the regular commercial service, ultimately transferring them to new series circuits.

It has been found to be desirable to use a lamp of rather low efficiency for the street lighting service, as there is always danger of leakage and short circuits from wet boughs of trees and other objects getting into contact with the wires, and thus diverting an abnormal current through some portion of a lamp circuit. In such a case a lamp of high efficiency is pretty certain to be burned out, or at least to have its career of usefulness materially abridged. In this plant the average consumption of energy in the street-lights, including lamps, lines, shunts and leakage, is found to be about 140 watts per lamp of 32 C. P.

Perhaps the most ticklish part of the whole undertaking was the changing over of the Westinghouse system, which was a 1050-volt primary and a 52-volt secondary, running at 16,500 alternations. In accordance with the new plan, it was of course necessary to double the pressure both in the primary and secondary circuits, and to substitute 104-volt for 52-volt lamps throughout. A preliminary test of one of the transformers demonstrated that which perhaps might have been foreseen from theoretical considerations, viz., that a dangerous quantity of heat was developed within a few hours when it was used to convert from 2,000 volts down to 100. In order to utilize, so far as possible, the old transformers, and at the same time avoid the above difficulty various expedients were resorted to. Wherever a group of consumers was located in one neighborhood, a pair of large transformers was installed, with secondary mains extending from 500 to 600 feet in various directions, these transformers being of course placed in series with each other. Scattering consumers as far as practicable were connected together in small groups and supplied by a pair of small transformers coupled in the same way. The Westinghouse meters, having been originally constructed for a frequency of 16,500 alternations, ran slow when the frequency was reduced to 8,000. The necessary coefficient for correction of the readings was easily ascertained by experiment, and as fast as possible the meters were fitted with new disks, supplied by the Westinghouse Company at a trifling expense, and adapted to the lower frequency.

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[*] I regret that I am unable to present any actual measurements of the insulation of the line of the Great Barrington company, no opportunity having occurred since the work was completed of making tests under atmospheric conditions of minimum insulation. Several years ago, however, while engaged in telegraphic service, I made a series of nearly 100 separate tests in rainy and foggy weather, extending over a period of five years, of a set of 10 porcelain insulators of the same make and pattern in every particular as those now on the Great Barrington line, erected on a house-top in the city and therefore much exposed to smoke and dirt. These measurements gave a mean resistance of 28.3 megohms, and a minimum resistance of 19 megohms per insulator, on a metallic circuit: therefore the minimum insulation resistance at each pole would be 38 megohms. On the Great Barrington line of 28,260 feet there are 250 poles and other supports, and hence we may assume that the minimum resistance of the insulation of the circuit as a whole would be 152,000 ohms. The current loss by leakage is found by dividing the mean voltage by the insulation resistance: $\frac{2,200}{152,000} =$ 0.014 ampere; an amount too small for serious consideration.

Of course it will be understood that the reason for resorting to these various shifts and expedients was merely that we might utilize the old apparatus as far as it could possibly be done, and also that we might carry on the work of reconstruction, for the most part, with the ordinary working force of the establishment.

The horizontal double turbine which is used to drive the two-phase generator has done such good work that it deserves a few words of commendation. The selection of the best among the many available types of turbines for electric work is a matter which merits far more consideration from a scientific standpoint than it generally receives. Water-wheels, like dynamos and motors, are sometimes sold on commission by agents, and it not infrequently happens that the salesman who makes the largest "claims," especially if he sells his goods the cheapest, carries away the contract. It needs to be said, however that there is a far greater difference than is often suspected in the amount of work different types of wheels will do with a given, and especially a limited, amount of water. There are, furthermore, a great many types of wheels in the market which, although as efficient as could be asked for with a full volume of water, are very far from being so when the volume of water is reduced, even by a comparatively small percentage. It is but just to say that it is seldom that a turbine makes so favorable a showing, not only in this but in other respects, as the one provided by the company from which we lease our power. The following figures are selected from a much larger number obtained by actual measurement of its performance in the testing-flume of the Holyoke Water-Power Company.

Head acting on wheel feet.	Revolutions per minute.	Quantity of water passing through wheel (cu.ft. per sec.)	Horse-power.	Per cent. of Efficiency.
16.6[illegible]	1[illegible]6.25	81.75	124.[illegible]0	80.99
16.80	155.00	[illegible]0.79	10[illegible].37	81.18
17.02	154.50	[illegible]8.4[illegible]	95.86	78.39
17.26	156.75	52.19	78.42	71.95
17.44	15[illegible].25	42.55	58.71	63.90

These results are worthy of particular note, for the reason that they show a very high percentage of efficiency maintained through a wide range of variation in the quantity of water passing through the wheel, a most valuable characteristic for electric work. When the quantity of water used was diminished from 81.75 to 42.55 cubic feet per second the percentage of efficiency fell only from 80.99 to 63.9, and what is even more remarkable, it was found that the efficiency remained well above 80 per cent. over a range of variation of discharge from 83.22 to 70 cubic feet per second or 15.9 per cent. More than one type of turbine which enjoys a high reputation and extensive sale among manufacturers will not reach 65 or even 60 per cent. efficiency at "three-quarters gate," while the 33" wheel above referred to has been found to give by actual test 78 per cent. under similar conditions.

The turbine carries upon its shaft a driving-pulley 100 inches in diameter, weighing 11,000 lbs., which serves as a balance-wheel. It is also provided with a Replogle electric governor operated by three cells of gravity battery, which has never failed to do its work quickly and certainly, even under trying conditions.

In carrying out this work, some things have been learned by experience which may be of use to others called upon to advise or to undertake the construction of similar works, and I will therefore venture to summarize some of my conclusions as follows:

1. In considering the advisability of operating an electric plant by water-power do not on any account neglect to ascertain from authentic sources of information just how much water can be depended upon during the low stage in an extra dry year, *for this is the measure of its value for electric work* except when used as an auxiliary to steam. The ordinary estimates of the commercial value of a water-power are only too apt to prove preposterous exaggerations.

2. If rights-of-way or releases of damages can be obtained without too much trouble and expense, it is better to build the feeder line as directly across country as may be than to follow a highway. The saving in cost of construction will usually be more than enough to pay for the right-of way, and on such a route there need be no interference from trees, while many inconvenient angles and much trouble in guying and bracing are avoided. Shorter and stouter poles may also be used, in itself a very important consideration.

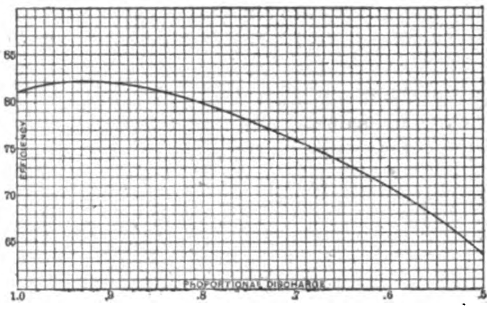

FIG. 2.—Efficiency Test of McCormick's Turbine.

3. In electric line-construction it is preferable to dispense with cross-arms unless there are more than six wires. The best arrangement is to place one wire on a top-pin and the others alternately on the front and back of the pole, at a vertical distance apart of 12 inches. This construction not only costs less than properly braced cross-arms, but is much less conspicuous and therefore much less objectionable in a public street, is less interfered with by trees, and is far more durable. Much trouble is caused by the decay of cross-arms after they have been exposed a few years to the weather; they split at the ends so that the pins come out, and not infrequently break in the middle, thus fouling the wires.

4. In medium-sized towns and cities, especially in shaded streets, the incandescent lamp may be made to give a far better distribution of light for the same money than is possible with the "half-arcs" so extensively used, and is much less troublesome to maintain in good working order. My own experience leads me to think that the lamps ought not to be of less than 24 or more than 32 candle power. Use lamps of low rather than high efficiency, but run them at full candle-power, or even a trifle above. Good street-lights, well arranged, and renewed sufficiently often, are the best possible advertisement for any electric company.

5. Use large transformers as far as practicable, placing the consumers within 500 or 600 feet radius upon secondary mains. We have used both two-wire and three-wire mains. The latter plan is certainly to be recommended when the distance approximates or exceeds 500 feet, but for a short distance, as, for example, when distributing within a single block at a pressure of 100 volts or more, it is a question whether the gain in cost of copper over the two-wire plant is of sufficient importance to offset the additional complexity.

6. It was found that raising the voltage in the residence district from 1,000 : 50 to 2,000 : 100 greatly improved the uniformity of distribution by lessening the potential drop without entailing any corresponding disadvantages. It would seem to be preferable, on every account, to use the higher pressure.

7. One of the most important minor points in the management of a plant is apt to be too much neglected—the maintenance of the insulation of the wires by promptly replacing all cracked and broken insulators, and by keeping the wires absolutely free from contact with uninsulated objects. The covered wires which lead into the hoods of the street-lamps need to be carefully looked after.

8. Number all the poles with yellow paint applied with a stencil on a black ground, and keep a record book of the position of each one and its distance by the line from the test station.

9. In selecting a turbine wheel, consult competent authority as to the available fall and minimum quantity of water, and when making the purchase do not expect to get a thousand-dollar wheel for a hundred dollars. Pay a fair price and insist, not only that the wheel shall be well made in every way, but that it shall be tested by an expert before acceptance. If it does not give an average efficiency of 76 per cent. between half-gate and full-gate, it is not advisable to accept it, inasmuch as you can easily do better, as our own experience proves.

10. I think our experience shows that it is possible to largely increase the net earnings of an old plant without necessarily refitting it throughout, but plenty of time should be taken for consideration as well as for execution, in order to secure satisfactory results with a moderate expenditure.

London Notes.

(From our Special London Correspondent.)

Some time ago, as was stated in your columns, a London police authority announced that omnibuses, carriages, or similar vehicles propelled by electricity, running on the common roads, were liable under the Locomotive Acts, which made it necessary that a man with a red flag should precede each conveyance of the kind, and that a speed of three or four miles must not be exceeded.

A bill which is to overcome these too rigorous requirements has now been introduced into the House of Commons by Mr. Shaw Lefevre. It provides for the exemption from the provisions of the locomotive acts of such vehicles as are propelled by petroleum, steam, gasoline or electricity, and also exempts them from the ordinary locomotive tax of £10, allowing a maximum weight of two tons for each vehicle.

There is to be started almost immediately in London a double line of electric omnibuses, although Mr. Shaw Lefevre's bill cannot, of course, become a law for some considerable time

The routes for these omnibuses are: (1) Starting from Hammersmith by way of Notting Hill, along Bayswater Road and Oxford street, Hol-

born and Cheapside to Liverpool street; (2) from Hammersmith by way of Kensington, Piccadilly and the Strand, also to Liverpool street.

At various times during the last few years we have had a number of experiments on our streets with electric vehicles, but none so important as this present attempt.

The Westinghouse Report.

Results for the Year Ending March 31, 1895.

To the Stockholders of the Westinghouse Electric and Manufacturing Company.

Your Board presents herewith its report, with the financial statement for the year ending March 31, 1895.

The all-important feature of the year's business has been the creation of a magnificent workshop, having unequaled facilities for the carrying on of the business in which your company is engaged, and the concentration therein of the manufacturing operations formerly conducted under great difficulty in three widely separated works, with material stored in numerous warehouses.

These new works, located at East Pittsburg, about twelve miles east of Pittsburg, are extensive and exceptionally complete in every detail necessary to the production of the best class of apparatus at the lowest possible cost, and will thus insure to your company many advantages. These new works were erected during a period of exceptionally low prices for labor and material, and under other favorable circumstances, so that the cost shown in the accompanying balance sheet is greatly below earlier or present prices for like work.

As was to be expected, such extensive building operations and the removal of materials from the old to the new works reduced the output for the year to about three-quarters of what it would have been without the interruption and extra work entailed.

The annual meeting of the stockholders of the company was adjourned at the regular date (May 15) to July 17, as the transfer from the old to the new works had not at the earlier day been fully effected, it having proved far more difficult and complicated than your directors had anticipated. They are glad to be able to announce that it is now completed, with results which promise to be most satisfactory in the immediate future of the company. It was the desire of the board that at the annual meeting every opportunity be afforded the stockholders to see for themselves what had been accomplished, and so form their own opinions of the efficiency of the plant and the value of the property. This was not possible in May; it is possible now. The directors therefore earnestly invite all holders of the company's stock, who may be able and desire so to do, to attend in person the annual meeting on July 17 at Pittsburg, where special railway and other arrangements will be made. Meanwhile, the directors feel justified in saying that the works are as nearly perfect as they could now be made and are now operating to the entire satisfaction of those in charge, and that the production has already been increased to a point where the demands of all customers can be promptly met, and there now seems to be no reason why your company should not in the near future be as large a producer of electrical machinery as there is in the country.

In anticipation of the increased facilities which your company would have in its new shops, a large amount of time and energy was put into the development of new and better forms of apparatus for the trade, and this extra work together with that incident to the preparations necessary to occupy the new quarters increased the general and extra expenses to a figure somewhat above that for the year ending March 31, 1894.

So far as ascertained there was expended directly in removing the machinery and material $80,[illegible]9.54, after deducting which from the earnings from business and from other sources, there is left a net profit of $711,909.63.

This, also, it must be borne in mind, was the outcome of a business year during which, for reasons already stated, your company was working under conditions as to output which, in the opinion of your directors, were so unfavorable that the net results scarcely represent half of what might reasonably have been expected under ordinary circumstances.

LIGHT AND POWER PROPERTIES.

Your company has for the past six years been interested in two important light and power properties, namely, the United Electric Light and Power Company of New York, and the Brush Electric Company, Baltimore, Md. During the past year both of these companies, with the assistance of your company, have carried through financial plans which have put them on a prosperous business basis, and have given a large increase to the value of their securities held by your company.

The United Electric Light and Power Company, under the plan referred to, has acquired almost all of the stock of the Brush Illuminating Company and of the United States Illuminating Company, both of New York City, and is now completing and will soon have in operation one of the most comprehensive light and power stations in the United States. It has contracted with your company for ten complete electrical outfits of 1,000 H. P. each, and for all the converters and other needed apparatus, half of these outfits having been used for the World's Fair lighting. On the completion of the above contract your company will have in securities of the United Company:

First mortgage bonds	$918,000
Preferred stock	550,400
Common stock	411,700

having already received of the above amount, under the terms of the reorganization, for material, unsecured notes, claims and for a cash subscription of $200,000,

First mortgage bonds	$548,000
Preferred stock	187,500
Common stock	411,700

From its old stations this company is now doing a business of about $800,000 per annum, which should be more than doubled by the revenue from the output of the new station, giving it a net revenue sufficient to pay interest on its bonds and dividends on all of its stocks, there now being a demand for light and power sufficient to absorb the entire capacities of the stations of all existing companies.

Brush Electric Company of Baltimore, Md. In the reorganization of this company your company subscribed for $40,000 first mortgage 5 per cent. bonds and took in payment for machinery $170,000 first mortgage 5 per cent. bonds, making your company's total holding $210,000 first mortgage 5 per cent. bonds. Your company was the owner and now holds 5,060 ($100) shares of the common stock out of a total of 7,292 shares outstanding.

The station of the Baltimore Brush Company is new and is one of the finest to be found in the country. It has three of the World's Fair 1,000 H. P. engines and generators and has been supplied with a large amount of other electrical apparatus, and will be hereafter, as will also the United Company, a constant purchaser of your company's apparatus and supplies.

The fields of operation of these companies are unusually profitable ones, and it is believed by your management that the value of the securities of both properties will, in the near future, be equal to or above their par value (amounting to $2,591,100) and that the final profit to your company on these securities will be a large one. (See Note.)

Outside of the profit your company will make from its interest in the United Electric Light and Power Company of New York and the Brush Electric Company of Baltimore, your management anticipate a great addition to its business from the experience gained with these two companies and others in building light and power station throughout the country and the rebuilding on like lines of many antiquated plants, the managers of which are rapidly being forced to the conclusion that they can only continue to have a profitable business and successfully meet any competition that may arise by using multiphase alternating current generating apparatus directly connected with engine shafts whereby Tesla motor and all other services can be had from one class of machinery.

As stated in the last report, your company "has no contracts of any character with local lighting or other companies which can in any manner interfere with the sale of its apparatus."

The final closing of the World's Fair contract, and the cancellation of all the bonds given by your company for the faithful carrying out of the work, in connection with the profitable sale of the machinery used there, will make the following letter received from the President of the World's Columbian Exposition, Mr. H. N. Higinbotham, of interest to stockholders:

"World's Columbian Exposition,
"Executive Department,
"Chicago, August 27, 1894.

"George Westinghouse, Jr., Esq., President Westing-
"house Electric and Manufacturing Co., Pittsburg, Pa.

"Dear Sir: It is with great pleasure that I hereby acknowledge the important work performed by your company in and for the World's Columbian Exposition.

"Your company installed in Jackson Park fourteen (14) dynamos, having a total capacity sufficient for operating 188,000 16 C. P. lamps; these dynamos operated both incandescent and arc lamps, as well as small motors, the entire capacity being equivalent to over seventy-five thousand (75,000) 16 candle-power lamps. Your company installed this plant complete, including distributing system as well as inside wiring.

"Your contract required you to install, operate, maintain and remove your machinery; the task undertaken was one of great difficulty, as you were frequently delayed by the construction of other buildings and underground work by other contractors not being prompt in the execution of their contracts. The latter was done under very unfavorable conditions, owing to inclement weather, and the inside wiring was done hastily, as the position of lights could not be determined until shortly before the opening of the Exposition. Notwithstanding all these difficulties the result of your work was fully up to our expectations and the requirements of your contract; and I take pleasure in certifying to the fact that the World's Columbian Exposition were in every respect fully satisfied, not only with the plant, but with the work performed, and the uniform gentlemanly and courteous treatment received at your hands as well as from your subordinate officers.

"For this work I beg to extend to your company the thanks of the Exposition Management as well as my own personal acknowledgment for the many courtesies received at your hands. With respect, I am, dear sir, very truly yours,

"(Signed) H. N. Higinbotham.
"President."

COLLATERAL TRUST BONDS.

After full consideration of the subject, your board, under the powers conferred upon it by the company's charter, has authorized the issue of $1,250,000 ten year 5 per cent. collateral trust bonds, secured by certain bonds and stocks held by the company, provision being made in the deed of trust for the sale of a portion of all the securities, and for the cancellation of the corresponding amount of the collateral trust bonds secured thereby. It is proposed to fund out of the proceeds of this issue of collateral trust bonds an equal amount of debt, a greater part of which has been created in the building of the new works, the purchase of new machinery, and the outlays in connection with the financial plans of the United and Brush companies.

WESTINGHOUSE ELECTRIC COMPANY, LIMITED.

Your company during the past year sold additional patent rights to the above company, and with the proceeds purchased the preferred and common stock of a number of English holders, so that your company now owns $782,500 preferred and $1,307,400 common stock (together, $2,089,900) out of $2,[illegible]52,750 outstanding, and your company will hereafter direct all of its affairs. All apparatus sold by the London Company has been purchased from your company at profitable rates, and the business of the London Company has always been profitable, last year having netted nearly 5 per cent. on a valuation of $1,000,000. It is proposed to push the business in Great Britain, Continental Europe, and in the various colonies, in order to increase the sales of your company's product, there having been many inquiries during the past year which your company has been unable to respond to, owing to lack of manufacturing facilities.

It is believed that the new prices which we have been able to make to the London Company will enable its management to largely increase its sales and give a permanent value to all of your stock in that company.

PATENTS AND LITIGATION.

Your company, through its able counsel, has been successful in favorably terminating the litigation in respect to incandescent lamps, the feeder and main and other important patents, and it was especially successful in the celebrated Bate Refrigerator case before the Supreme Court, in which the life of a number of patents, which were being used to influence trade by your adversaries, was finally determined.

In the McKeesport case, argued in the Supreme Court, October last, involving the ownership of the carbon burner for incandescent lamps, no decision has yet been handed down, but the long delay on the part of the Court in arriving at a conclusion is regarded as no unfavorable to the sustaining of the claims of our Sawyer-Man patent.

To-day the most important inventions are those relating to the use of alternating currents, and your management believe that with the exclusive control of the Tesla patents its position in patent matters is more favorable than that of any or all of its competitors.

STREET RAILWAYS OPERATED BY UNDERGROUND ELECTRIC CIRCUITS.

Your company has secured the controlling interest in the stock of the Electro-Magnetic Traction Company of West Virginia, and through it the control of valuable inventions relating to the operation of street railway cars in large cities by means of underground circuits.

This system has been in continuous operation in Washington during the past year, and is now in successful operation on the tracks of your company in and about the buildings at East Pittsburg, where it is to be used for moving freight cars and for general work.

This arrangement appears to be a complete solution of the problem of street car propulsion in all large cities and should give to your company a large amount of additional business.

A model of this system is now in operation at our office at No 120 Broadway, New York City, and will be exhibited to stockholders between the hours of 10 A. M. and 4 P. M. during July.

TESLA POWER DISTRIBUTING INVENTIONS.

Your company owns the exclusive right to manufacture and sell apparatus under the patents of Nikola Tesla, covering the use of multiphase alternating currents for power distribution. The rights under these patents are of great value, for developments indicate that it is only by means of Tesla's inventions that elevated and long lines of railways can be successfully operated, and that power can be most economically distributed over wide areas and throughout workshops. All of the machinery in your company's new factory at East Pittsburg is driven by Tesla multiphase motors, and in such a successful

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Note.—The profitable character of the light and power business in large cities is indicated by the present prices of the common stock and bonds, which mostly are selling at a large premium.

manner that orders for like apparatus have followed its inspection.

The 5,000 H. P. generators contracted for by the Niagara Cataract Construction Company have been put in successful operation, and other important installations for power transmission under the Tesla patents have been made in various parts of the country.

Recently your company has fitted a short branch of the Pennsylvania Railroad with ordinary electrical apparatus for the propulsion of standard cars, and the tests have been highly satisfactory. Your company is, however, pushing forward the manufacture of multiphase motors under the Tesla patents for practical tests in running standard cars on elevated roads and long lines, the success of which will be of especial importance, for it will insure to your company a large amount of trade for which your rivals will have no right to compete.

Suits under the Tesla patents are pending against the Stanley Electric Manufacturing Company of Pittsfield, Mass., and the Thomson-Houston Company. In the latter case, on application made by attorneys of your company, the defendants have been limited to the 7th of October within which to close their testimony, it being the intention of counsel to push this and all cases of infringement to a hearing in order that your company may enjoy the exclusive privileges to which it is entitled.

While heretofore a very large percentage of the business of the country has been done by means of apparatus using continuous currents, it is now estimated by experts that the percentage will change so that in the near future the bulk of the business will be done by means of alternating current multiphase apparatus, involving the use of Tesla's important inventions.

CAPACITY OF NEW WORKS.

Our present room is sufficient for the employment of between four and five thousand men. The various buildings have been so arranged that the main workshop can be readily extended and the capacity of the works doubled at a comparatively small outlay without interference with regular manufacturing during building operations. Outside of the main buildings the others already have the required capacity and there is still available for further buildings fully one-half of the forty acres owned by the company.

The indications are that the demand for electrical apparatus in general will be greater during the next twelve months than for any like period in the past, and it is therefore a matter of great importance that our new works are now in complete operation. Very respectfully,

GEORGE WESTINGHOUSE, JR., President.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

BALANCE SHEET, MARCH 31, 1895.

Assets.

Cash in banks			$202,880.89
Bills receivable			80,133.81
Accounts receivable			2,146,131.10
Material in stock and in process of manufacture (at cost of labor and material)			2, 20,227.95
Advances to leased companies			14 ,588.20
Bonds (par value $8 6,207.17)			811,271.88
Stocks (par value $,656,009.7)			4, 92,519.40
Real estate and buildings, Pittsburg			464,4 3.48
New factory—land and buildings		$1,186,750.22	
Less—first mtg. on land and buildings (final payment due April 1, 1900)	$ 00,000		
Second mtg. on land (final payment due April 1, 18 6)	115,000		
First mtg. second purchase of land (due July 1, 1899)	59,300	574,300.00	
Total			612,450.22
Machinery and tools			1,159,8 2.44
Miscellaneous			70,2 2. 7
Charters, franchises and patents			4,404,499.45
			$16,314,241.09

Liabilities.

Accounts payable		$403,017.02
Bills payable, issued for merchandise		3. 9,222.36
Discounted with collateral		1,265, 00.00
CONTRACT AND CONTINGENT LIABILITIES:		
Scrip dividend		194 5 0.00
Stock subscription		13,12 .00
Collateral trust bonds		250,000.00
U. S. Elec. Ltg. Company's 6 per cent. 15 year bonds, $50,000 payable annually		500,000.00
(Bills receivable under discount, $396,972.57.)		
CAPITAL STOCK:		
Preferred, 79,865.31 shares	$3,993,265. 0	
Assenting, 103,779.02 "	5,18 ,9 1.00	
Common, 2,9 4 "	147,700.00	9 3 9,916.50
(In treasury 13,266.98 shares assenting and 134.69 shares preferred.)		
Surplus		3,979.400.21
		$16,314,241.09

SURPLUS ACCOUNT:

Surplus balance March 31, 1894			$3,822,049.38
Twelve months' net earnings from business	$ 34 6 8.85		
From other sources	67,7 0.57	$ 02,409.2	
Less expense applicable to moving factories		90,499.54	711, 09.68
			$4,533,959.06
Less amounts written off in adjustment of matters pending prior to current year		$ 8 031,86	
Adjustment and depreciation in current year		133,408.00	211,439.86
			$4,322,519.20
Interest on bonds and mortgages		$ 7,386,61	
Interest on scrip		11,6 3.60	
Dividends paid		271,058. 8	343,118.99
Surplus balance March 31, 1895			$3, 79,400.21

[The report here presented does not make as frank a showing as was to be hoped, and it is to be regretted that the directors did not take the stockholders into their confidence a little more fully, making a report more in detail, giving gross business done, with operating expenses so classified as to enable those outside of the company's service to know just what the management is. Considering that there was a loss of three months' business owing to moving to the new works, the item of net profit appears creditable. The item of accounts receivable, over $2,000,000, leads to the conclusion that the company has been a little too liberal in extending its credits. Yet long accounts are better than accepting stocks and bonds. Material in stock, etc., also looks too large, but is probably explained by an accumulation of orders during the moving operations. It is impossible for the stockholders to use their own judgment in estimating the value of stocks held by the company, carried at about $4,000,000, unless they are advised just what these stocks are. A list should have been given. Patents, etc., are still carried at about $4,400,000. This is far out of proportion to their actual value. Reminders of the unfortunate trade with the United States Company are not wanting, yet they must be carried. The proposed bond issue of $1,250,000 is not excessive.

With a clear field for the coming year, a well-equipped factory, and with careful management, the condition of the company should show a marked improvement by the time for the next report.—ED.]

An Oversight.

In our recent elevator articles, by an unaccountable oversight, the name of the Elektron Manufacturing Company of Springfield, Mass., was omitted from the list of independent concerns. The Elektron Company was one of the earliest in this field, is one of the old patrons of ELECTRICITY, and has made a good record for itself. It is now supplying motors to various prominent makers, in addition to its own complete electric elevator system.

An Electro-Metallurgical Plant for Scranton.

It is reported from Scranton that Dr. Carey T. Hutchinson, in behalf of a syndicate of Englishmen for whom he acts as consulting engineer, is about to establish in that city a plant for treating ores. One thousand horse power will be needed, and it is supposed that culm will be the fuel.

Helios Electric Company's Increased Facilities.

The Helios Electric Company, now at 1,310 Filbert street, Philadelphia, will remove their factory and offices on July 2 to 1,225-1,229 Callowhill street, where much larger quarters have been secured. ELECTRICITY congratulates Mr Marr and his company upon the success which has made this move necessary.

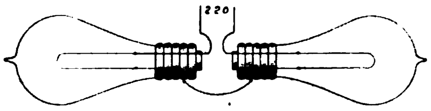
A Way to Connect Lamps for Use About Grounded Machinery.

BY WILL. D. LUTZ.

Having had occasion to use electric lights about machinery, and experiencing the inconvenience of receiving shocks, and occasionally making connection with the base of the lamp to the grounded machine with quite disastrous results, it occurred to me that such things might be avoided by properly connecting the lamps to the service wires. Of course I refer to the service as furnished by the Edison three-wire system as generally found in this country.

It is a well-known fact that the so-called neutral wire of the three-wire system is often purposely grounded, and consequently there is a difference of potential of 110 volts between either outside wire and the earth.

We will first take the two lamps in series as used by many wiremen, engineers, etc., as a portable light for use on the two outside wires. We connect our service wires to those binding screws in the sockets which lead to the centers of the lamp bases. We then connect the other two binding screws in the sockets which lead to the outside or exposed portion of the lamp bases together by a wire of a length to suit the circumstances. It is evident that this wire corresponds to the so-called neutral wire. Therefore we will have no difference of potential between this wire and the exposed parts of the lamp bases and the earth, provided similar lamps are used in each socket. The lamps can now be handled and used about grounded machinery without fear of a shock or short circuit. In the case of single lamps it is only necessary to ascertain which is the neutral wire, and connect that to the exposed part of the lamp base, connecting the other wire, as before, to the center of the lamp base.



These lamps may also be used in testing for a ground by connecting only one wire to one of the outside service wires and making connection with the base of the lamp to the object to be tested. If the object be grounded one lamp will burn. For general testing I find it far superior to a magneto, as one can form some idea of the resistance of the circuit tested.

[Our contributor is in error in one or two things. In the first place, while the neutral usually has a ground, as in fact is the case with all other circuits, it is not an intentional ground, such being forbidden by the Underwriters' rules. Second, the "two-lamp-in-series" method would not, unless the neutral wire were thoroughly grounded, answer the purpose intended, since if there were a better ground on either the positive or negative wires, contact with the socket would cause a flash on the negative or positive lamp. Third, no ground detector using a lamp as an indicator can be as reliable or sensitive as the magneto test, for unless the resistance of the ground plus that of the lamp is low enough to permit sufficient current to pass to illumine the filament, it will escape detection entirely, and if a ground is detected in the manner suggested it will still be a matter of conjecture whether it is on the neutral wire or on one of the outside wires. The resistance of the ground, too, would also be a matter of nearly the same uncertainty as when detected by the magneto.—ED.]

Personal.

Mr. George O. Fairbanks, of Chicago, an old-time Westinghouse man, was a New York visitor this week.

General News.

What is Going on in the Electrical World.

Chatsworth, Ill.—The electric light plant has been sold to F. C. Stanford.

Hyde Park, Vt.—The village trustees have purchased a water privilege for the purpose of running an electric plant.

Philadelphia.—The Market street cable cars have been withdrawn, and the trolley system is now in operation on that line.

Princeton, Minn.—An electric light plant is to be put in here; bonds have been issued for that purpose by a vote of the village.

East Orange, N. J.—John P. C n ling has asked the township committee for a franchise to string wires for an electric light service.

Oakland, Cal.—E. P. Vandercook has petitioned the board of supervisors for a franchise to construct and operate an electric road in this city.

St. Johns, Mich.—The village council called a special election for July 8 to vote on bonding the village to raise $35,000 for an electric light plant.

Cottage City, Mass.—The local street railway company headed by Josiah Quincy, Jr., of Boston, is securing rights of way for a belt electric line on the northeast end of Martha's Vineyard.

Wilmington, Del.—As soon as the right of way is determined, the directors of the new Wilmington and Chester Electric Railway Company will arrange for an active prosecution of the work.

Cincinnati.—A special election to take place July 17 has been ordered by the village council of Elmwood Place to vote upon the issue of bonds for the purpose of putting in an electric light plant.

Cape Girardeau, Mo.—The Cape Girardeau Street Railway has been sold at receiver's sale to J. A. Matteson, who represents a syndicate which intends to make an electric line of it and extend the mileage.

Little Falls, N. Y.—The Little Falls Electric Railway Company and the Herkimer and Little Falls Electric Railway Company have both been granted franchises to operate electric lines in the city.

Lynchburg, Va.—The Western Electric Company of Chicago has contracted with the Lynchburg and Rivermont Street Railway Company to put in an electric light plant for city lighting, to cost $48,000.

Vineland, N. J.—Charles Keighley & Son, owners of the city water works, have offered to supply the town with electric lights, and at the next meeting of the borough council, it is said, will apply for a charter.

Lansingburgh, N. Y.—At the special election of taxpayers on the 1st inst., to vote on an appropriation of $13,000 per year for five years to pay for 40 lights of 2,000 C. P., the measure was carried by a vote of 189 to 134.

Peoria, Ill.—Congressman J. Frank Aldrich, of Chicago, has been awarded two franchises by the city council of Peoria—one for electric and the other for gas lighting. He says he will begin the construction of his plants at once.

Bucyrus, O.—A New York capitalist has completed arrangements with the projectors to build the Inland electric road from Bucyrus via Sulphur Springs to Shelby at an estimated cost of $350,000, work to commence immediately.

Langdon.—There is talk of organizing a company to build and operate a line of cars from Langdon to connect with the Columbia cable at 12th street, Washington. Dr. L. C. Loomis is the prime mover in the proposed enterprise.

Southbridge, Mass.—At a meeting of local capitalists on the 2d inst. $25,000 was pledged toward the building of an electric railroad from Sandersdale to Fiskdale. It is expected that a portion of the route will be open in two months.

Tamaqua, Pa.—The Inter-County Electric Railway Company's trackage and partly finished plant have been sold at sheriff's sale to the Lehigh Coal and Navigation Company. The road will now be known as the Lansford and Tamaqua Electric Railway.

Jamaica, N. Y.—Col. A. A. Degrauw, one of the wealthiest men of Jamaica and a large stockholder in the Jamaica and Hempstead plank road, is negotiating with an electric railway company to build a trolley line over this route from Jamaica to Hempstead.

Montreal, Can.—At the annual meeting of the Canadian Electric Light Company, the old board of directors were re-elected. The directors elected R. McLennan president, Adolphe Davis vice-president, and F. S. McLennan secretary-treasurer.

Goliad, Texas.—The firm of Greathouse, Taylor & Burr, of Beeville, have been given the contract for constructing the necessary buildings and putting in the plant for waterworks and electric lights for this city. The whole work is to be completed in six months from July 1.

Milwaukee, Wis.—The incorporation papers of the South Milwaukee and Cudahy Street Car Company have been signed and are ready for filing. The company is capitalized at about $100,000. M. C. Ring, C. E. Estabrook, W. M. Williams, Theobald Otjen and W. S. Stanley are the incorporators.

Norfolk, Va.—The Portsmouth Street Railway Company has been granted right of way for its proposed electric railway in specified streets and roads of the county.—A company is considering the plan of building an electric road from Berkeley along the eastern branch of the Elizabeth River by way of Kempsville.

Brooklyn, N. Y.—H. M. Littell, who lately resigned the presidency and general management of the New Orleans City and Lake and Crescent City Railroads, has been elected president and general manager of the Atlantic Avenue and Brooklyn Bath and West End Railroads, the properties of the Brooklyn Traction Company.

Pittsburg, Pa.—Legal notice of the application for a charter of the Consolidated Traction Company has been filed by George I. Whitney, G. W. Elkins, C. L. Magee, Wm. Flinn and Geo. Sheppard. The application will be made at Harrisburg on July 22. This the *Dispatch* construes to mean the general consolidation of the Duquesne, Central and Pittsburg traction lines and all their branches.

Alton, Ill.—Application has been made for letters of incorporation for the Alton Railway and Illuminating Company. The new company will absorb the Alton Electric Street Railroad Company, the Alton Improvement Association and the Alton and Upper Alton Horse Railroad and Carrying Company. The new company will be incorporated with a capital stock of $250,000. The incorporators are J. F. Porter, C. W. Milnor and H. R. Phinney.

Atlanta, Ga.—The Atlanta Traction Company is changed under the reorganization to the Atlanta Railway Company, and the ownership and management are in new hands. The incorporators named in the new charter are: W. C. Shaw, R. D. Fisher, Henry Helken, W. S. Thomson, Alex. C. King, Luther Z. Rosser, M. F. Amorous, F. I. Stone and G. W. Parrott. Mr. Parrott has been elected president and Mr. Amorous vice-president. The capital stock has been placed at $300,000 and many improvements will be made in the system.

Niagara Falls.—The first practical test of power transmission from the plant of the Niagara Falls Power Company was a great success. The monster dynamo, transformers, converters, and all the machinery and apparatus worked as smoothly and easily as if it was but a 1 H. P. plant that was in operation instead of one of 5,000 H. P. The power was transmitted one mile over wires to the Pittsburg Reduction Company's works, where the machinery connected was almost instantaneously set in motion by the current transmitted from the power works.

Harrisburg, Pa.—Governor Hastings has vetoed the electric light bills which were rushed through the Legislature in the closing week of the session. One of the bills extended to cities the privilege enjoyed by boroughs, of manufacturing electricity for municipal purposes, but made compulsory the purchase of any existing private company's plant before a municipal plant could be established; the other bill was intended to give electric light, heat and power companies a monopoly by preventing new companies from going into territory already occupied.

Wheeling, W. Va.—Wheeling parties will soon put in operation at Sisterville an electrical device for pumping oil. It is proposed to put an electric motor at each well and furnish power from a central electrical plant, a single wire being sufficient to take the place of the fuel and costly water line. With the application of electricity twenty wells may be strung on one wire and all furnished with power from it. It is the intention to get a plant in operation at Sisterville by the first of October which will operate 200 wells for a starter.

Buffalo, N. Y.—The electrical supply dealers and contractors of Buffalo have formed an association. Their preamble says: "Whereas, in consideration of furthering the interests of the electrical supply dealers and contractors, and the want of a closer business and social relation, therefore we, master electricians of the city of Buffalo, do form an organization for our mutual benefit and protection." The preamble is signed by F. P. Jones & Co., Jaynes Electrical Company, the F. P. Little Electrical C. and S. Company, W. A. Fenn and the Buffalo Electrical Company.

Hoboken, N. J.—The elevators at the West Shore ferry, Weehawken, and the steam road over the iron viaduct to Fort Lee have ceased operations, the new trolley line to the ferry having opened for traffic. Motors leaving the ferry go direct to Hudson Heights.—James H. Symes, of the township of Union, contemplates operating an independent trolley road through North Bergen and Union Hill to connect with the Rutherford road at Homestead and the North Hudson County Railway Company at Main street and Bergenline avenue, Union Hill, and if he gets the necessary right of way he will push the project with vigor.

Baltimore.—Tests have been made of the big electric locomotive in the Belt tunnel, and its operation in the several trials was witnessed by a number of railroad officials and electrical engineers, who expressed themselves as satisfied that the machine was fully capable of performing the work for which it was intended. A speed of twenty miles an hour was attained in the trials.—The Canton, Sparrows and North Point Railroad Company is considering whether or not to build its own power house. If built, an equipment of at least 1,000 horse power will be needed for dynamos. F. Wood is one of the directors of the company.

New York.—The Mayor's veto of the franchise granted by the board of aldermen to the Third Avenue Company for an electric road along Washington Heights to Kingsbridge has brought that company (which in the franchise voted it got the right for nothing) to make an offer for the franchise of $250,000, with a percentage of not less than 2 per cent. of the gross receipts above the statutory requirement. The Metropolitan Traction Company has offered for the franchise not less than 2 per cent. of the gross receipts in addition to the 3 and 5 per cent. imposed by statute, and a cash bonus of $100,000. Both applications have been filed and a hearing has been set for August 7.

Washington, D. C.—Mr. Benedict, the public printer, intends to thoroughly light the new Government Printing Office by electricity, and will also have much of the machinery operated by the same power. Small motors will be applied to the various machines, in order that they may be operated independently. A contract has been made with the Westinghouse Electric and Manufacturing Company for an engine and three generators. Another contract has been made with the Crocker-Wheeler Company of New York for one of the largest switchboards in the country. Contracts will be let soon for electric wiring, and in this connection 70,000 feet of wire and 10,000 yards of flexible cord will be purchased.

Chicago.—The contract for equipping the Lake street elevated railroad has been awarded to the General Electric Company.—The *Inter-Ocean* states that the Chicago and Northern Pacific Railway Company has decided to change the motive power of its three suburban lines—Thatcher's Park, Harlem and Chicago Central—from steam to electricity. The overhead trolley system will be used and about thirty-five miles of track will be affected. If the electrical experiment on the Chicago and Northern Pacific proves a success the new motive power will undoubtedly be adopted by the St. Paul on its Evanston branch and by the Illinois Central on its entire suburban system.—The council committee on streets and alleys have recommended for passage an ordinance permitting the running of trolley cars on Clark street.

THE TELEPHONE WORLD.

The wires of the People's Telephone Company at Leavenworth, Kan., are up, the switchboards are being put in place at the central office and other interior work is being pushed.

The application of the International Telephone Company for permission to string wires and erect poles within the limits of the city of Cape May, N. J., has been referred to the committee on streets.

Thomas Ryan, Charles M W rner, John Dunfee, Frank Hiscock and others have applied to the common council of Syracuse, N. Y., for a franchise.

The common council of Corning, N. Y., has granted a franchise to the American Telephone and Telegraph Company to erect lines through that city.

The Wisconsin Telephone Company has been granted a franchise by the council of Menasha, Wis.

The canvassers for the projected new telephone exchange at Bridgeport, Conn., are meeting with success. It is believed that the company will acquire the charter rights of the Connecticut Telegraph and Telephone Company.

The Astoria Telephone Company of Astoria, Ill., has been incorporated by A. J. Baxter, J. H. Windi erst, J. M. Todd, T. W. Emerson and H. F. Farwell. The capital stock is $2,500.

The Interior Department at Washington is now successfully operating its own telephone system. Every head of bureau or division has upon his desk a movable apparatus consisting of receiver and transmitter, and it is but an instant's work to call up the central office, located in the building and run by one operator, and get connection with any other official. The work was done by the Western Telephone Construction Company.

The Baxter Overland Telephone Company, Utica, N. Y., has resolved to raise $ 5,000 on mortgage to provide means to pay off its debts and put the line in first class condition. The company will renew its [illegible]00 miles of wire, and it has 300 telephones which can be put to use in a few days.

The Buffalo *News* says: "Many complaints are made nowadays of the service given by the Bell Telephone Company in this city. It was thought that dividing the system into four districts would better the service, but it seems to get worse instead. It is no uncommon thing to call from three to half a dozen times for central, and then to have to call up '95' to get proper attention. The discipline of the service seems to need bracing up very badly."

The Little Rock (Ark.) Telephone Company has filed a certificate of an amendment to its articles of agreement and incorporation increasing the amount of capital stock to $100,000, which amount may be increased by a majority vote of the stockholders of the company at any general meeting to any sum not exceeding $50[illegible],000. The board of public affairs of Little Rock has reported favorably an ordinance granting the company a franchise.

The entire plant of the Citizens' Mutual Telephone Company, worth $25,000, together with the franchise, was sold at Decatur, Ill., recently, to John A. Brown of that city as trustee for a syndicate. The bill of sale was made by the Rev. Charles G. Wood, who has held a chattel mortgage on the property for over a year. The company has about 600 Harrison telephones in use.

The Washington *Post* is opposed to the establishment of a new telephone company in the city of Washington, and a recent article in that paper, inspired doubtless by the present monopoly, prompted the *Times* to say: "It has been just such influence and arguments that have kept the Washington public in the hands of corporations. Heretofore whenever competition has endeavored to enter the field this contemporary has denounced the effort as chimerical, impracticable, and Congress and the public generally has been made to believe that the corporations then supplying the service were nearly bankrupt, and that it would be an act of injustice to compel them to submit to competition or make a reduction in prices. It is cheaper telephone service that is desired, and whether the *Post* and its client like it or not, citizens have a right to control for that service." There are two telephone companies after franchises in Washington—the Standard and the Home.

Both the Harrison and Brown telephone franchises have, after reconsideration, been referred back by the Detroit city council to the committee on streets and ordinances.

The Phœnix Telephone Company of Indianapolis is trying to get 1,000 subscribers in Des Moines, so that an exchange can be opened there by November. It is said that between 20 and 300 signers have already been secured and that the prospects are good for the company's securing 1,000. Its rates are 24 a year for residences and $36 for business houses. The old company will meet the competition by lowering its rates.

The Pittsburg *Leader* says: "In Johnstown, Pa., an independent exchange, recently organized, has ordered 100 new instruments from one of the independent manufacturers, and is putting them in use. Some time ago the Bell people asserted that a $[illegible]0 rate a year did not pay 6 per cent. interest on investment. The new company made a rate of $24 for residence telephones and $30 for business houses, and a good and satisfactory profit is said to be earned from these rates. The old Bell subscribers have nearly all gone to the new company."

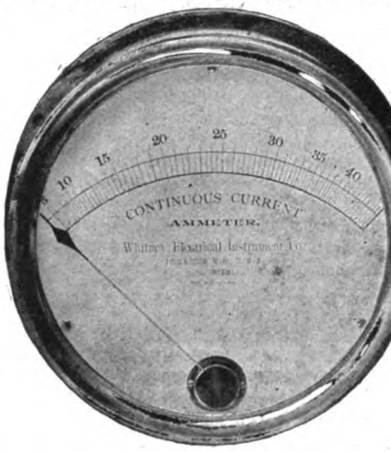
C. E. Severance, president of the California Telephone Company, when in San Jose recently said that the work of the company at Sacramento was progressing rapidly, and the company would be equipped for business about July 15 after which the men in charge of the construction there would commence work at San Jose providing the company obtains the franchises applied for. The company will then connect with the Alameda, Santa Cruz and Sacramento companies. The Santa Cruz company will be ready for business as soon as the telephones arrive from the East.

A prominent member of the San Francisco Chamber of Commerce says he is convinced that the Pacific cable which has been talked about for years and discussed ad interim in Congress, is to be built by British capitalists. To the statement that Englishmen and Australians, with Canadians, have decided to undertake the work, he adds the further assertion that the difficulty of obtaining a midocean station has been overcome. The United States decided last winter not to sanction the establishment of such a station on one of the Hawaiian Islands to be controlled solely by Britishers. To avoid international complications, Fanning Island, in Lat. 3 North, has been decided upon as a station. The cable is to be laid from Auckland, New Zealand, to Norfolk Island, in the Southern Pacific, a distance of 415 miles. The second section of the cable will be from Norfolk Island to Fiji, a distance of 1,002 miles; the third to Fanning Island, 1,715 miles, and the fourth and largest section from Fanning Island to Vancouver, a distance of 3,242 miles. The total length of the cable will thus be 6,374 miles. The estimated cost of the cable from Auckland to Vancouver is, in round figures, $7,585,000.

The independent telephone company (Electric Messenger Co.) lately formed at Pittsburg, Pa., to compete with the Bell company includes some of the most prominent business men of the city. J. N. Pew, president of the People's Natural Gas Company, has been elected president; Joseph T. Colvin, formerly president of the National Bank of Commerce, secretary; Theodore Johnson, treasurer. Other stockholders are Representative William T. Marshall, Samuel G. Pew, Thomas Bigelow, R. S. Duffield, superintendent of the People's Natural Gas Company, and E. O. Emerson, of Titusville. It is the purpose of the company to erect exchanges in and run its lines through the counties of Adams, Allegheny, Armstrong, Beaver, Bedford, Bucks, Butler, Cambria, Crawford, Chester, Cumberland, Center, Clearfield, Clarion, Delaware, Dauphin, Erie, Fayette, Franklin, Greene, Huntington, Indiana, Juniata, Lancaster, Lebanon, Montgomery, Mifflin, Mercer, Philadelphia, Perry, Schuylkill, Venango, Washington, Westmoreland and York. An ordinance has already passed the Pittsburg city councils granting the right to lay lines, and a similar ordinance is now pending in Allegheny councils for right of way on the north side.

The New Whitney Switchboard Instrument.

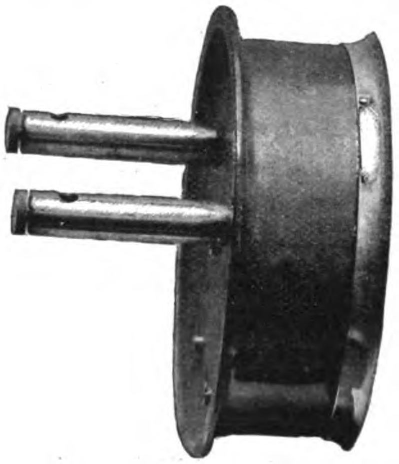
The Whitney Electrical Instrument Company of Penacook, N. H., have just begun putting on the market a new Switchboard Instrument for direct current reading, which is illustrated in the accompanying cuts. The features which specially commend this instrument to the central station man are—



First—Their extreme accuracy, being guaranteed within 1 per cent of absolute accuracy.

Second—The large scale, nearly seven inches in length, permitting the divisions to be large and clear and hence easily legible at a distance.

Third—Their handsome mounting in black enameled iron cases with nickel front.



The instruments are dead-beat, thoroughly dust proof, and not affected by outside influences They are intended to remain constantly in circuit, and when thus used will not show a heating error.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Bangor, Me.—George E. Macomber, J. P. Hill and others are talking of erecting a building for public meetings, conventions, etc.

Buffalo, N. Y.—Plans have been prepared for a six story flat building, to be erected near the Circle and North street....Samuel E Laird will erect a six story apartment house at northwest cor. Main and Utica sts.; Architects Strong & Wilby.

Hicksville, Ohio.—Plans have been prepared for the erection of an opera house; electric lights, etc. Mr. Huber owner

Jacksonville, Fla.—Fred F. Wilton & Co. of Boston propose building a theatre in La Villa.

New York City —R Townsend, 1,[illegible]96 Broadway, is making plans for a sixteen story office building to be erected on Cedar st....Samuel Hirsch has plans for two six story office buildings, 9 University Place and 38 Clinton Place ..Wm. Broadbelt, the builder, is having plans made for a seven story mercantile building to be erected at 2 1 West 23d st.; elevators, electric light and power appliances, etc.; Architect F. B. Dinkelberg, 3 Union Square....It is reported that the Washington Life Insurance Co. will erect an office building cor Broadway and Cortlandt st. ....Alexander Moore, 151 West 61st st., will erect a seven story brick apartment house, cor. of 6[illegible]th st. and Centra

Park West, to cost $125,000....Boehm & Coon, the builders, who now have in course of construction at Washington Square and Washington Place a seven story fire proof store and loft building, are making preparations to build a similar structure on the plot adjoining the Washington Place front. The new structure will contain modern equipments, including elevators, electric wiring and apparatus....John Kehoe, the builder, will erect a seven story store and loft building on northeast cor. of Broome and Wooster sts....A modern fire-proof apartment hotel, ten or twelve story, is to be built in 14th st. by Walker & Lawson; Architect M. B. V. Ferndon, 176 Broadway; passenger and freight elevators, electric wiring, etc....St. Nicholas Skating Club expects next winter to build a $5 0,00 skating rink, near the Boulevard and 6 th st., the building to include a restaurant: among those interested are Cornelius Vanderbilt, Mrs. Stanford White, Mr. and Mrs. John Jacob Astor and others ...Mrs. Ida Wolf will build a 6 story brick store and warerooms at 74 Hester st....R. H. Macy & Co. will build a nine story store and roof garden at 57- 1 West 13th st.; Architect Wm. Schickel, 111 Fifth ave. ....A mercantile building will be erected at 45-47 Crosby st. on a plot recently purchased by Edward Judson, the builder; the structure will be heated by steam and lighted by electricity; elevators, etc.; Architect C. A. Anderson.

Philadelphia, Pa.—John Stafford will erect a handsome four story residence for himself at cor. of Broad and Norris sts....Estimates have been invited by Architect Smedley for work on the stores and apartments to be built by J. W. Halahan, 1682 Chestnut st.; the structure will be six stories....The American Baptist Publication Society is preparing to build a six story building on the site of the old Siloam Methodist Episcopal Church at Juniper and Lombard sts....The Kensington Labor Lyceum intends to erect a handsome building at 2d and Cambria sts. for hall and meeting-rooms and conservatory of music....The plans for the new Philadelphia Museum, on the University grounds, have been approved by the board....The eight story building to be erected by Hamilton Diesinger on the south side of Chestnut st., and above 12th, and for which Architect Frank P. Watson is preparing plans, is to contain an individual electric light plant.

St. Louis.—The Oriental Theater Company will erect a theater building, north side of Pine, between 16th and 17th sts.; electric lighting, electric bells, and all modern appliances; Architects Kirchner & Kirchner, 520 Olive st.

Washington, D. C.—Sealed proposals, in duplicate, will be received at the Department of the Interior until 2 o'clock on the 22d inst., for the furnishing and installation of an electric light plant at the Government Hospital for the Insane, near Washington, D. C., in accordance with specifications to be had on application to the Department.

Ypsilanti, Mich.—The Ypsilanti Opera House Company will erect an opera house; electric lighting etc. Architects Malcomson & Higginbotham, Moffatt Block, Detroit, Mich.

INCORPORATIONS.

The Electric Boat Company of New York, New York City—to deal in and manufacture electric propellers for boats, and electrical appliances generally. Capital stock, $8,000. Promoters: F. S. Allen, B. T. McDowell, C. H. DeWitt, New York City.

The Syracuse and Suburban Railroad Company, Syracuse, N. Y.—to build and operate an electric street surface road in Onondaga County. Capital stock, $ 50,000. Promoters: W. B. Cogswell, O. V. Tracy, G. E. Higgins, Syracuse.

The Chaplin Company, Kittery, Maine—to purchase, manufacture and sell electrical, mechanical and chemical inventions. Capital stock, $75,000. Promoters: Edwin D. Chaplin, Cambridge, Mass.; Hiram L. White, Somerville.; Henry C. Halloran, Boston, Mass.

The Wilde Tidal Power Company, Kittery, Maine—to manufacture and deal in machinery for developing electricity by means of tidal water. Capital stock, $500,000. Promoters; John Wilde, Lorin M. Cook, Alfred Caldwell, Providence, R. I.

The Consolidated Electric Purifier Company, Chicago, Ill.—to own, control and deal in and operate under letters patent, particularly such as relate to improvements in machinery, steam boilers and engines, the fittings and attachments therefor. Capital stock, $1,500,000. Promoters: A. Miller Befield, Wm. C. Ancher, Jno. W. Hill.

The Arkansas City and Northwestern Construction Company, Jersey City, N. J.—to build, construct, maintain and operate railroad and steamboat lines; to construct, develop and promote electric railways. Capital stock, $ 00,000. Promoters: Marion W. Lewis, Boston, Mass.; John B. Leake, New York City; Geo. L. Dayton, Jersey City.

The Penn Insulated Wire Company, Camden, N. J.—to manufacture all kinds of insulated wire, cables, paper, tapes and insulating compounds for electrical purposes. Capital stock, $150,000. Promoters: Franklin S. Randall, W. Howard Holden, Howard A. Engle, Philadelphia.

The Inter-Ocean Electric Railway Company, Chicago, Ill.—to construct, equip, own and operate electric railways, both surface and elevated, and electric telegraph, telephone and signal lines; acquire inventions and letters patent for improvement in railways, cars, motors, brakes, trolleys, etc.; construct and operate electric light plants. Capital stock, $200,000,000. Promoters: James G. Hulse, Parker Crittenden, John W. Hill.

The Gas Consumers' Association of the United States, San Francisco, Cal.—to deal in the regulation of illuminating gas and electric light, make and sell fixtures, appliances and inventions pertaining to the regulation of illuminating gas and electric light. Capital stock, $300,000. Promoters: J. D. Whitney, J. R. Spring Sampson Tanes, Isaac Hecht, Henry Kerber, Jr., San Francisco; D. L. Randolph, Alameda; Carter P. Pomeroy, San Rafael, Cal.

The Consumers' Light and Power Company, Spokane, Wash.—to operate machinery for electrical and other power for lighting, heating, etc. Capital stock, $2 0,000. Promoters: S. Oppenheimer, W. R. Newport, A. D. Hopper, J. W. Binkley, M. J. Waller, H. A. Van Kempen, E. J. Dyer.

The Phœnix Electric Company, Butte, Mont.—to engage in a general electric business. Capital stock, $100,000. Incorporators: John F. Cowan, James A. Talbot, H. L. Frank, A. Whel and C. H. Smith.

The Albany and Suburban Railway Company, Albany, N. Y.—to construct an electric road about twelve miles in length for passengers, express and freight, to connect Greenbush, Castleton and Bath-on-the-Hudson with Albany. Capital stock, $200,000. Directors: F. H. Barnes, John S. Burke, George T. Cunningham, of Ballston; George D. Moore, of Worcester, Mass.; Arthur Hilton, of Boston; John Leggett, Joseph A. Leggett and Albert J. Barnes, of Troy, and Charles A. Goddard, of Lowell, Mass.

The Wilmette Electric Light and Power Company, Wilmette, Ill.—to manufacture electricity. Capital stock, $15,000. Incorporators: John S. Meyer, John W Meyer and Edwin Webb.

The Consolidated Electric Purifier Company, Chicago—to operate purifiers. Capital stock, $1,500,000. Incorporators: A. M. Belfield, William C. Archer and John W. Hill.

At a recent meeting of stockholders of the Ellicott City Electric Light and Power Company, at Ellicott City, Md., a resolution was adopted to incorporate a new company, to be known as the Electric Light Company of Howard County. The capital stock named is $5,000.

The Electric Wire Hanging Insulator Company, Chicago, Ill.—to manufacture electrical apparatus. Capital stock, $100,000. Incorporators: Edgar O. Baker, M. A. Robertson, Henry W. Rice.

The South Freeport and Cedarville Electric Railway Company, Freeport, Ill.—to build and operate an electric railway between Freeport and Cedarville. Capital stock, $10 ,000. Incorporators: A. Bergman, Henry Lichtenberger and A. Baumgardtner.

The Alton Railway and Illuminating Company, Alton, Ill.—to operate a street railway, power and heat. Capital stock, $250,000. Incorporators: Joseph F. Porter, Charles W. Milnor and Henry R. Phinney.

The American Telephone Directory Company, Chicago—to publish a directory. Capital stock, $10,000. Incorporators: John R. Collins, Joseph A. Peters and Albert L King.

The American Electric Fuse Company, Chicago—to manufacture electric fuses. Capital stock, $25,000. Incorporators: Eugene Hildebrand, Clarence E. Brown and Ralph W. Bowman.

Articles have been filed at Springfield, Ill., for the incorporation of the Transcontinental Railway Company. The principal office of the company is to be maintained in Chicago, and the capital stock is placed at $200,00 ,000. It is proposed to construct and operate a railroad from Chicago to Jersey City, N. J., with all necessary switches, branches, depots, turntables, houses, etc. The incorporators and first board of directors are: Lysander Hill, Charles C. Bilkley, M. E. Beasley, L. A. Gardiner and John W. Hill, all of Chicago.

The Union Electric Company, of Charleroi, Pa. Capital, $1,000. Incorporators: John A. Irwin and James S. Carr, Allegheny; Harry W. Gleffer, Haysville, and Henry S. Stewart and James S. McKean, Pittsburg.

The Greenwich and Schuylerville Electric Railroad Company, Greenwich, N. Y.—to build and operate an electric railroad between the places named in the title. Capital stock, $ 00 000. Directors: Thomas W. Cantwell and William J. Wilson, of Albany; Watson N. Sprague and Robert Hamilton, of Greenwich; Martin Schenck and Reeves Smith, of Troy; James Mealey and James E. Kelly, of Schuylerville and Albert M. Crandall, of Middle Falls.

The Citizens' Electric Company of Mishawaka, St. Joseph, Ind. Capital stock, $10,000.

The Welsbach Commercial Company, New York City—to manufacture and deal in all kinds of devices for the production of light, heat and power. Capital stock, $7,000,000, of which $3, 00,000 is preferred. Directors: S. H. G. Steward, E. McMillan, Jr., W. F. Boudouthrift, J. H. Scoville, E. Francis Eldridge, A. L. Page, J. O. Havemeyer, R. M. Murray, Charles J. Lithgow, E. J. Cratz, Edson Purcell, J. L. Nesbit and A. M. Poole.

The Fairmont Railway Company, Fairmont, W. Va.—to operate a street railway in Fairmont. Capital stock, $200,000. Incorporators: M. A. Clayton, W. T. Norton, C. L. Skinner and others.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JULY, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.20 P. M.	2	3.30 A. M.
2	11.50 "	3	3.30 "
3	......	..	......
4	12.30 A. M.	4	3.30 "
5	1.30 "	5	3.30 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	8.00 P. M.	9	10.30 P. M.
10	8.00 "	10	10. 0 "
11	8.00 "	11	11.10 "
12	8.00 "	12	11.30 "
13	8.00 "	13	11.50 "
14	8.00 "	15	12.10 A. M.
15	8.00 "	16	1.00 "
16	8.00 "	17	1.30 "
17	8.00 "	18	1.40 "
18	8.00 "	19	2.30 "
19	8.00 "	20	3.30 "
20	8.00 "	21	4.00 "
21	8.00 "	22	4.00 "
22	7.50 "	23	4.00 "
23	7. 0 "	24	4.00 "
24	7.50 "	25	4.00 "
25	8.30 "	26	4.00 "
26	9.00 "	27	4.00 "
27	9. 0 "	28	4.00 "
28	9.50 "	29	4.00 "
29	10. 0 "	30	4.00 "
30	11.00 "	31	4.00 "
31	11.00 "	Aug. 1	4.00 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 2, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

541,9 9. Trolley-Wire Clip. Fred W. Haeusgen, Buffalo, N. Y. Filed Oct. 9, 1894.

542,002. Trolley-Restoring Attachment. William D. McDaniel, Philadelphia, Pa., assignor of one-half to Luther S. Green, same place. Filed Oct. 29, 1894.

542,036 Electric Locomotive. Thomas E. Adams, Cleveland, Ohio. Filed Oct. 3, 1894.

542,105. Conduit Electric Railway. Leonidas C. Pressley, San Francisco, Cal. Filed Feb. 13, 1895.

542,164. Conduit Electric Railway. Louis R. Lavalle and Albert H. Lavalle, Holyoke, Mass. Filed March 17, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

541,929. Incandescent Electric Lamp. Robert Greer, Westbrook, Me. Filed Nov. 10, 18 4.

542,210. Safety Device for Handling Electric-Arc Lamps. Edward P. Snowden, St. Joseph, Mo. Filed March 22, 189 .

DYNAMO ELECTRIC MACHINERY.

541,854. Dynamo-Electric Machine. Thomas H. Hicks, Detroit, Mich. Filed Aug. 2 , 1894.

541,919. Commutator-Brush. Hermon B. Collins, Fulton, N. Y. Filed Jan. 26, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

541,967. Automatic Telegraphy. Patrick B. Delany, South Orange, N. J. Filed April 3, 1895.

541,994. Duplex and Diplex Telegraphy. Minor M. Davis, Brooklyn, N. Y. Filed April 18. 1895.

5 2,0 2. Telephone System. Angus S. Hibbard, Chicago, Ill. Filed Feb. 21, 1895.

512,066. Annunciator-Circuit for Telephone-Switch-Boards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 12, 1894.

512, 91. Magneto-Electric Telephony. Edward S. Halsey, South Evanston, assignor of one-half to William J. Phelps, Chicago, Ill. Filed April 20, 1894.

BATTERIES.

542,049. Galvanic Battery. Ralph W. Gordon, Boston, Mass. Filed Jan. 31, 189 .

MISCELLANEOUS.

541,921. Manufacture of Electrical Conductors. Louis W. Downes, Providence, R. I. Filed April 2, 1895.

541,923. Phonograph. Thomas A. Edison, Llewellen Park, N. J. Filed Nov. 21, 18 0.

541,924. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed Dec. 3, 1890.

541,9 8. Electric-Wire Joint. Alfred Gartner, Newark, N. J., assignor to Charles H. McIntire, same place. Filed May 2 , 1895.

512,030. Automatic Safety Device for Electric Circuits. Lewis G. Rowland, Camden, N. J., assignor to the Universal Fire Alarm Company, same place. Filed Feb. 6, 1895.

542,057. Electrolytic Process and Apparatus. Leon P. Hulin, Modane, France. Filed Dec. 19, 1894.

541,94 . Block-Signal for Railways. William G. Roome, Jersey City, N. J. Filed April 28, 1892.

542,108. Train-Annunciator. Charles H. Rittenhouse, Kendallville, Ind. Filed Feb. 14, 1 95.

54 ,109. Coin-Operated Toll Collector and Annunciator. William A. Rogers, Omaha, Neb. Filed March 7, 1895.

DESIGN.

21,459. Electric-Heater Case. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car-Heating Company, same place. Filed March 7, 1895. Term of patent 14 years.

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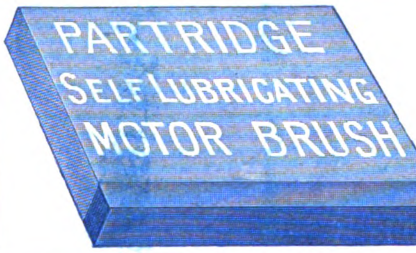

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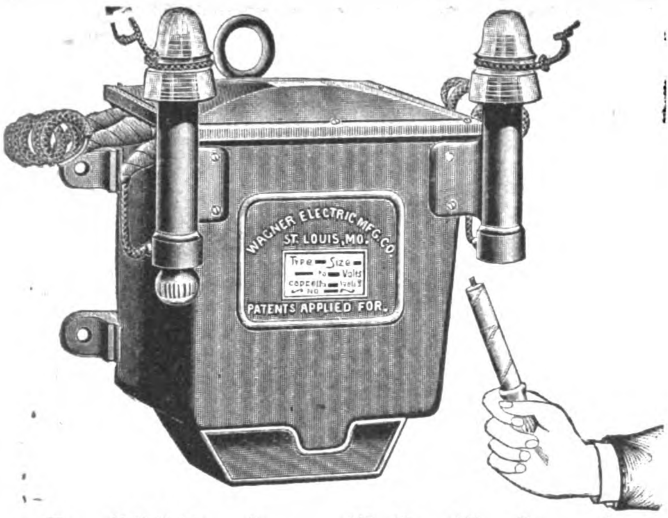
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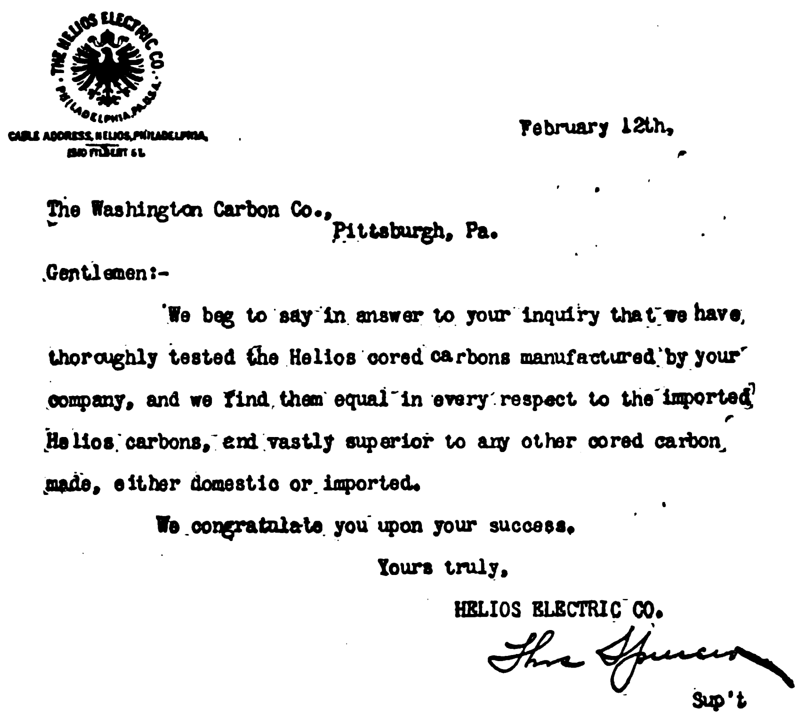

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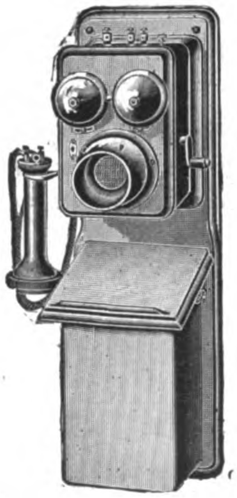

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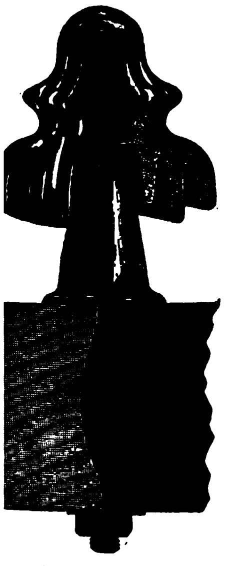

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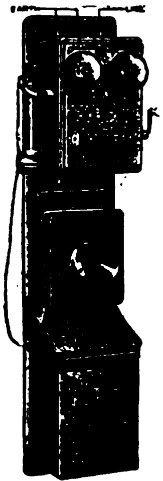

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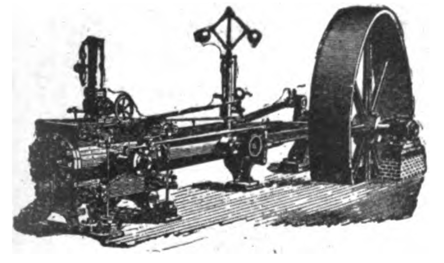

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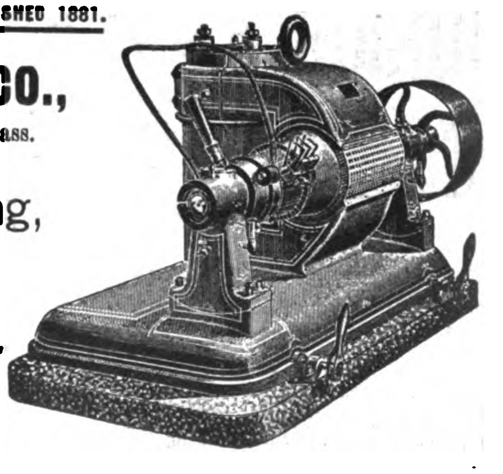

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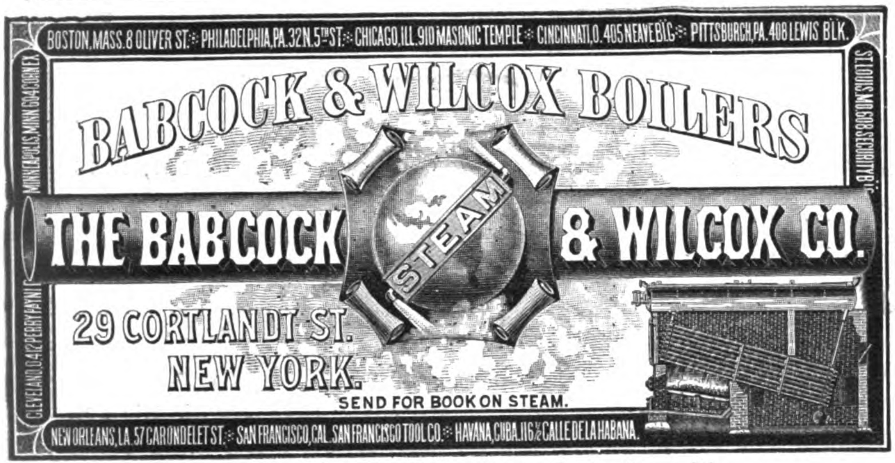

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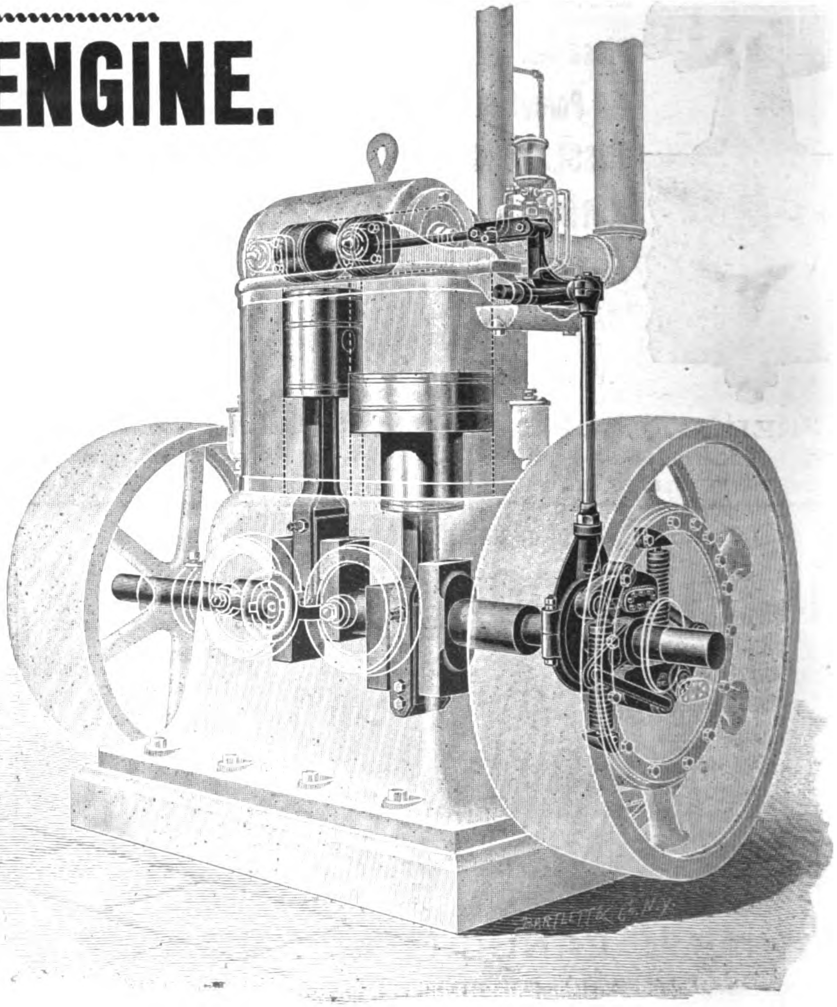

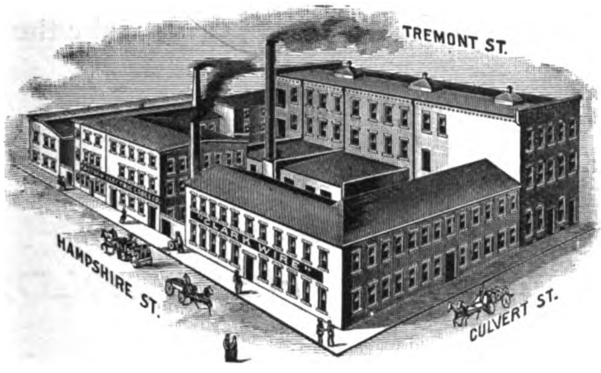
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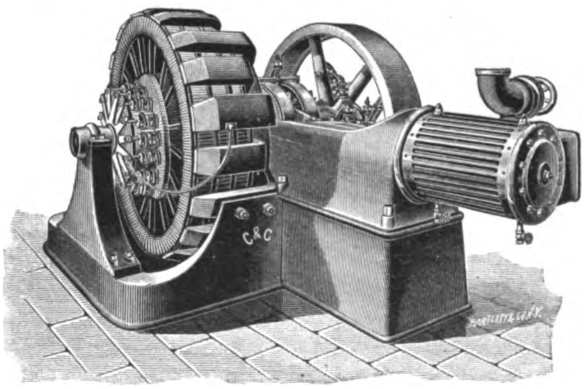

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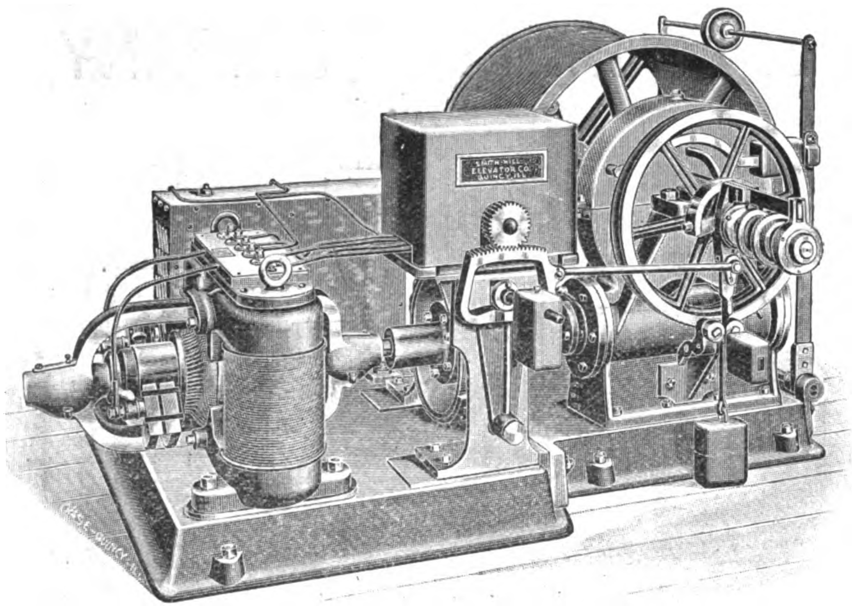

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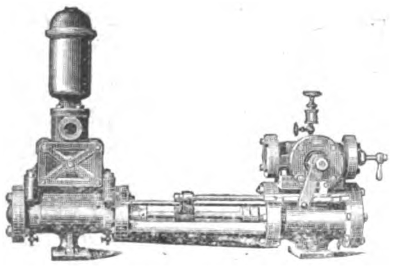

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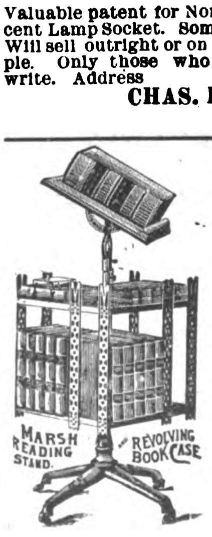

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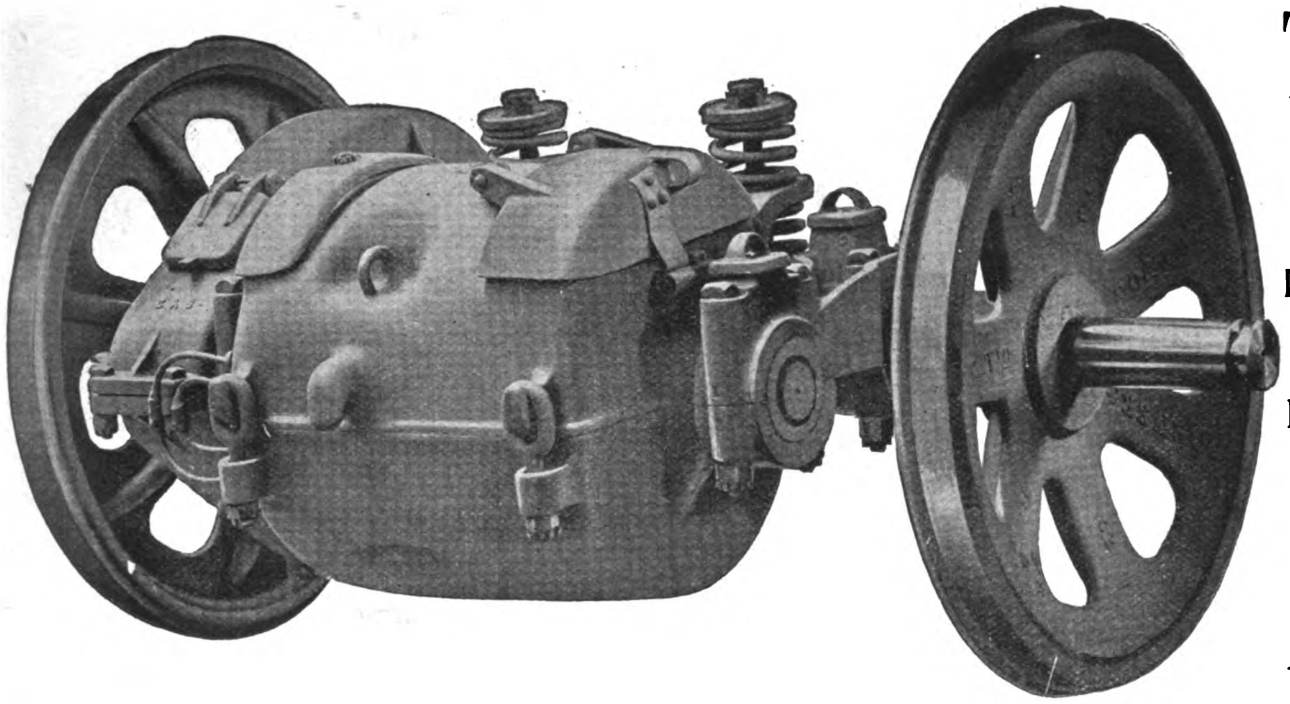

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ELECTRICITY.

VOL. IX. NEW YORK, JULY 17, 1895. No. 1

ELECTRICITY

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EDITORIAL NOTES.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

The Elevator Trust. On another page we give space to a communication from Mr. R. T. Crane, president of the Crane Elevator Company, which has been called forth by our recent strictures on the business methods of the Elevator Trust, of which Mr. Crane's company is a prominent member. The letter is a dignified and gentlemanly one, and while we are always ready and glad to print both sides of questions raised in our columns, we are particularly glad to give space to communications such as this. We can scarcely regard Mr. Crane's letter as a reply to what we have said against the Trust, for it is partly an admission and partly an evasion of the questions we had raised. In one point only does Mr. Crane meet us squarely, viz., where he denies flatly that the bids of the several companies composing the Trust are according to a mutual agreement. We must therefore have been in error in this. Mr. Crane admits, however, that "there are a number of persons in this country who, to a certain extent, control one another," and that "these builders have a right to utilize all the good things that there are in all the patents belonging to all these different companies," and maintains that the public has no right to complain of anything of that kind *unless undue advantage* is taken of them. The italics are ours. We must understand from this, then, that the Elevator Trust is an eleemosynary institution, in which each member gives to every other member the free use of all the good patents which he owns, in order that he may have no advantage over his brother members in competitive bidding and the public may be the gainers. In other words, the members of the Trust are banded together for the purpose of fostering among themselves a spirit of competition.

The *Morning Advertiser* of January 7, 1893, contained the following statement:

> "AN ELEVATOR TRUST."
>
> "Each company does the business of a certain portion of the country.
>
> "As soon as word is received that a new building is to be erected in which an elevator will be required, the combine fixes up a set of bids, all close together, but one of which is lower than all the others. The low one comes from the firm in whose territory the sale is to be made. If by any chance it is awarded to any of the other firms of the combine, the contract is filled and the matter is adjusted among the elevator men."

The fact that this, until now, has gone without contradiction, and that other unfortunate fact, that the business community with which we have had most to do had not yet developed the altruistic side of its nature to the same extent that the members of the Trust appear to have, must be our partial excuse for the erroneous belief that the organization of which Messrs. Crane and Otis are conspicuous members was *not* an eleemosynary institution.

Referring now to the above italicized portion of what we quoted, Mr. Crane is certainly right in his belief that the public have no cause to complain of the Trust or of its methods "*unless undue advantage*" is taken of them, but just there is the very point which we have been endeavoring to emphasize, viz., that the Trust *has* been taking undue advantage—not only that, but it has stooped to low and dishonorable methods to squelch competition from outsiders. It is not necessary to rehearse examples of practices chargeable directly to the Trust which no honorable business man can countenance. Many of these have already been given in these columns. We are glad to believe that Mr. Crane was not cognizant of or responsible for any of these. He has other and much larger interests to engage his attention, and the elevator business may in a sense be regarded by him merely as a side issue. We trust, however, that now his attention is drawn to these things, he will use his influence to correct the abuses that have grown up in the business around him.

Mr. Crane says: "In connection with this combination, I would also say that prices have not been advanced in consequence of such combination, or since it was formed, but instead of advancing they are continually going lower." This is the gospel truth—but why? Not through any fault of the Trust, surely. But Mr. Crane answers it quite as well as we can when he says: "*Notwithstanding the combination*" the prices have come down. Why? Because "there is a larger number of elevator builders outside of it—certainly enough to keep up a healthy competition." This admission is certainly a candid one, and is far-reaching when we understand its full purport. It means that notwithstanding the fact that five of the most prominent and wealthy concerns in the business have banded themselves together so that each may have "the right to utilize all the good things that are in all the patents belonging to all these different companies" against unorganized outside competition, still that outside competition has been strong enough to threaten the stability of the Trust with all its "good things." There must be some merit behind all this, but is Mr. Crane willing to confess that with all its "good things" the Trust is yet inferior to its individual outside competitors?

Mr. Crane makes one statement in regard to the cost of electricity that astonishes us in view of the present state of the art. While impliedly admitting that under certain conditions it might be cheaper to operate elevators by electricity drawn from the street mains than by hydraulic means, he raises the question as to whether it would be as cheap if the electrical power were generated locally. It is a fact, undisputed until now, that when the demand for current reaches any considerable proportion it *is cheaper* to generate it locally than to buy it from the central station. Else why do all of our modern office buildings install isolated plants? As a matter of fact every one knows—nearly every one knows, that isolated plants are installed simply because it is found economical to do so.

Mr. Crane raises the question as to whether it is not cheaper to transmit the power to elevators by hydraulic means than by electrical means. Under the conditions he is probably correct, that it is cheaper to transmit a given power a short distance by hydraulic means than it is to transmit the same power the same distance by electrical means. Not necessarily *cheaper*, but undoubtedly the hydraulic means would be the more efficient. But in elevator practice that is not the situation. Equal quantities of energy are not required to do the same work in the electrically and hydraulically operated elevator. By the latter means the elevator requires the maximum energy whenever it requires any at all—it requires the same amount of energy to raise the car empty that it does to raise it with its fullest load, and herein lies its lack of economy. The electrically operated elevator, however, requires energy only in proportion to the load it is carrying, and herein lies one of its greatest advantages and economies.

As to the relative merits of the respective makes of elevators, hydraulic and electric, we have little concern, personally. Mr. Crane singles out the Sprague elevator as one with which he would like to try conclusions, and implies a lack of willingness on the part of Mr. Sprague to meet him in contest. Mr. Sprague will doubtless reply in person. We have such confidence in his ability to take care of himself that we would regard it as supererogatory on our part to undertake any defence for him, even if we felt inclined to do so.

THE current number of *Cassier's Magazine* is of intense interest. The great Niagara plant is fully described by those best qualified for the work, the entire issue being given to this subject. It will be for some time the mine from which searchers for information as to this enterprise will dig for it.

On Monday last, July 15, power was sent over the line from Folsom to Sacramento, 24 miles, and the street car system of the latter city operated thereby. Everything is reported to be working satisfactorily. Current is transmitted at 10,000 volts.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER I.

The Winona General Electric Company.

INTRODUCTORY.

About nine years ago the Northwest Thomson-Houston Electric Company was organized, under the laws of Minnesota, with offices at Minneapolis. The company was simply a selling agent, owning the patent rights for T.-H. apparatus in northwest territory. Upon the organization of the General Electric Company in New York the name of the Minneapolis concern was changed to the Northwest General Electric Company. A controlling interest in the stock of the Northwest Company has always been owned by the parent company in the East. While the former had always been represented to be an extraordinarily prosperous concern, it suddenly went into liquidation in the latter part of 1894, and Mr. H. M. Byllesby, the former manager, is at present in New York completing the winding up of the company's affairs. No receiver has ever been appointed, and there has been no public confession of bankruptcy. The minority stockholders of the concern have had no official notification of the decision of the majority to close up the affairs. They only know the situation from what has appeared in the public prints, chiefly in ELECTRICITY. In 1894 a committee went to Minneapolis, took by force all the assets there were in the safe of the Northwest Company, left the town in the middle of the night, and turned the stolen securities over to the G. E. Company, in whose latest schedule they appear as assets. Thus the debt of the Northwest G. E. to the General Electric Company, for apparatus bought, was cancelled.

In the last two reports of the G. E. Company, over the signature of Mr. C. A. Coffin, president, there have appeared statements intended to convey the impression to G. E stockholders and to the public that the collapse of the Northwest Company was an accident for which no one in the management of the G. E. Company was responsible.

The purpose of the present series of articles in ELECTRICITY is to prove by the presentation of official records and statistics that the ill-starred career of the Northwest G. E. Company was only an incident of the gigantic swindling scheme conceived and engineered from start to finish by Mr. C. A. Coffin, fostered first by the Thomson-Houston Company, and later by the General Electric Company. We shall prove that there was nothing unique or exceptional in the conduct of the Northwest G. E. Company; that every feature of the swindle there has been duplicated in greater magnitude by the parent T.-H. and G. E. Companies in the East, and that there is no escape from our charges against those in control of the parent company, not alone Mr. Coffin, but the bankers and capitalists who have sat in the Board of Directors.

We shall prove to the satisfaction of every unprejudiced man that the disastrous ending of Northwest General Electric, in which the stockholders will be assessed in the final settlements, is but an anticipation of the larger failure which awaits the parent company, "built up" on exactly parallel lines. We shall show that the failure of neither was an accident, but the result of a premeditated swindle, a cold-blooded, conscienceless scheme for robbing the financial institutions and smaller investors of New England and the East.

The series of articles will continue for several weeks. We shall print first official records, and then present a clear exposition of the affairs of the Northwest Company from the time of its beginning, under the guidance of Mr. E R. Gilman, to the time of it disgraceful end. We will show that the parent and constant promoter of the entire scheme was Charles Albert Coffin.

NORTHWEST GENERAL ELECTRIC.

As before stated, this company was only a selling agency. Its assets in the beginning consisted of territorial rights only. As it sold plants it bought the apparatus on credit from the parent T.-H. or G. E. Company, sold it for bonds, turning the latter over to the United Electric Securities Company in the main, realizing cash enough to pay the G. E. Company, and keeping part of the stocks and bonds received in its own treasury.

The charge of ELECTRICITY is this, that—

THE ENTIRE CAREER OF THE T.-H. AND G. E. COMPANIES HAS BEEN A GIGANTIC SWINDLE, BASED UPON THE SALE OF WORTHLESS BONDS AND STOCKS TO THE PUBLIC.

We shall now present an unanswerable argument—a complete analysis of the condition of the various companies financed under the direction of Mr. C. A. Coffin through his agents in the Northwest General Electric Company, and later a comparison of these companies with some of the companies directly handled by the parent companies themselves.

One of these companies (Tacoma) has already been reviewed (ELECTRICITY, Vol. viii, No. 22). In this issue we take up the case of the Winona G. E. Company. The figures presented in this and succeeding articles are official, copied directly from the books of the various companies.

THE WINONA GENERAL ELECTRIC COMPANY.

When the T.-H. financiers began operations in Winona there was a lighting plant there, equipped with Van Depoele apparatus. There was also a horse railway with four miles of track and old, almost valueless equipment. It had never been successful, and had had a hard struggle for bare existence. It was capitalized for about $25,000.

The first move was to get control of this property and equip it electrically. About $25,000 was paid. After this transaction the capitalization was increased to $100,000 stock and $100,000 bonds. After a brief period, during which the company had proved its inability to pay operating expenses, it was planned to consolidate the two interests—lighting and railway—issue more bonds, sell them in Boston, and swell the treasury of the parent company.

It mattered not that neither venture had been, or had any prospect of becoming, profitable Mr. Coffin wanted bonds. They might be worthless. Even so. They could be taken at 60, sold to the public at 80, and the public's losses or profits never interest the financier of the Coffinesque order.

In the latter part of 1892 it was decided to put the two companies together and play the bond-swindling game to its limit.

The property of the railway company at this time was as follows:

[COPY.]

INVENTORY
OF
WINONA CITY RAILWAY COMPANY.

November 1, 1892.

One-half block Hamilton's Addition...	$1,000.00
Barn, car-house and buildings..........	2,000.00
Lot 8, Block 4, Winona...............	6,000.00
Four miles track with pole lines and overhead equipment complete @ $10,000...............	40,000.00
5 closed cars and motors complete, @ $3,000............	15,000.00
2 open cars, motors complete, @ $2,500...............	5,000.00
Snow sweeper, complete...............	3 000.00
80 H. P. generator..	3,500.00
Extra armature for 80 H. P. generator.	700.00
500 volt meter.......	55.00
Ampere meter, 180.	30.00
2 railway rheostats @ $40	80.00
Station switch......	45.00
2 extra wheels and axles...............	50.00
Gear P..............	50 00
[illegible]00 lb feed wire @ 16c	108.00
390 lb trol'y " @ 15c	75.00
10 iron poles with bases and tops....	210.00
4 ex. fields (motor)..	240.00
Fuse box, 500 volts.	4.20
Marieto bell........	15.00
2 ex. gears & axles..	12.00
20 extra pinions....	100.00
5 ex. int. boxes @ $7	35.00
[illegible]0 extra armature boxes @ $[illegible]........	100.00
25 cedar poles @ $4.	100.0
2 0 ties (tamarack) @ $ 5..............	62.50
Clutch pulley.......	100.00
222 steel rails.......	1,100.00
10 street horse cars equipped	1,000.00
3 snow plows.......	205.00
Two-horse wagon..	55 00
Pair bob-sleds......	20.00
2 horses.............	200.00
2 stoves.............	15.00
2 clocks.............	12.00
Night watch clock..	70.00
Office secretary.....	5 00
Office chair.........	2.00
Office wall lamp....	.75
3 barn lamps.......	4.50
5 barn lanterns.....	4.00
60 gallon oil tank...	$3.00
43 car la'p chimnneys	3.87
Keg rail spikes.....	4.15
Set wagon dump boards.............	1.50
Coal scuttle.........	.50
Iron vise and bench.	2.00
New wagon reach..	.75
Sprinkling can......	.50
Duplex register....	20.00
Brace and 6 bits....	1.10
2 screw-drivers.....	.50
14 in. steel track broom.............	1.25
50 ft. rub. hose, 1 in.	7.50
Pair sheep shears..	1.75
Set wagon harness.	12.00
3 scoop shovels.....	6.00
3 lime shovels.......	4.05
Buck saw.	.50
Leather fly net.....	3.00
10 window screens.	5.00
2 transom screens..	3.00
6 screen doors for barn..............	12.00
3 wooden ladders...	3.00
3 one-gallon jugs...	.45
2 wheelbarrows.....	3.00
Water tub...........	1.00
Hydrant water.....	4.00
Sledge hammer.....	1.00
4 stone hammers...	3.00
5 extra curve rails..	8.25
Hot water kettle stove.	12.00
3 wooden wat'r pails	.60
2 hatchets..........	.75
Hammer chisel.....	.25
2 switch scrapers...	.50
2 track gauges......	.50
11 new shovels.....	8.25
12 new picks........	7.80
3 old shovels........	.75
8 tamping bars.....	6.00
Pinch bar..........	1.25
2 spike mauls.......	2.00
Grindstone..........	1.50
3 barn wheelbar'ows	3.00
3 hay forks..........	3.75
Fairbanks pit scales	1.0.00
Galvanized feed pail	.75
4 monkey wrenches.	2.50
5 S. wrenches.......	2.50
Office table..........	3.00
Hall's iron safe.....	165.00
Transfer table......	50.00
Buffalo scales, 1,000 lbs................	24.00
Hay on hand........	6.00
Total...........	$83,902.22

The company had no power house, but hired their power from the Indurated Fibre Company, for which they had to pay cash weekly. It had four miles of track, five closed and two open cars. The car shed was of the cheapest possible wooden construction.

In February, 1893, when Mr. Coffin decided to consolidate the companies under the name of the Winona General Electric Company, he had the condition of the railway enterprise laid before him in detail.

The condition and prospects of this concern are made sufficiently clear by the following statements:

[COPY.]

WINONA CITY RAILWAY COMPANY.

TRIAL BALANCE FOR TWELVE MONTHS, ENDING JANUARY 31, 1893.

Property account........................	$193,803.80	
Electric plant...........................	3,000.00	
Northwest General Electric Co........	14,370.00	
Track equipment	1 689.43	
Car equipment..........................	687.26	
Organization expense..................	404.50	
Tools and fixtures.....................	39 25	
Overhead construction................	8.78	
Building extension....................	87.32	
Cash..	157.66	
Transportation......	7,272.96	
Motive power............................	6,986.07	
Maintenance of cars and motors......	2,974.04	
Office and superintendence............	1,944.80	
Maintenance of way....................	1,148.18	
Contingent expense.....................	3 5.00	
Insurance.................................	370.23	
Taxes.....................................	262.08	
General expense......................	145.52	
Personal injuries.......................	68.00	
Repairs to steam plant.................	14.00	
Interest on bonds......................	3 000.00	
" " notes..........................	2,695.01	
		$241,504.07

Credits.

Capital stock............................	$100,000.00	
Bonds......................................	100,000.00	
Notes payable............................	20,870.56	
Earnings	20,477.90	
Advertising..............................	125.00	
Surplus.	30.61	
		$241,504.07

Analyzing the above, we find that the financial status of the company did not warrant any further increase of bonded debt. It was already bankrupt, and should have been thrown into the hands of a receiver. The summary shows that the capital stock was already impaired to the amount of $34,761.77.

CONDENSED BALANCE SHEET, WINONA CITY RAILWAY COMPANY.

12 MONTHS ENDING JANUARY 31, 1893.

LIABILITIES :		
Capital stock...........................	$100,000.00	
Bonds......................................	100,000.00	
Bills payable............................	20,870.56	
Interest on bonds due and accrued.	5,000.00	
Interest on notes........................	2 69 .01	
		$228,565.57
LESS ASSETS AS FOLLOWS :		
Real estate, roadbed, franchises and plant, per inventory....................................		$193,803.80
Deficit..		**$34,761,77**

In addition to the unquestioned fact of impairment of capital, a far worse condition of affairs is shown by the statement of earnings and expenses :

[COPY.]

WINONA CITY RAILWAY COMPANY.

EARNINGS AND EXPENSES FOR TWELVE MONTHS, ENDING JANUARY 31, 1893.

Earnings.

Fares collected.............................	$20,477.90	
Advertising.................................	125.00	
		$20,602.90

Expenses.

Transportation.............................	$7,272.96	
Motive power................................	6,978.07	
Maintenance of cars and motors......	2,974.0	
Office and superintendence............	1,94 ,80	
Maintenance of way.....................	1,148.18	
Contingent expense.......................	375.00	
Insurance....................................	370.23	
Taxes...	2 2.08	
General expense..........................	145.52	
Personal injuries..........................	68.00	
Repairs to steam plant..................	14.00	
Maintenance of power station........	8.00	
		$21,5 1.88
Deficit..		$958.98

Interest.

Interest on bonds.........................	$3,000.00	
Interest on notes..........................	2,6 5.01	
		$5 695.01

The above, however, does not clearly express the facts. Analyzing the official report, where in spite of every effort to conceal the truth a deficit of $958.98 in operating expenses had to be acknowledged, we find the following as the actual condition :

PROFIT AND LOSS ACCOUNT, WINONA CITY RAILWAY COMPANY.

YEAR ENDING JANUARY 31, 1893.

Earnings.....................................	$20,602.90	
Expenses....................................	21,561.88	
Loss from Operation............................		**$958.98**
FIXED CHARGES:		
Int. on bonds, $100,000 at 6 per cent.	$6,000.00	
Interest on notes..........................	2,695.01	
Loss..		**$8,695.01**
ADD :		
Six per cent. depreciation on inventory of $193,803.80..		$11,628.22
		$21,2 2.21
Dividends on $100,000 stock at 6 per cent.......		6,000.00
Total Deficit in Operation..............		**$27,282.21**

If interest on bonds and notes was to be paid, and the road kept out of the hands of the courts, the deficit would be increased to $9,653.99. And looked at from an honest and conservative standpoint, to see how far the property fell short of being a safe investment, allowing the most moderate percentage for depreciation and 6 per cent. interest on the stock, we find that the total deficit in operation for one year was $27,282.21.

When the consolidation scheme was determined upon, a piece of land was bought for $6,000 and improvements made to the total amount of $60,000.

The condition of the lighting company at this time was even worse than that of the railway company. Its apparatus was antiquated, and while it had never paid expenses, it needed now, in order to run at all, a complete new outfit. This is very fairly shown by the following report which was sent to Boston:

[COPY.]

WINONA ELECTRIC LIGHT COMPANY.

SCHEDULE OF PROPERTY, OCTOBER 1, 1892.

Real Estate :
  Lot 5, Block 8, of original town, 60 x 140 feet.
  Brick building, with stone foundations, 40 x 85 feet.
  Stone foundations for engines and dynamos.
Steam Plant :
  Three steel boilers, each 54 in. x 16 ft. (80 H. P.). Set complete.
  One iron smoke stack, 50 in. x 60 ft. above building.
  One Buckeye engine, 15 in. x 30 in.
  One Ball aut. " 12 in. x 12 in.
  One heater, 250 H. P.
  Two pumps.
  Five clutch pulleys.
  Shafting.
  Belts.
  Piping, valves, covering, etc.
Electric Plant :
  One 10 light Van Depoele arc dynamo and exciter.
  One 30 " " " " "
  One 40 " " " " "
  One 30 " Edison " " "
  Four 360 light (No. 8) Edison incandescent dynamos.
  75 2,000 C. P. Van Depoele arc lamps.
  24 2,000 C. P. Edison " "
  27 1,500 C. P. Mosher " "
Pole Lines :
  Poles.
  Cross Arms.
  Pins, Insulators, etc.
  Fifteen 10 ft. Adams iron masts, set.
  Two 140 ft. " " "
  Eleven miles of No. 6 arc circuits, underwriter and waterproof wire.
  6,000 feet No. 8 incandescent circuits, bare wire.
Inside Wiring :
  Installations of wire, cutouts, switches, sockets, lamps, etc.
Tools, fixtures, etc.

Memorandum.

81 city arc lamps at $87 per annum .

Monthly receipts from public lighting..........	$565,00
" " " customers' lighting........	575.00
	$1,140.00

It will be noted that the equipment of the company was worth *new* about $35,000. It was not new in 1892, but entirely out of date. Agents of the Northwest G. E. appraised it at $25,000, but the owner wanted $35 000. Mr. Byllesby said: "Ten thousand dollars is only a small matter anyway in a scheme of this kind; pay them what they want." The $35,000 was paid. The GROSS EARNINGS of this company were only $13,680 a year, and it was of course losing money.

Thus the WINONA GENERAL ELECTRIC COMPANY was launched with an investment account as follows:

Winona City Railway Company..........	$193,803.80
New improvements........................	60,000.00
Paid for Light Company..................	35,000.00
	$28 ,803.80

Upon this foundation of two worthless companies, under the consolidation, $500,000 of stock was issued and $400,000 of bonds planned to be sold in Boston.

To properly appreciate the criminality of this entire proceeding, it must be borne in mind that the lighting company had no possible chance of making any money whatever, and that the railway company would have been in the hands of the courts if the Northwest General Electric Company had not loaned the money with which to meet the interest on the bonds and notes, pending the arrangements for a new and larger bond issue.

Was there any hope that the condition of either of these properties could be improved by a consolidation? None whatever. The only hope, the only object, was to swindle the New England public by selling them worthless bonds. The only possible result was and is that every investor in those securities has lost his money. As a commentary on the gigantic capitalization of this Winona G. E. Company, it is proper to refer again to Mr. E. E. Higgins's work on street railway finances. Winona has a population of 18,200. Of railway enterprises in towns of less than 25,000 people Mr. Higgins says :

"None of the securities are worth the consideration as investments of other than local capitalists who may be able to give personal time and care to the management of the properties."

The record shows that for towns much larger than Winona a capitalization of $12.50 per capita is the largest permissible. This would allow for the Winona Railway $225,000. Adding $35,000 for the light company, we have $260,000 as the extreme limit as against the $900,000 planned by the Boston financiers. Deducting $35,000 for the light company's share of the capitalization, we have $865,000 of securities on four miles of track, or **$216,250 per mile**, and on a road which never paid operating expenses.

These are the facts in regard to the Winona General Electric enterprise, and we trust that every reader of ELECTRICITY will give them careful thought.

Nine hundred thousand dollars of securities issued on a plant costing less than $300,000 and losing $30,000 a year!

The record is plain.

Argument is superfluous. It is for those who bought the bonds to ascertain whether they were swindled within the law or not.

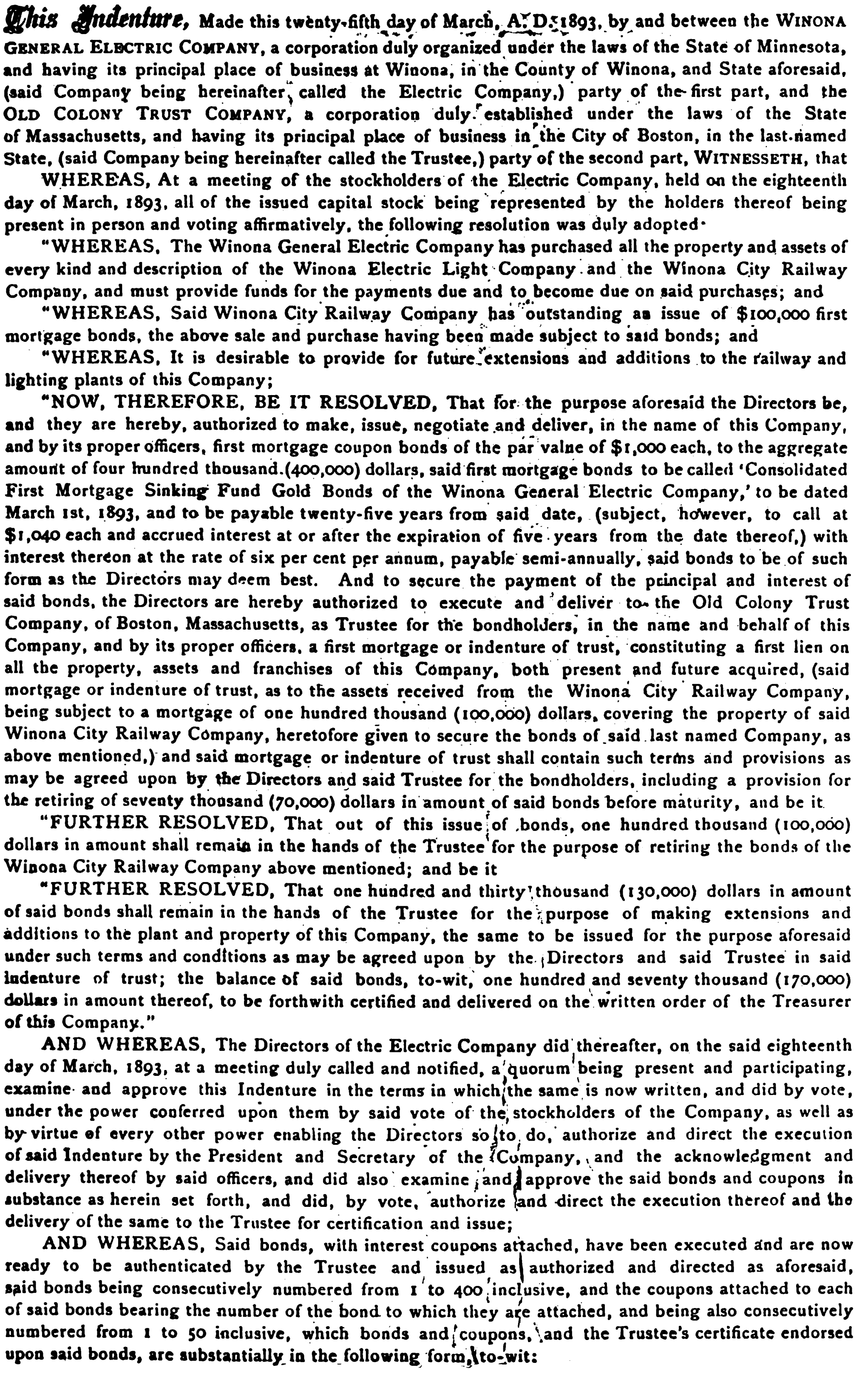
But it is for ELECTRICITY to make the evils of this infamous system of financing so plain that the system and its originators will be forever banished from the trade.

When we have finished this work it will be more evident than ever that ELECTRICITY's policy has been absolutely correct from first to last.

A Correction.

WE are informed by Mr. W. C. Bryant, of the Bryant Electric Company, that we did his company an injustice in stating that an injunction had been obtained against the latter by Mr. O. S. Platt. The news came to us through a Bridgeport daily, and we supposed it to be correct. If any injustice has been done, we shall be at pains to present the complete facts.

THE BOND AGREEMENT (Fac-simile).



This Indenture, Made this twenty-fifth day of March, A. D. 1893, by and between the WINONA GENERAL ELECTRIC COMPANY, a corporation duly organized under the laws of the State of Minnesota, and having its principal place of business at Winona, in the County of Winona, and State aforesaid, (said Company being hereinafter called the Electric Company,) party of the first part, and the OLD COLONY TRUST COMPANY, a corporation duly established under the laws of the State of Massachusetts, and having its principal place of business in the City of Boston, in the last-named State, (said Company being hereinafter called the Trustee,) party of the second part, WITNESSETH, that

WHEREAS, At a meeting of the stockholders of the Electric Company, held on the eighteenth day of March, 1893, all of the issued capital stock being represented by the holders thereof being present in person and voting affirmatively, the following resolution was duly adopted·

"WHEREAS, The Winona General Electric Company has purchased all the property and assets of every kind and description of the Winona Electric Light Company and the Winona City Railway Company, and must provide funds for the payments due and to become due on said purchases; and

"WHEREAS, Said Winona City Railway Company has outstanding an issue of $100,000 first mortgage bonds, the above sale and purchase having been made subject to said bonds; and

"WHEREAS, It is desirable to provide for future extensions and additions to the railway and lighting plants of this Company;

"NOW, THEREFORE, BE IT RESOLVED, That for the purpose aforesaid the Directors be, and they are hereby, authorized to make, issue, negotiate and deliver, in the name of this Company, and by its proper officers, first mortgage coupon bonds of the par value of $1,000 each, to the aggregate amount of four hundred thousand (400,000) dollars, said first mortgage bonds to be called 'Consolidated First Mortgage Sinking Fund Gold Bonds of the Winona General Electric Company,' to be dated March 1st, 1893, and to be payable twenty-five years from said date, (subject, however, to call at $1,040 each and accrued interest at or after the expiration of five years from the date thereof,) with interest thereon at the rate of six per cent per annum, payable semi-annually, said bonds to be of such form as the Directors may deem best. And to secure the payment of the principal and interest of said bonds, the Directors are hereby authorized to execute and deliver to the Old Colony Trust Company, of Boston, Massachusetts, as Trustee for the bondholders, in the name and behalf of this Company, and by its proper officers, a first mortgage or indenture of trust, constituting a first lien on all the property, assets and franchises of this Company, both present and future acquired, (said mortgage or indenture of trust, as to the assets received from the Winona City Railway Company, being subject to a mortgage of one hundred thousand (100,000) dollars, covering the property of said Winona City Railway Company, heretofore given to secure the bonds of said last named Company, as above mentioned,) and said mortgage or indenture of trust shall contain such terms and provisions as may be agreed upon by the Directors and said Trustee for the bondholders, including a provision for the retiring of seventy thousand (70,000) dollars in amount of said bonds before maturity, and be it

"FURTHER RESOLVED, That out of this issue of bonds, one hundred thousand (100,000) dollars in amount shall remain in the hands of the Trustee for the purpose of retiring the bonds of the Winona City Railway Company above mentioned; and be it

"FURTHER RESOLVED, That one hundred and thirty thousand (130,000) dollars in amount of said bonds shall remain in the hands of the Trustee for the purpose of making extensions and additions to the plant and property of this Company, the same to be issued for the purpose aforesaid under such terms and conditions as may be agreed upon by the Directors and said Trustee in said indenture of trust; the balance of said bonds, to-wit, one hundred and seventy thousand (170,000) dollars in amount thereof, to be forthwith certified and delivered on the written order of the Treasurer of this Company."

AND WHEREAS, The Directors of the Electric Company did thereafter, on the said eighteenth day of March, 1893, at a meeting duly called and notified, a quorum being present and participating, examine and approve this Indenture in the terms in which the same is now written, and did by vote, under the power conferred upon them by said vote of the stockholders of the Company, as well as by virtue of every other power enabling the Directors so to do, authorize and direct the execution of said Indenture by the President and Secretary of the Company, and the acknowledgment and delivery thereof by said officers, and did also examine and approve the said bonds and coupons in substance as herein set forth, and did, by vote, authorize and direct the execution thereof and the delivery of the same to the Trustee for certification and issue;

AND WHEREAS, Said bonds, with interest coupons attached, have been executed and are now ready to be authenticated by the Trustee and issued as authorized and directed as aforesaid, said bonds being consecutively numbered from 1 to 400 inclusive, and the coupons attached to each of said bonds bearing the number of the bond to which they are attached, and being also consecutively numbered from 1 to 50 inclusive, which bonds and coupons, and the Trustee's certificate endorsed upon said bonds, are substantially in the following form, to-wit:

Attempted Elevator Monopoly.

THE ELECTRIC ELEVATOR QUESTION.

CHICAGO, July 2, 1895.

To the Editor of ELECTRICITY.

DEAR SIR: My attention was called some few days since to an article in your paper on the elevator question, in which the conduct of the Crane Elevator Company (among others) was criticised, which article, to my mind, calls for a reply.

As this article covered considerable ground, it will be necessary in making reply to refer to a number of questions.

In the first place I would say that so far as the combination of elevator builders of which you speak is concerned, your statement in general is correct. There are a number of persons in this country who, to a certain extent, control one another; but I do not suppose that in this single fact there is anything of which the general public has a right to complain. I think they have no right to complain of anything of that kind unless undue advantage is taken of them.

Upon the other hand, the general public has, through this combination, had this advantage—that these builders have a right to utilize all the good things that there are in all the patents belonging to all these different companies.

Then with regard to the making of prices on each job that comes up, would say that the remarks in your article on this point are not true. This is contrary to my ideas of business, and I have never allowed it to be done in connection with this work in any instance, and I understand that it has not been done by any of the other builders.

I would further say that, so far as my company is concerned, the public has no grounds for complaint on the question of the prices for which we do the work. We have always given full value in our services—in fact, I think, a great deal more.

As to this feature of the question, when we take into consideration the great responsibility, energy and talent that have been put into the business, I think there is not another business in the country in which the same amount of labor has been expended that has paid so poorly. As an illustration, I would state that there are certain classes of machines that we are putting in to-day for which we receive not more than one-fifth the price that was paid for similar machines (but which were nowhere near so good) at the time we commenced business.

In connection with this combination I would also say that prices have not been advanced in consequence of such combination or since it was formed, but instead of advancing they are continually going lower.

Notwithstanding the combination, there is not much danger of the public being taken advantage of by it, in view of the fact that there is a large number of elevator builders outside of it—certainly enough to keep up a healthy competition.

If there were any such state of things existing in regard to prices as you complain of, and as is intimated in your paper, it certainly ought to be for the benefit of the outside builders, and why they should complain of a state of things that is to their benefit, and seek in every way to make capital of it, I cannot understand.

In reference to the St. Paul case, would say I do not see why it is unnatural for us to feel that it was an injustice to our company. I think it would be but natural for anyone to feel in the same way in such a case. If the work had been awarded to Mr. Sprague at a lower price than our figures it would have been a different mat-

(*Continued on page 7.*)

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.*

BY ELIHU THOMSON.

Considerable attention has recently been drawn to the subject of means for counterbalancing or preventing armature reaction in dynamo-generators or motors. The valuable paper of Messrs. H. J. Ryan and Milton F. Thompson, read before the Institute at its meeting on March 20th, called forth considerable discussion as to the actual utility or need of added devices, which undoubtedly render a machine more complex, but which can certainly be made to obliterate armature reaction or overcome its effects. The opinion which seems to prevail amongst engineers is that by taking advantage of the best principles of design the output of our machines is not limited by armature reaction, but rather by heating or the capacity to diffuse the heat which is sure to be produced during operation.

The writer's views are in accord with the general sentiment indicated by the discussion of the paper in question, excepting that he conceives that it may on occasion become desirable to possess a structure, either generator or motor, in which a load which would inevitably overheat the machine if continuous may be borne without destructive results for short periods only. The development of engineering work may in fact demand, occasionally, machines which would be regarded as emergency machines, to be operated with the highest possible loads for short periods. It is sometimes desirable that a dynamo be adapted to driving at different speeds while maintaining the same potential at the terminals, as in the case of direct driven dynamos coupled with engnies of different makes and speeds. Such an adaptation would require a change in the armature turns, or in the field excitation, the former demanding a reconstruction amounting to the production of a special type, while the latter, change of field strength, might involve such a weakened field at the higher speeds as would be incompatible with proper commutation. In such cases means and methods for securing proper commutation and neutralizing reaction may become quite useful. The subject itself has been worked upon by the writer as far back as 1879. At first a peculiar disposition of the field coils and pole pieces was selected, unfavorable to armature reactions, and later, in a patent applied for by the writer in the year 1885 the series coil of a compound-wound machine was so disposed as to add, under load, a magneto-motive force to the field in the region of armature opposition, and as a consequence to diminish somewhat the magneto-motive force of the field where the reaction of the armature was positive or assisting.

In the present paper, however, the writer desires to bring to the attention of the Institute a different type of dynamo, worked upon by him some three or more years ago, in which there is no series winding whatever, though the machine is in effect compounded or over-compounded at will.

It is expressly to be understood at the outset that the present paper is not intended to advocate the disposition described as a desirable commercial structure, or even as one which will be likely to come into practical use on any scale. On the contrary, it is believed to be open to objections which would take it out of competition with ordinary types in which the compounding effect is secured by the series coil or load circuit wound as usual as a part of the field energizing conductor.

The machine is, however, interesting as bringing out forcibly the capability of the armature current to neutralize its own effects in a proper structure and maintain, or even increase, the potential of the brushes under heavy loads. In fact the current in the armature in the type of machine herein treated is made to react under load to magnetize a portion of the field structure which at no load is neutral or nearly so. The reaction may thus be made to give rise to a magnetic flux sufficient, or more than sufficient, to compensate for its effect in diminishing the flux of the other or excited portion. The result is accomplished by dividing each field pole into a portion which is left unwound and a portion which is wound and excited in shunt or separately. At no load only the wound polar portions act to generate the open circuit E. M. F. As the load is put on, the unwound or dead poles become active in consequence of a magnetic flux developed in them by the armature currents themselves, that is, in consequence of the M. M. F. generated by the current in the winding of the armature itself. The disposition of the poles in a bipolar structure would be represented by Fig. 1, where A A are the excited poles or wound field cores, under the fringe of which commutation is effected, while D D are the "dead" poles or sections of polar surface unenergized at no load. A dotted line *a a* may pass through the neutral or non polar portion of the armature iron, threaded by all field lines on one side, while the lines *b b* may indicate the diameter of commutation on which the brushes rest. In such a structure, by choosing the position and spread of the "dead" poles in relation to that of the wound or excited polar portions, and adjusting the M. M. F. of the initial field relatively to the turns on the armature and the speed of driving, the effect of compounding or over-compounding may easily be obtained. The "dead" poles may be made adjustable in position so as to vary the effective M. M. F. of the armature upon them and various changes in relations of the parts are conceivable.

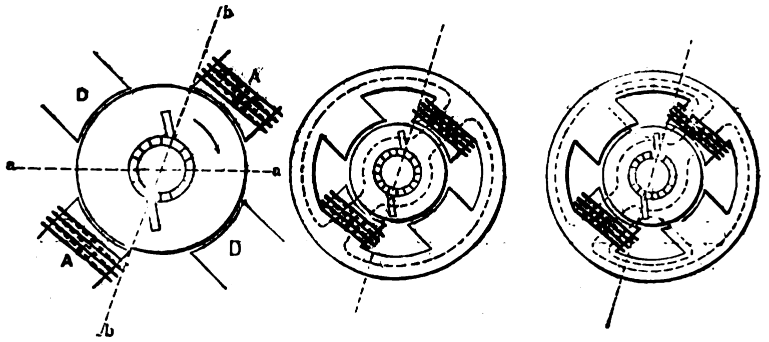
In Figs. 2 and 3 an attempt has been made to represent the magnetic flux under no load and under load respectively. In Fig. 2 the flux in the air-gap between the excited poles A A and the armature may be considered as of uniform density except at the edges, while in Fig. 3 it is, under the same pole, somewhat diminished towards the diameter of commutation. In Fig. 2 the "dead" poles are without flux across the air-gap, while in Fig. 3 the density increases from one edge to the other in the direction of rotation.

Fig. 4 is from a photograph of the dynamo constructed in accordance with the principle under discussion. It is multipolar, having four wound poles and four "dead" poles alternating in position around the armature. The latter is of standard iron projection type, being, in fact, identical in construction and dimensions with the armature used about three years ago in regular four-pole dynamos of the marine type of the Thomson-Houston Electric Company.

The principal data of the armature construction are as follows:

Diameter over all	17	inches.
Length (laminations)	8	"
Radial depth of laminations	4	"
No. of projections	87	
Width of slot	.34	"
Depth of slot	.75	"

The armature is series drum-wound and has two conductors in each slot. The commutator has 87 segments. The new field system was constructed of two rings of cast open hearth steel having heavy lugs, four in number, projecting laterally from each ring on one side, and forming the "dead" poles when assembled in the machine. Separate castings for carrying the field coils and constituting the active poles were made,



FIGS. 1, 2 AND 3.

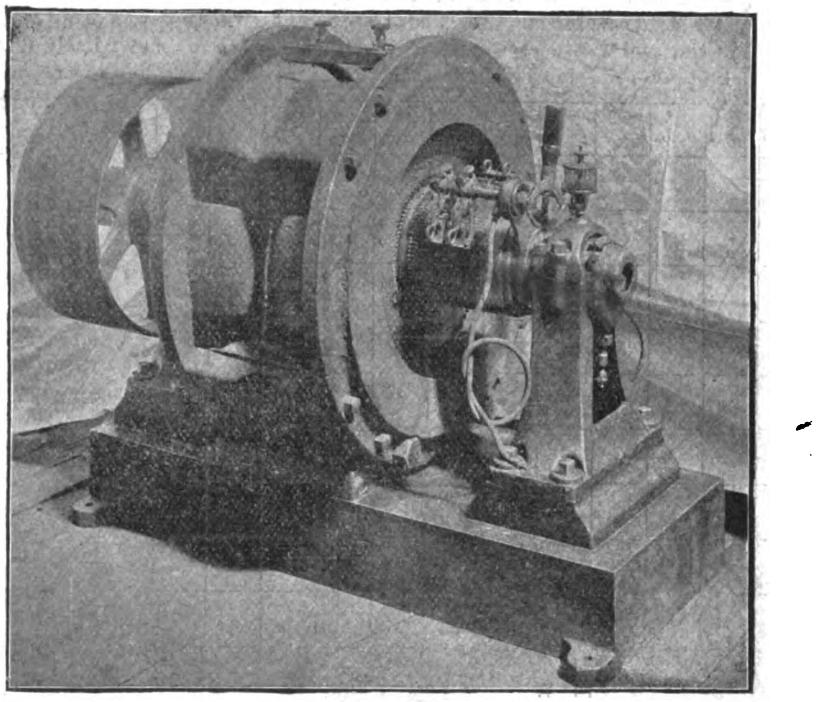


FIG. 4.

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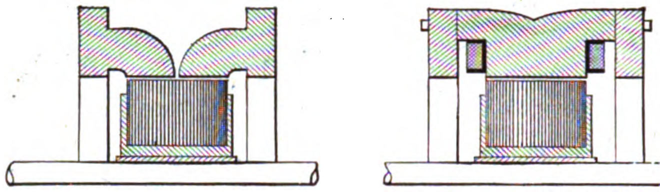
*A paper presented at the 12th General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 26, 1895.

wound and bolted between the two ring castings of the field. The arrangement will be understood at a glance from an inspection of Figs. 5 and 6. Fig. 5 is a section of the field in a plane passing through the "dead" poles and the axis of the armature, and Fig. 6 is a similar section through the active or wound poles. The wound cores have a section of 3½ inches by 8 inches and are of steel. The field was bored to 17¼ inches, thus giving a clearance of ⅛ of an inch around the armature. The excited or wound poles covered each about 5 inches, the "dead" poles each 5½ inches, leaving spaces between wound and "dead" poles of about 1½ inches. The face of each "dead" pole is 5½ by 8 inches.

The coils on the active poles can be connected in shunt to the armature terminals with a variable rheostat in the branch, or separately excited, as desired. It was found that for the purposes of test the latter arrangement was most satisfactory, as the exciting current could then be adjusted to any given value, and would remain undisturbed by variations in the potential difference between the brushes or terminals of the machine.

Fig. 7 shows the relation of volts at the terminal to varying exciting current at no load (full line) and at 30 amperes load (dotted line) with a speed of 800 revolutions per minute. It will be noted that the load has caused an increase of voltage, particularly at the relatively higher excitations. The normal current of full load for the armature as constructed and used in the regular multipolar field was 140 amperes, and it was found that as the load was increased steadily during a run the potential was not only maintained but increased with each increment of load, thus showing an over-compounding effect. This effect was less marked when the initial excitation was weak, as when less than three amperes traversed the field coils. The over-compounding under load was, of course, still more increased when the field coils were connected in shunt to the armature. Thus, at a little over 750 revolutions per minute, with an exciting current of four amperes, the open circuit volts were 84, rising to 104 when a load of 130 amperes was put on, with an increase of the exciting current to 4.8 amperes.

It was noticed that on any considerable increase of load being made the potential rose in some cases as much as 5 or 6 volts above the point at which it would remain, or which it would reach after a short interval. Similarly it was found that the sudden taking off of load caused a temporary fall below the stable voltage under the new or diminished load conditions. This curious effect was traced to the differences of time between that needed to build up or cut down the flux in the dead poles as compared with that required to cut down or build up the excited poles, which, being wound with wire, were naturally more sluggish under the conditions of use. Currents would be induced in the coils under each change of flux, which change itself would thereby be rendered more gradual. The dead poles being unwound could respond more rapidly. Any increase of load would of course tend to break down the wound poles and to increase the flux in the dead or unwound poles, and the taking off of load would have the opposite effect.



FIGS. 5 AND 6.

Fig. 8 shows a compounding curve obtained under a constant excitation of four amperes at a speed of 790 revolutions, the load being varied from 0 up to more than thrice the full load. It will be noticed that the potential at first increases and only breaks down under extremes of load. The final breaking down is doubtless due to saturation of the forward portions of the dead poles, together with the armature core projections. Part of the drop was undoubtedly due to resistance at the brushes, which were of carbon and by no means fitted to conduct off such heavy currents. Taking this drop and the drop over the armature conductor itself, it is not surprising that at the high loads the potential should fall off.

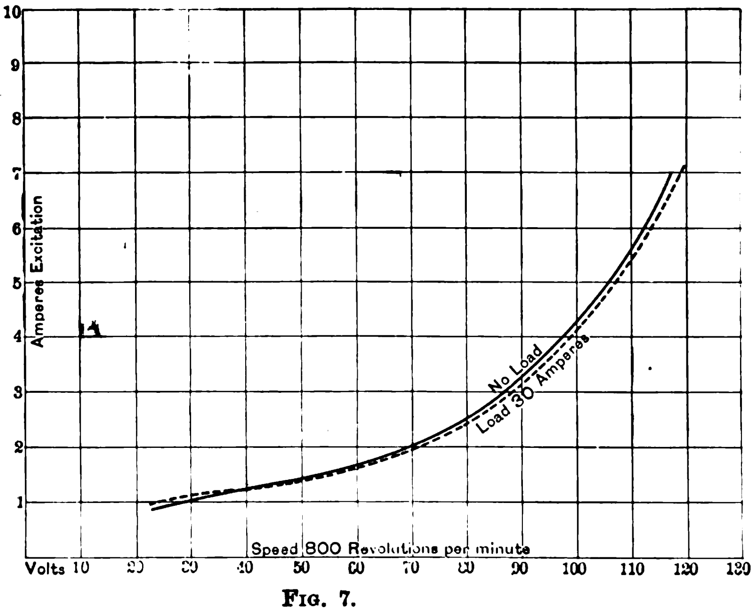


FIG. 7.

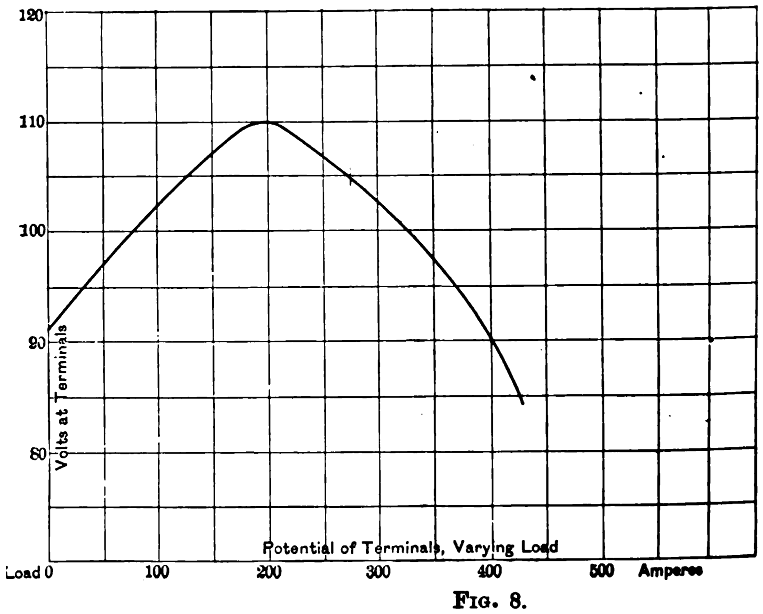


FIG. 8.

A horizontal plotting of the potentials generated in the armature coils under no load obtained by the two brush methods of Dr. S. P. Thompson is given in Fig. 9, the relative positions of the wound and dead poles being marked in dotted lines, and the arrow indicating the direction of movement of the armature relatively thereto.

Fig. 10 gives the same plotting under a load of 100 amperes and accentuates the effect of the armature reaction in magnetizing the dead poles. The curves are only approximate indications owing to the fact that the number of points at which readings were taken was less than was desirable, and because in some cases it was difficult to maintain all conditions unchanged, particularly with the very heavy loads.

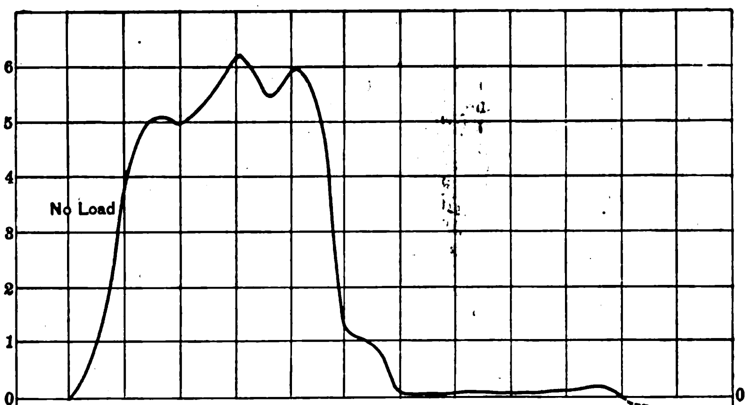
Figs. 11 and 12 show a similar plotting for abnormal or extreme loads. The former shows how completely the wound pole has been broken down by armature reaction, and how the unwound poles have now become the chief working field poles, or rather how the armature winding itself has furnished the field for its own cutting. A calculation of the flux density at the forward edge of the unwound pole shows that the magnetization has risen to saturation. The other parts of the pole are shown to be still susceptible of increase of flux, but their relation to the armature is far less favorable for its generation.

The machine described is probably chiefly interesting from a theoretical aspect. Still it shows clearly that so far as the effect of the series field on compound wound machines is concerned, the electrical engineer has other resources at his command giving similar results. It cannot be doubted also that the design of armature and field might be considerably improved with special regard for the particular feature of compounding. A feature of the machine which developed itself when carbon brushes were used was that even at heavy loads the brushes could be set back from their maximum position, or true diameter of commutation in this case, and that the movement was attended with little if any increase of spark, while the potential steadily went down. It was thus easily possible to adjust the potential by a backward movement of the brushes in the space between the unwound and wound poles, while the slight sparking under the carbon brushes was not increased thereby. The writer has never noticed this effect in so pronounced a degree in any other structures, but thinks that it may not be peculiar to this machine.

A further interesting consideration is the effect of dispensing with the wound poles altogether, and either neglecting to employ any reversing or commutating field while maintaining the brushes near the forward edge of the field poles which now remain, namely, the unwound poles, or employing commutating arrangements similar to those used by Mr. Sayers, that is, returning the leads through slots in the armature under the strong induction of the forward edge of the pole as the armature leaves it. In such a case it would appear from theoretical considerations that the machine should, if it possessed any permanent magnetism, excite itself as a series dynamo entirely without any winding on the field and solely by the action of the armature winding itself. This fact was, I believe, first pointed out by Drs. J. and E. Hopkinson.

In conclusion it may be stated that tests of the machine used to generate single phase and three phase alternating currents in its armature winding were made by dispensing with the commutator and substituting rings and connections common in such cases. The results indicated a substantially similar effect of compounding, but to a less degree, owing no doubt to the fact that the phase of the electromotive force generated by the wound pole flux would not coincide with that due to reaction on the dead poles, since the position of the poles with relation to any portion of the moving wire is different at the same instant.

FIG. 9.



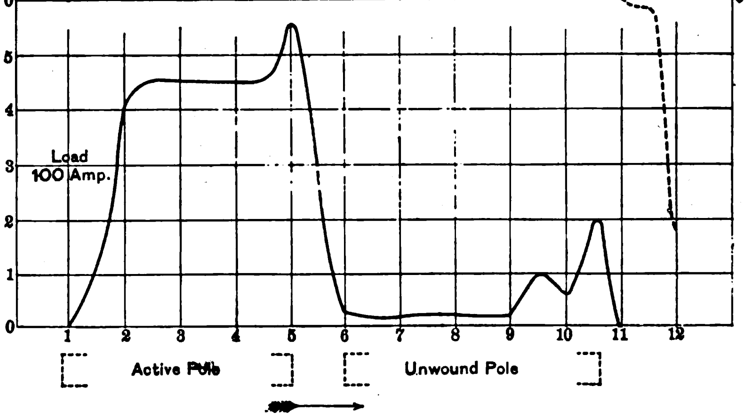
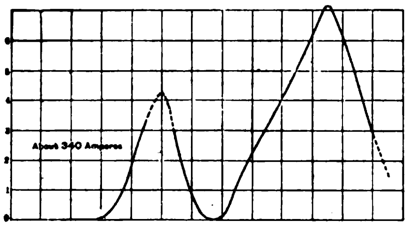


FIG. 10.

FIG. 11.



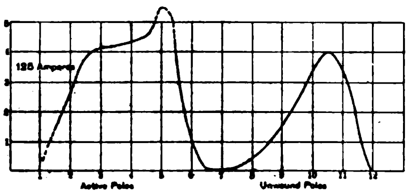


FIG. 12.

Gas Engines in France.

According to the *Electrical Review* (London) French gas engineers appear fully alive to the advance in gas engines. The Société Technique de l'Industrie du Gaz recently received a report from M. Salanson, stating that while little advance had been made in the principles of construction, a good deal had been done in details. Engines were becoming larger, gas was being used more efficiently, and compression before ignition was being carried to a greater degree, even, at times, to seven atmospheres, the Dick-Kerr engine compressing to five and six atmospheres with producer gas. Gas producers were extending, and there was greater regularity in the quality of their output.

Attempted Elevator Monopoly.

(*Continued from page 4.*)

ter. In the past it has been the fact in the elevator business that when a great preference in price has been given to one maker over another, it has generally been given to the maker who has shown by the test of years that his machine is durable, economical and as near perfect as the elevator art knew how to go, thereby divesting the transaction of all chance of new experiment, but in this particular instance the higher price has been given to an inexperienced company and one which has, in its machinery, departed from the well-established mechanical principles of running elevators. This would but naturally seem to be an error, and I am inclined to think that we were justified in making a contest.

Mr. Sprague's machine is like any other new thing that comes out; it may be better than the old devices and people may be justified in paying more money for it, but in our experience we have found very few persons who were willing to take the chances in such things.

The merits of their machinery can only be demonstrated after having been run for a number of years at least, and having been in the hands of persons who are not directly interested in its success.

It is well known that our machinery will, as a rule, run for a great many years at a very reasonable expense for wear and tear and care; in fact in this respect it is everything that could be desired.

While writing, I think it probably is well enough to say something that perhaps is not altogether called for in replying to your letter on this subject of electric elevators, but which may interest your readers, and it is very important that the public should be set right on this question.

In the early introduction of electricity as a power, quite a number of elevator builders—among them being the most prominent ones—at once saw that there was a field for electric elevators, and they immediately went to work to perfect and build this class of machinery.

A large number of the builders have met with reasonable success, and the only question that has troubled them to settle was, how far this machinery could be introduced to advantage—that is, when it ceased to be profitable to buy the current in the street and of more advantage to put in a steam plant, with hydraulic or steam elevators.

So far as we are concerned (and I think the same is true of other prominent elevator builders), it never occurred to us that it could be made profitable for a person to run electric elevators where he had to produce his own electricity. But Mr. Sprague has taken the bull by the horns and assumes that this can be done, and now it remains to be seen whether he is right or not.

To make this subject clear, it may be said that electricity in this machine takes the place of water in the hydraulic elevator. Neither is it a power within itself, but is simply a means for the communicating of power—as air, water, shafting, belting, etc., and the real question is, which article (everything being considered) will prove the best.

To settle this question two points must be considered—

First, loss of power in the working of this means—whether the power can be put into electricity, and then taken out of that and put into an elevator, with the same economy that water can be used.

Second, adaptability of the machinery, and the care and wear and tear caused by its operation.

Now, there is nothing very positive about the economy of using electricity in this manner. In regard to water, however, it is well understood that there is a very small percentage of loss in communicating power through this medium; and when it comes to using water for hydraulic elevators it has always been regarded as the most perfect means of communication that could be used.

Water has been universally approved of all over the world where elevator or hoisting service was required, and he is a bold man who will undertake to revolutionize this subject.

We are now brought to the question of wear and tear and the complications of the machinery used in this connection.

The first machinery is, of course, the pump, and there need be little said regarding that. All know what pumps require in this direction and what the expense is of their care.

The same can also be said of the elevator; it is the simplest and most easily understood machinery that can be devised.

But when you adopt electricity for this purpose it will be seen that you get into great complications. This is a class of machinery that is very much more liable to get out of order, and it is exceedingly difficult to understand and requires very much more attention.

These things, however, cannot be settled theoretically. Of course every one can have his opinion, and my opinion is very much averse to electricity as used under the above conditions.

Now, as this subject is of vital importance to the general public, and as Mr. Sprague and ourselves are in a position to get at the bottom of it, I have invited him to make a test, as you will see by the following communication, but thus far he has made no reply:

"Chicago, June 15, 1895.

"Sprague-Pratt Electric Company,
"Postal Telegraph Bldg., New York City.

"Gentlemen: Whereas the question of what position the electric elevator is qualified to occupy in the elevator business is an undecided one, and as this is a very essential question and one in which all elevator builders, as well as many purchasers of elevators, are most decidedly interested, we, as elevator builders, owe it to the purchasers of elevators to give them all the light we can upon the subject and to place it before them in the most intelligible manner.

"As you and ourselves are able to give this information, and assuming that you are disposed to do your part, we hereby invite you to make a test of electric as compared with hydraulic elevators at such time as suits your convenience, which we trust you will be pleased to do without unnecessary delay.

"My views of the subject are that the real question only applies to the larger class of jobs and where parties furnish their own power.

"The test and investigation should cover every essential question in connection with the elevator service.

"The economical test should be confined to the consumption of fuel.

R. T. Crane,
Pres't of the Crane Elevator Co.

A SEVERE BLOW TO THE ELEVATOR TRUST.

Opinion of Judge Dallas in the Cases of the National Company vs. Belcher, and National Company vs. Morse, Williams & Co.

In pursuance of a stipulation filed, these two cases have been heard together, and upon the same proofs. They both involve the same five patents.

1. The patent to Philip Hinkle, No. 183,05[illegible], dated October 10th, 1876, is for "Improvement in air-chambers for forcing water for operating elevators etc."

The claim in question in this suit is as follows:

"1. In a hydraulic hoisting device, an air and water chamber, A, interposed between and communicating with the elevator-cylinder and a pressure-generator, substantially as described."

In the specification, it is said:

"I may employ a pump, or such construction that when there is a determined amount of pressure in the chamber, A, the pump shuts off, but when the pressure lowers, the pump again starts."

This is the only mention which is anywhere made of any particular kind of pump or construction, and it amounts to nothing more than a suggestion which may, or may not, be followed. Complainants' expert says that "the patentee proposes to provide the pump of such construction that a determined amount of pressure in the tank chamber, A, will automatically stop the pump; the pump being started again when the pressure in the chamber becomes lower"; but for this statement there is no other foundation than the language which I have quoted from the specification. Whether the patentee, if he had, in his claim, specifically designated the automatically-acting pump here referred to, would have strengthened his position is at least doubtful; but as it is very plain that the claim does not call for any peculiar form or construction of "pressure generator," inquiry as to whether a claim so constructed might have been made and sustained would be profitless. As it stands, this claim has been met by overwhelming evidence of anticipation, and, therefore, I am constrained to hold that it is invalid.

2. The patent to Charles R. Otis, No. 228,107, dated May 25th, 1880, is for an invention which, as stated in the specification, "consists in means . . . for preventing accidents from the breaking or slipping of the hoisting rope of an elevating apparatus, or from the cage acquiring an undue velocity from any cause; the invention further consisting in means for automatically restoring the parts to an operative position after the movement of the cage has been arrested or reduced."

Four of the seven claims in this patent are involved. These are as follows:

"The combination with an elevator cage having appliances for arresting or retarding the movement thereof, of mechanism for throwing said appliances into operation on an undue increase of speed, and devices for automatically restoring the said appliances to their first position as the speed is reduced, or motion arrested, or reversed, substantially as set forth.

"4. The combination, with a cage and its arresting appliances, of the cable k, connected thereto and traveling therewith, governor operated by said cable, a clamp operated by the governor to automatically grip and release the cable, substantially as set forth.

"6. The combination of the cage, its detents, the cable k, and its retarding appliances, and the spring interposed between the operating arm of the stopping or retarding devices and a bearing on the cable, substantially as set forth.

"7. The combination of the cage, it arresting devices, operated from a crank or arm, a cable traveling with the cage and connected to said arm, governor operated by the movement of the cable, and jaws arranged adjacent to the cable, to act directly thereon, and connected to the governor, to be opened and closed thereby."

The ten prior patents discussed by the learned counsel of the defendants have been carefully examined. They certainly do show that before this Otis patent was applied for much thought had been directed to securing safety in the operation of elevators, and that the trend of the inventive efforts of others had been in the same general direction as that of Mr. Otis. His construction, however, though very nearly approached, had never been reached; and, upon its introduction, the contrivance of the patent in suit was adopted in preference to anything which had preceded it, and was and is largely used. His achievement, now that it has been realized, may not appear to have been a very difficult one to accomplish, but that it met a recognized want and was regarded as being new as well as useful is quite persuasively shown by its extensive adoption and the prolonged acquiescence of the trade in his monopoly. The claim which is most seriously attacked is the third, and the reference by which that attack is most plausibly maintained is to a patent issued to John Fensom, No. 151,014, dated May 19th, 1874, for "improvement in elevators." But by that patent, although its appliances for arresting the movement of the cage may, after service, *fall* out of operative position, there are disclosed no "devices for automatically restoring the said appliances to their first position as the speed is reduced or motion arrested or reversed," and the employment of such devices constitutes a material element of the third claim of the patent in suit.

Infringement has been clearly shown. These are all combination claims, and though some of the corresponding parts in the respondents' arrangement are not precisely identical with those of the patent, yet it is obvious that they have the same purpose in the combination and effect that purpose in substantially the same manner.

Upon the authority of Dunlap vs. Schofield, 152 U. S. 244, I sustain the point made for respondents, that "there can be no recovery for damages and no accounting for profits, because the complainant has failed to allege in the bill of complaint either that the patented devices were marked 'Patented,' or that actual notice of the fact was given to the defendants, as required by Section 4 900, Revised Statutes."

In Allen vs. Deacon, 21 Fed., 122, it was held in a suit in equity that, in the absence of marking or notice, neither damages nor profits can be recovered.

3. The patent to George H. Reynolds, No. 317,202, dated May 5th, 1885, is "for means for controlling the operation of elevators." The only claim involved in this suit is as follows:

"1. The combination, with the car or cab and its controlling-valve of a lever or hand-gear on the car or cab, and occupying a stationary position relatively thereto as it travels, sheaves g g^1, and bearings therefor arranged at the bottom of the shaft and adapted to move upward and downward, other sheaves, h h, at the top of the shaft, flexible connections passing around these sheaves from the top to the bottom of the shaft and connected at their one end with the said lever or hand-gear on the car or cab, and connections between the valves and the movable bearings for the sheaves g g^1 at the bottom of the shaft, through which the movement of the lever or hand-gear on the car and the rising movement of one or other of the sheaves g g^1 will effect the shifting of the valves, substantially as herein described."

This claim was before the Circuit Court for Northern District of Illinois in the case of Crane Elevator Company vs. Standard Elevator Company, but the opinion filed by that court is silent upon the question of the patent's validity. That question is, therefore, an open one, and as such has now been considered. It is, however, unnecessary to discuss the evidence bearing upon it, except as it relates to a single matter upon which I have reached a decisive conclusion.

A German patent, No. 18,400, to D. Lampe, for "gearing for lifts," published June 8, 1882, contains this statement: "For moving cocks, valves, slide valves, pistons which have not a tendency to go into the cut-off position, the mechanism is doubled, whereby the loose rollers are set upon a two-armed lever, which then can act directly as cock key or beam." That patent was placed in the hands of a machinest and model maker, with instruction "merely to show by the construction of a model, a modification as described, of a double endless rope to operate the model as described in the specification according to his judgment as therein described: . . . only to show the operation of the modification of doubling the hand rope to move stop valves or other devices at the bottom of the shaft, as described in the specification." He had no further instructions, and received no drawings other than those which accompanied the Lampe patent, and upon information derived wholly from that patent, and the specification annexed to it, he constructed a model which fully discloses the invention claimed in the claim in suit. The learned counsel for the complainants contend that it is impossible that this model could have been produced by the exercise of mechanical skill merely, and with no other instructions than to illustrate the modification suggested by Lampe, comprising double cables, and that, therefore, either the testimony to that effect is false, or else that the person by whom the model was made also made the same invention Reynolds had made. I cannot accede to this. The evidence of the model maker is not controverted otherwise than by argument, and is supported by the testimony of other witnesses. The ability he displayed in making this model may astonish the unskilled, but, in view of the positive and uncontradicted evidence, it cannot be regarded as transcending possibility, and that it was not inventive in character is, I think, placed beyond question by his own testimony that he "did not experience any difficulty in the mechanism; the drawings and specifications made it plain." That he had himself made some inventions is true, but in doing this piece of work he was, as he tells us, a mere imitator; the drawings and specifications of Lampe, not his own inventive faculty, supplied all that was requisite for his purpose. The necessary result is that the Lampe patent must be regarded as establishing that the first claim of the Reynolds patent, No. 317,202, is void for lack of invention and patentable novelty of its subject matter.

4. The patent to George H. Reynolds, No. 456,122, dated July 14, 1891, is for "controlling device for elevators." Its two claims, both of which are involved in this suit, are as follows:

"1. In a controlling device for elevators, the combination of a car, two cables attached positively at each of their ends, to travel with the car, and connected with the controlling device, and an operating device upon the car to positively take up and pay out said cables, to shift positively the controlling device, substantially as set forth.

"2. In controlling devices for elevators, the combination of a car, traveling cables connected positively at each of their ends to the car, and passing over stationary pulleys at one end of the well, and around movable pulleys connected to the controlling device at the other end of the well, and means for positively contracting and relaxing the bights of the cables, substantially as set forth."

These claims were adjudged to be valid by the Circuit Court in Illinois, in Crane Elevator Company vs. Standard Elevator Company (supra); but I believe that if the additional evidence which has now been adduced had been submitted to that court its decision would have been different. The Lampe patent was produced in that case, but the model made thereunder, which I have already discussed, was not presented. This new matter is applicable to patent No. 456,122 as well as to patent No. 317,202; and as it shows that the Lampe patent supplied all the information necessary to enable a skilled mechanic to do all that was claimed by Reynolds in patent No. 456,122, it is a complete anticipation of that patent also.

The patent to George H. Reynolds, No. 458,917, dated September 1st, 1891, is for "controlling device for elevators." Its second and third claims are involved in this suit, and are as follows:

"2. In an elevator-control mechanism having two control-cables attached to and running with the car, in combination with yieldingly-supported pulleys, as F F, adapted to rise and fall together, substantially as described.

"3. In a cable-operating mechanism for elevators comprising two control-cables attached to the car, a weighted lever having sheaves over which the cables run for regulating and maintaining the tension of the cables; substantially as shown and described."

This patent, as to its claims 1 and 3 was adjudged invalid by the Circuit Court for the Northern District of Illinois, in another case between the Crane Company and the Standard Company. Claim 2 was not considered; but if the first and third claims are invalid, it would seem that the second must necessarily be so.

The brief of complainants appears to impliedly concede this, but insists that this case "is much stronger than the former case." As respects the argument and manner of presentation, this may be so, but if any new evidence has been introduced here, which would, if presented in the Illinois case, have affected its decision, it has not been pointed out, and I have not observed it. Therefore, following the judgment I have referred to, and without expressing any independent opinion, I hold that this patent is invalid.

Let a decree be prepared in accordance with this opinion in each case.

PULL THE STRING.

You may have forgotten it. When you receive your copy of ELECTRICITY next week, look for the little notch on right hand end of wrapper. Pull the string, and presto! the brightest trade paper in the world is before you.

Personal.

Mr. Chas. Wirt, formerly of 56 Fifth avenue, Chicago, has removed to Philadelphia, where his address is Ludlow street, corner 31st street.

General News.

What is Going on in the Electrical World.

Elizabeth, N. J.—The directors of the Elizabeth Street Railway Company have decided to equip the road with the trolley system.

Ocean City, Md.—Extensive improvements are being made here, and it is proposed to build an electric railway about six miles long.

Mason, Mich.—The city has purchased the electric light plant of Paddock & Henderson, now in operation here; $7,000 was the price paid for it.

Forest City, Pa.—The borough council has granted a franchise to the Carbondale and Forest City Passenger Railway Company for an electric railway route.

Glen Ridge, N. J.—The North Jersey Traction Company has applied to the borough council for a franchise to run a trolley line through the borough.

Meadville, Pa.—A petition has been received by the city council from Dr. T. B. Lashells asking for a franchise to construct and operate an electric railway in this city.

Charleston, W. Va.—The Charleston electric light and gas plants, the waterworks and the electric street railway have been sold to a syndicate of Northern capitalists.

Wadsworth, O.—The Wadsworth Electric Railway Company has been organized by W. A. Ault, M. C. Lytle, O. B. Dibble, J. S. Oberholtzer, F. C. Lee and F. B. McCauley.

Norwich, Conn.—Work of constructing the trolley road between this city and New London will begin in the early fall, and it is believed it will be finished by May 20, 1896. A survey of the route will be begun shortly.

Madisonville, Ky.—This city is now ready to receive bids for supplying it with thirty or more electric (arc) lights of 2,000 candle power. Mr. I. Bailey, chairman of the committee, will furnish specifications and particulars.

Detroit, Mich.—Copies of a $7,000,000 trust-mortgage given by the Detroit Citizens' Street Railway Company to the New York Security and Trust Company have been filed in the register of deeds' and city clerk's offices in this city.

Gretna, La.—Moss & Gerdes have applied to the parish authorities for the right to build and operate an electric railway from New Carrollton to East End; Benjamin T. Waldo has petitioned for a like franchise from Upertine street to Kennerville.

New York.—The new electric conduit road of the Metropolitan Traction Company, in Columbus avenue, is now in operation and works successfully. There are two motors in each car having a nominal strength of fifty horse power between them.

Austin, Tex.—Mr. W. E. Holmes, president of the Texas Gas and Electric Light Association, reports that organization as being in a flourishing and healthy condition. There are now about thirty members, and all of them take great interest in the work.

Jamaica, N. Y.—It is thought likely that a special election will be called to ascertain the will of the voters as to bonding the village in the sum of $200,000 for the purpose of enabling the village to own its water supply, its electrical light system and to macadamize all its streets.

Fremont, Neb.—The board of public works have awarded the contract for putting in an electric light plant to Bigelow & Company of Lincoln, Neb. The electric light company fought the project of the city owning a plant and operating it, but without avail.

Springfield, Ill.—The Pocatello Electric Light and Power Company of Chicago was the first corporation organized under the new corporation act of Illinois, and was obliged to pay $175 for license to open books of subscription to its capital stock of $150,000.

Los Angeles, Cal.—W. L. Richardson lately submitted to council a franchise for erecting and maintaining an electric light and power plant in Los Angeles which he wished to bid for after public notice had been given. The franchise has been ordered published and bids will be opened August 7.

Minneapolis, Minn.—As the time for holding the convention of the National Brotherhood of Electrical Workers in this city approaches, interest in the matter increases. The convention will comprise about 400 delegates, representing between 35,000 and 40,000 workers, and they will come from every section of the United States.

Youngstown, O.—The Park and Falls Electric Company of Youngstown has applied to the county commissioners for a charter for a road from this city to North Lima and Poland. They intend to carry freight as well as passengers and will complete the road by December. It is intended eventually to extend the road to Salem.

Oshkosh, Wis.—The Oshkosh Street Railway Company has appointed a committee to ascertain the cost and report upon the feasibility of substituting electricity for animal power on their lines. Charles Barber has been elected president of the company, J. H. Porter vice-president, and J. H. Jenkins secretary and treasurer.

New Orleans.—The Hart interest in the Canal and Claiborne street railroad has been purchased by local and Philadelphia capitalists, and the line as rapidly as the work can be done will be equipped with electric cars equal in speed and comfort to those now being operated by the New Orleans Traction Company.

Lancaster, O.—As a preliminary step towards the final completion of the electric street railway, Henry B. Peters, vice-president of the Fairfield County Bank, has been appointed receiver of the road, giving bond in the sum of $30,000. Several parties have been negotiating for the road for over a year, but the stockholders could not agree upon a price.

Fresno, Cal.—It is stated by those interested in the electric transmission scheme to bring power to this city from the north fork of the San Joaquin River, 33 miles distant, that the plant will be ready for operation in about four months. Power enough will be developed to supply all the lights needed and run all the machinery used in Fresno and adjoining places.

Manlius, N. Y.—A syndicate of Syracuse capitalists, headed by Charles E. Hubbell, has purchased the water power on the Appleton farm in this town. The syndicate intends to use the power to furnish electric light, heat and power for the towns of Manlius, Fayetteville and Cazenovia. Its members are also interested in the Syracuse and Oneida electric railway.

Liberty, Ind.—Right of way has been secured on a part of the route of the proposed trolley line between Richmond and Liberty, and from present indications the remainder will be secured in a few weeks. Richmond capitalists are at the head of the scheme and they are confident that the line will be ready for operation within six months. Freight will be carried as well as passengers.

Albany, N. Y.—At a meeting of the railroad commissioners, the Rome City Railroad Company of Rome, N. Y., was given a hearing on its application to change its motive power to electricity or compressed air. The board granted the road the privilege of using the trolley. The Ogdensburg Railway Company was given permission to use electricity and increase its capital stock from $75,000 to $150,000.

Whitinsville, Mass.—At a recent meeting of the subscribers of the proposed electric railway between Millbury and Rockdale, it was decided to put the road through. The following directors were chosen: F. A. Lapham, of Worcester; J. H. Ferguson, Herbert A. Ryan, Charles Buck, of Millbury; E. E. Howe, of Grafton, L. E. Chase, of Sutton, and S. M. Snow, of Providence. The capital stock is to be $100,000.

Altoona, Pa.—The Cumberland Valley Traction Company, which for a long time past has been trying to connect by a trolley road a number of the largest roads in Cumberland County, has sold out to Benjamin F. Myers, Luther Gorgas, George W. Crumbler, F. H. Alleman, W. K. Myers, all of Harrisburg, and John Skiles, of Blair County, Pa. The road from Harrisburg to Carlisle will now be completed, taking in Mechanicsburg. After that it will be extended to Boiling Springs.

St. Clair, Pa.—Proposals will be received by the borough of St. Clair up to July 31, 1895, for the furnishing of two incandescent dynamos of not less than 1,100 16 C. P. each, with station equipments; also one 250 H. P. stationary engine to run the above in connection with present dynamos, said engine to run not more than 85 revolutions per minute with 80 pounds of steam. Bids to be for engine and foundations and dynamos and foundations separately. For further information apply to Julius Sclump, superintendent, or Jacob Schuster, John H. Mullin and Samuel Dewald, electric light committee, St. Clair, Schuylkill County, Pa.

Hornellsville, N. Y.—Mr. J. Cooley, of this city, an electrician, has invented an air ship which he claims is superior to anything of the kind yet exhibited. A miniature "ship" has been tested and worked successfully. The vessel is a curiously constructed affair with wings about 12 feet long and with a body about 20 feet in length. It was built by its inventor and was not intended to carry a person, but in the wake of the model will come a machine of practical utility so constructed that it will carry a person any distance without difficulty. In the rear of the machine will be placed an electric propeller and with the rudder the slightest touch will suffice to steer it.

Baltimore.—The 90-ton electric locomotive was attached to a train of twenty-four loaded coal cars in the Belt tunnel a few days ago, but it was too much of a pull. The start was a slow one, and it was evident the test was about all the motor could stand. When the middle of the tunnel was reached the shoe of the trolley was found to be red-hot, and the connection from the shoe to the car broke. There was no time for repairs, for northbound trains were expected. So the locomotive to which the cars were attached made an effort to pull the motor, train and all, but it could not budge them. The train was then divided into two sections, and the motor and nine cars were first taken through, and then the fifteen cars were pulled through by the locomotive.—A preliminary route has been mapped out for a surface electric line 2½ miles long in Clifton Park, for use during the proposed Centennial Exposition.

Harrisburg, Pa.—Application has been made to the State Department for charters for the Philadelphia, Lancaster and Harrisburg Railroad Company, capital $6,000,000; for the Lancaster and Manheim Railroad Company, capital, $50,000, and for the Lancaster, Ephrata and Reading Railroad Company, capital $70,000. The corporators of the first-named company are John J. Patterson, J. Hay Brown, John D. Skiles, J. Gust Zook, Michael Reilly, Dr. M. L. Herr, Dr. Henry Yeagley, S. H. Reynolds and H. C. Hopkins; the corporators of the latter two companies are John J. Patterson, J. Hay Brown, John D. Skiles, J. Gust Zook, Michael Reilly, Dr. M. L. Herr and Dr. Henry Yeagley. The Pennsylvania Traction Company now holds charters for these roads, but some legal questions having grown out of a recent decision of the Supreme Court preventing traction companies from building lines of railway connecting country towns, it was decided to apply for charters under the general railroad act of 1868.—A reorganization of the Cumberland Valley Traction Company has taken place. The new board of directors includes George W. Cumbler, B. F. Meyers, F. H. Alleman, W. K. Meyers, Luther Gorgas. Mr. Cumbler is president and Mr. Gorgas secretary and treasurer. It is expected that the extension of the line up the Cumberland Valley will be pushed along.

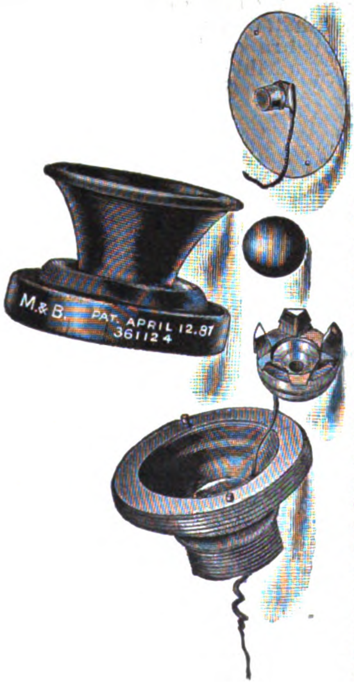
THE TELEPHONE WORLD.

United States Telephone Construction Co.

The United States Telephone Construction Company recently gave an exhibition to the press in the Bullitt Building, Philadelphia, of their various types of instruments for exchange work, private houses, factories, etc., in connection with the switchboard for exchange work manufactured under the Gould-Smith patents by the Eastern Electrical Manufacturing Company. There are a good many patents on switchboards owned by the Bell Co., and this switchboard is claimed to be the only one yet produced which is suitable for large or small exchanges, containing no infringing devices and being superior in every way to those in common use by the Bell Co. A distinct feature of the switchboard is the absolute secrecy in conversation between subscribers, the operator being entirely out of the circuit if two subscribers are connected; another feature is the entire freedom from danger from fires, the terminals in the switchboard automatically opening the moment strong currents get on to the circuits. Still another feature is the ease with which new subscribers can be connected up in the switchboard.

STYLE D—M. & B. TELEPHONE.

One of the accompanying cuts shows the M. & B. Transmitter dismantled. The diaphragm is of highly resonant material, which gives great efficiency. Attached to the center of this diaphragm is a small metal cup holding a carbon or other suitable point. In the back of the black rubber shell is a basket or runway of aluminum or other metal. The sphere, shown in the cut, which may be of carbon or other material, is eleven-sixteenths of an inch in diameter and lies in the basket or runway, which is so constructed that the sphere always rests on a plane that inclines towards the diaphragm. When these parts are assembled the point on the diaphragm comes about on a level with the center of the sphere, which, owing to the angle of the side of the basket, is normally kept against this point by gravity. The distance between the point on the diaphragm and the back of the basket is about three-quarters of an inch, which allows the sphere a maximum movement of a little under one-sixteenth of an inch. With every vibration of the diaphragm a movement of this sphere takes place which varies the battery circuit. The transmitter, as will be seen from this description, is novel in every detail. The makers claim superiority for the transmitter in the following points: Better articulation, greater volume of sound, capability for long distance transmission and simplicity of construction.



M. & B. TRANSMITTER DISMANTLED.

They also exhibited a novel toll line metallic circuit switchboard which is operated without cords or plugs.

Telephone and Telegraph.

The Conway Telephone Company, of Conway, Taylor County, Ia., has been incorporated with a capital stock of $5,000. Arthur Hayme and Miles H. Simmons are the incorporators.

A telephone company operating at Lenox and Clearfield, Ia., has been granted right of way into Creston. This makes the fourth company that has been given the right to enter Creston, and telephone competition promises to be lively.

Some people who are inclined to patronize independent telephone companies imagine they cannot get the long distance telephone service without paying double what they would to the Bell companies. This is incorrect as the interstate commerce law forbids any discrimination.

In St. Louis a number of the church organizations have recommended the passage of a city ordinance making it a misdemeanor to supply telephone service to immoral resorts.

The city council of Port Huron, Mich., has ordered the Bell telephones taken out of all city offices and have Harrison telephones substituted. The causes leading up to this action are the alleged methods made use of by the Bell company to freeze out the Harrison company. The right of the Bell company to occupy the streets of Port Huron will also be investigated by the city attorney.

The Creede-Bachelor Telephone Company of Creede, Col., has been granted an exclusive franchise in Creede for 10 years. As W. C. Munsell, who also applied for a franchise, holds an exclusive franchise for the town of Bachelor, there must be an arrangement between the two concerns before Creede and Bachelor can be telephonically connected.

There was a report current in New York last week to the effect that the new Standard Telephone Company had made an offer of $15,000,000 for the plant of the Postal Telegraph Company and that the bid was rejected because the owners of the Postal did not care to part with the property. The report has been both denied and affirmed by men supposed to know the facts.

The Bell telephones have been removed from all the offices of the Interior and Agricultural Departments and the Pension Office at Washington, and have been replaced by those of the Western Telephone Construction Company. Mr. J. E. Keelyn, a member of that company, has been making estimates on the cost of establishing a new telephone exchange in Washington.

In Detroit, Mich., the council committee on streets have agreed to report back the ordinances granting franchises to the Harrison Telephone Company and the Brown Loud-Speaking Company. Ordinances giving these companies franchises recently passed the council; a motion to reconsider was carried, and the franchises were resubmitted to the committee for amendment. These amendments have been made after consultation with the representatives of the companies, who have accepted them.

The board of directors of the Electric Messenger Company have formally accepted the conditions of the ordinance passed by the Pittsburg, Pa., councils granting to the company the franchise of the streets. The company was recently organized to compete with the Bell Company in Pittsburg, and proposes to supply a service and offer rates that will encourage patronage. A director of the company states that the company will get to work within a very short time. The financial matters necessary to construct the system have been arranged, and the company hopes soon to be soliciting contracts for instruments.

The Commercial Telephone Company have applied for a franchise at Oakland, Cal., and a resolution has been prepared for the action of the council in which the terms of the franchise are embodied. The resolution requires the new company to put up a certified check for $5,000, payable to the city clerk, at the time their bid for the franchise is filed. They are also required to furnish a good and sufficient bond for the sum of $20,000 to assure the council that they will in a certain time build 10 miles of line. They are likewise required to protect the city from any suits for infringement. The company fear no trouble as regards the patents of their instruments for they claim that they are not infringements on any of the other telephones.

The new law in regard to the maintenance of secrecy by telephone employees as to messages passing over the wires will come into operation September 1. It requires the staff of telephone companies to be as secretive regarding the nature of their business as are the men and women who handle telegraphic messages. A person who either wrongfully obtains or attempts to obtain any knowledge of a telegraphic or telephonic message by connivance with a clerk, operator, messenger or other employee of a telegraph or telephone company, or, being such operator or other employee, willfully divulges to any one but the person for whom it was intended the contents or the nature of a telegraphic or telephonic message intrusted to him for transmission or delivery, or of which contents he may in anyway have become possessed, is punishable by a fine of $1,000 or six months' imprisonment, or both. The same penalty attaches to neglect or refusal to transmit or deliver messages, except when they are intended for illegal purposes.

The Washington (D. C.) *Times* of the 4th inst. describes a test of the telephones in the Interior Department lately put in by the Western Telephone Construction Company of Chicago. It says: "The new granular-carbon microphone, designed by J. E. Keelyn, of the Western Telephone Construction Company, demonstrated the wonderful sensitiveness of the telephone. One instrument was placed near the F street entrance and connection made to the switchboard located in the basement, and hence to another telephone. A gentleman then whispered into the transmitter of the first mentioned telephone, the whisper being perfectly audible. Then the gentleman proceeded to move away from the telephone step by step, talking as he moved. He walked out from the lobby to the main corridor, to the Seventh street corridor and along the latter until opposite the superintendent's room, which is distant half the length of the building. At this point, about 500 feet distant from the telephone, his voice was plainly taken up by the instrument and transmitted to the listener at the other end of the line. The line of sound had to take the three angles of the corridors. This is the most remarkable result in telephony ever effected."

"The Car-Buyer's Helper."

This is the title of a very handsome trade-book, published by the Brownell Car Company of St. Louis, which gives in narrative style a thorough analysis of the street car from the beginning to the end of its construction, pointing out briefly but clearly those details which thought and experience have taught the expert to examine when called upon to give his opinion as to the material, strength, solidity and adaptability of everything that goes into the manufacture of an electric or cable car. The book is written in a style that makes it positively interesting to the ordinary reader, and to those who are seeking information on the subjects of which it treats it must seem an admirable instructor, at once practical and entertaining. There are a number of illustrations in the book of those parts of a car which need the aid of an engraving to better the understanding, and marginal side notes enable the reader to find at a glance the points he is seeking; there is also an index. We commend "The Car-Buyer's Helper" to all street railroad men.

Metropolitan Electric Company.

Business with the Metropolitan Electric Company, 186-198 Fifth avenue, Chicago, in the Fan Motor line is on the increase; they say they are doing a better business in this line than they have ever done before.

Their Metropolitan Incandescent Lamp is giving excellent satisfaction and they are making large sales constantly.

In this issue please note the great reudction which the Metropolitan Electric Company have made in the price of 12-inch Alternating Fan Motors. They report but a few left and request that orders be sent in at once.

COMMERCIAL PARAGRAPHS.

The De La Vergne Refrigerating Company have entered the Oil Engine field and have selected the Hornsby-Akroyd type, which is well known abroad. The headquarters of the company are at 138th street and East River, New York.

The Selle Gear Company of Akron, O., have purchased the manufacturing rights for the Replogle Water Wheel Governor and will at once place the device on the market. This is one of the inventions of Mr. Mark A. Replogle, who will remove to Akron.

The American Gas Engine Company, Chicago, issue a well written "Treatise on Gas Engines and Electric Power Up to Date," which is well worth reading and will be mailed upon request.

The Electrical Subway Commission of Baltimore has awarded the contract for the laying of new conduits to the National Conduit Company of New York. The amount involved is about $70,000.

Queen & Company of Philadelphia have secured the right to the Wirt switchboard instruments, and they will manufacture these instruments in the future. Mr. Wirt, who has removed from Chicago to Philadelphia, is manufacturing his "non-sparking" dynamo brush, and will shortly bring out a new brush intended for motors and dynamos which are required to run with almost no attention.

The Falls Rivet and Machine Company have secured the contract for the power transmitting machinery which will be required by the Diamond Match Company in equipping their large match factory now building at Liverpool, England. The order consists of shafting, ring oiling bearings, friction clutches, steel rim pulleys, gears, etc., and the company are very much elated over their good fortune in securing such an order, as they are confident the equipping of a factory of this size in that locality with American machinery will be of considerable benefit to them. They have already fitted up several factories in this country for the above company, and the present order demonstrates the fact that the material furnished has given perfect satisfaction.

The Ohio Brass Company.

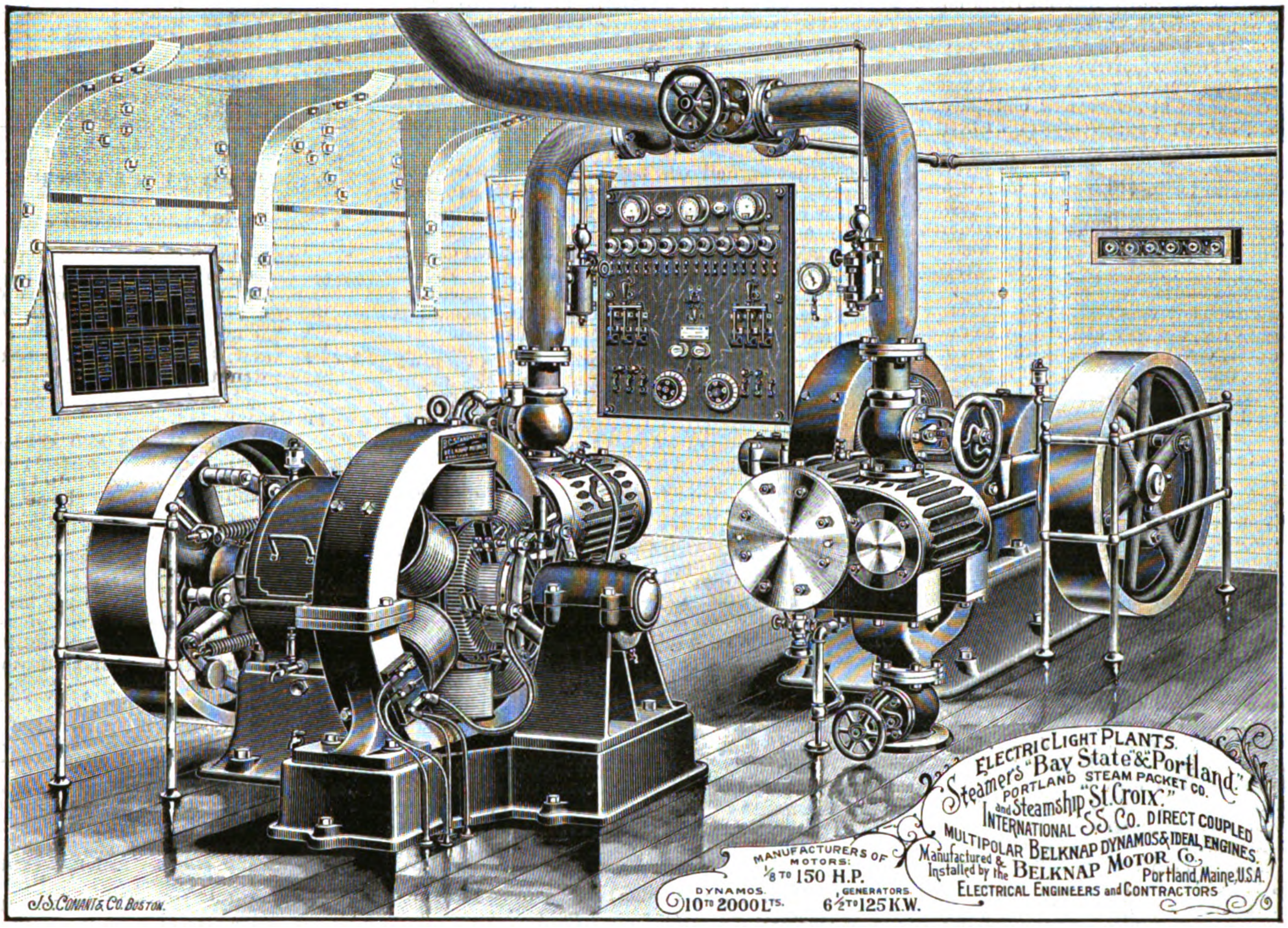
The Ohio Brass Company of Mansfield, Ohio, presents in its illustrated Catalogue, No. 3, a book that should have a place on the desk of every dealer in electric railway supplies. There are 140 pages between the handsome covers, and nearly every page has one or more engravings of articles dealt in by the company, with concise descriptions and prices appended. There are also an alphabetical index and other features that render it a convenient and useful guide to purchasers.

Electric Light Plant, Steamer, "Bay State."

Accompanying this is a cut illustrating the electric light plant on the new steamer "Bay State," of the Boston and Portland line, recently installed by the Belknap Motor Company of Portland, Maine. The engines used are the "Ideal." The dynamos are multipolar slow speed machines of 400 lights capacity each, but either machine will carry the entire load amounting to 540 lights. It has become a general practice to use duplicate plants for marine work so in case an accident should happen to either engine or dynamo the duplicate machine can do the work. The dynamos were designed by Mr. W. H. Chapman, electrician for the company. This plant does great credit to the company and has induced further orders for the installation of two direct coupled machines for the steamer "Portland" of the same line, also for the steamship "St. Croix" of the International Steamship Company, which is practically under the same board of management. The system of wiring is most excellent. There are eight main circuits controlled at the switchboard in the dynamo room which lead to sixteen different distributing boxes containing switches located in different parts of the boat, each switch controlling six lights, turning them on or off as may be desired. These distributing boxes have glass fronts secured with lock and key, and are under control of the steward of the boat. There are pilot lights on main and fore rigging and at the bows of the boat.

The fixtures are of the latest design, with opalescent globes and shades. The dining saloon is fitted with ground glass globes which give this part of the boat a very cheery and pleasing effect. The freight deck lights are protected with guarded fixtures.

The boat at night presents a brilliant spectacle, being a veritable floating palace and surpassing in all its appointments anything that can be found in Eastern waters, the Sound lines alone excepted. The addition of this new boat has been the means of popularizing this line with the best class of the traveling public.


ELECTRIC LIGHT PLANTS.
Steamers "Bay State" & "Portland."
PORTLAND STEAM PACKET CO.
and Steamship "St. Croix."
INTERNATIONAL S.S. Co.
DIRECT COUPLED MULTIPOLAR BELKNAP DYNAMOS & IDEAL ENGINES.
Manufactured & Installed by the BELKNAP MOTOR Co.,
Portland, Maine, U.S.A.
ELECTRICAL ENGINEERS and CONTRACTORS
MANUFACTURERS OF MOTORS: 1/8 TO 150 H.P.
DYNAMOS 10 TO 2000 LTS.
GENERATORS 6½ TO 125 K.W.
J.S. CONANT & CO. BOSTON.

TEST OF OKONITE WIRE.

Extracts from Report of Dr. J. A. Fleming, F.R.S., Professor of Electrical Engineering in University College, London.

December, 1894.

To Messrs. Laing, Wharton & Down,
62a New Bond Street, W., London.

The cables sent to me were in large coils of about half lengths, and came just as they were forwarded by the makers.

I have found in this Okonite Cable a very marked increase of insulation resistance with time of charging, and have therefore given all the results in the form of curves on a chart appended to this report, in which the insulation resistance of the samples is shown in megohms per mile of cable after one to five minutes' charging.

My opinion of these cables is, therefore, that the Okonite material is a remarkably good insulator, and that the samples of Okonite Cable submitted to me represent a very high degree of excellence in the manufacture of insulated cable. I do not lay much stress on mere megohms per mile in a cable. The real practical test of a cable is the electrical pressure it will withstand after prolonged soaking in water and such general rough usage as the cable will experience in actual handling. In order to test the mechanical toughness of the Okonite material, I bent and kinked several samples at such sharp angles as to break the copper strand inside the Okonite insulation. This mechanical toughness combined with its flexibility is a great point in its favor.

I consider that this Okonite Cable is a very excellent and high class cable for all outdoor, overhead, or underground electrical work, with high electric pressures, whether alternating or continuous.

I regard it also as an excellent material for indoor wiring work in cases in which the conductors are necessarily exposed to moisture and under conditions in which a very large factor of safety must be employed. The standard copper conductor, being tinned and twisted, was not in a form suitable for a very accurate test of the copper conductivity, but the figures given for the resistance per mile of the coils A, B and C, show that the copper employed is not less than 98 per cent conductivity in all probability.

I consider that the behavior of these samples of Okonite Cables places it in the front rank as a class of cable for electric lighting and transmission work.

February 1 , 1895.

The next question to which I have directed my attention is the power of the Okonite material to withstand the action of chemical agents. For this purpose fair samples of the Okonite cables were put to soak on January 12, 1895, in the following chemical solutions:

(a) was put into strong salt and water.
(b) " " " paraffin oil.
(c) " " " linseed oil.
(d) " " " caustic soda solution.
(e) " " " dilute sulphuric acid, 1 : 10, or battery acid.

These samples were left soaking in these solutions until February 15, or for thirty-four days. They were then tested for insulation at 100 volts, and found to be in excellent condition.

The samples were then submitted to the electric pressure test, the pressure being taken up to 3,360 volts by the use of an alternating current having a mean pressure of 2,400 volts, and all of these showed no signs of failure when exposed to this pressure for five minutes.

This forms an exceedingly severe test of the high insulating quality of Okonite, that after this soaking in oils, brine, acids and alkali for more than a month all the samples withstood a 2,400 alternating pressure perfectly.

I have no hesitation therefore in saying that I think the Okonite insulation is a remarkably fine insulating material, and one which by its electrical and mechanical qualities is well fitted for use in electric cables for high or low pressures. I have not found that the severe cold of the last month has rendered it at all brittle. I am, etc.

(Signed) J. A. Fleming.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Baltimore.—The American Title Insurance and Trust Company have purchased a site for an office building on North Calvert st., near Lexington.

Buffalo, N. Y.—Two additional wings will be added to the city hall at a cost of $400 000.. .The new Athletic Club have decided to build a handsome club house at a cost of $80 000 ; Architects Green & Wicks.

Cincinnati, O.—The Burnet Hotel Company will erect a sixteen story and basement building at a cost of $600.000 : ornamental galvanized and electrovanized iron and steel work ; freight and passenger elevators. electric lighting, fire escapes, etc.; Architects Adler & Sullivan, Auditorium Tower, Chicago, Ill.

Green Bay, Wis.—Wilhelm Griesser, 907 Randolph st., Chicago, Ill., will erect a $20,000 opera house in this city.

Huntington, W. Va.—F. F. McCullough, county clerk, will furnish information respecting the new court house building ; it will be lighted by gas and electricity.

Jersey City, N. J.—The Hudson County Caledonian Club will erect a clubhouse, with a hall for entertainments.

Milwaukee, Wis.—The Bohemian American Hall Association and Stock Company will build a new hall and club house on 12th st., cor. Wine st.; Architects Wiskocil & Schutz.

New Orleans, La.—B. Nazereau Reynes has prepared plans for an opera house for Louis Gunewald Sons ; lighted by electricity.

New York City.—The corporation of Trinity Church 187 Fulton st., will erect an eight story brick warehouse, cor. Varick and Spring sts.; Architect Charles C. Haight, 111 Broadway....Flora Sawyer will erect a seven story and basement store and loft building at 79-83 Wooster st., to be equipped with passenger and freight elevators, electrical apparatus, etc.; Frank E. Smith contractor.... F. P. Dinkelberg, 3 Union square, West, will make plans for a seven story mercantile building at Bleecker & Wooster sts....Architect George F Pelham, 503 5th ave., has prepared plans for a seven story warehouse, to be built at 197 South 5th ave.; steam heating appliances and elevator, electric wiring and all conveniences are to be introduced. ....Terence J. Duffy, 2[illegible]5 West 71st st., will erect an eight story brick store on south side of 32d st., west of 6th ave. ....Clarence S. Wadsworth, of Middletown, Conn., will erect a ten story brick store and office building at 41 East 17th st....Samuel Inslee, has deeded to the Y. M. C. A. the property 4[illegible] Broadway, valued at $200,000 ; two buildings will be erected....George J. Kraus, 217 West 48th st., will build two buildings, amusement house, etc., north side of 29th st., west of Broadway....John Baudouine, 936 Broadway, will erect a ten story office building on the site of the Brower House, now demolished....Henry F. Cook, 59 West 76th st., will build 8 four story dwellings, north side of 69th st., west of Central Park West.... John O. Barker, of Newark, will build 5 four and a half story dwellings, north side of 85th st., east of West End ave....Margaret A. McCaffrey will erect a five story flat and store, cor. of St. Nicholas ave. and 134th st.; Architect John C. Burne, 101 West 42d st....Charles A. Bailey will erect 8 five story flats on 111th st, west of 8th ave.; Architects Neville & Bagge, 215 West 125th st....W. H. Bingham, Elmford Park, Westchester County, will erect 2 five story flats, north side of 119th st., west of Park ave....Grumm & Grant, 471 Amsterdam ave., will erect 3 five story flats on southeast cor. of 107th st. and Amsterdam ave.; Architect Henry Anderson, 1180 Broadway.

Olympia, Wash.—Architect Ernest Flagg, 54 Broad st., New York, has prepared plans for the new State capitol building to be erected here.

Paterson, N. J.—The Passaic County board of chosen freeholders have decided to build a new court house at a cost of $200,000.

Philadelphia.—The county board of the Ancient Order of Hibernians intend to erect a club house at 213 South 8th st ..Rankin & Kellogg have completed plans for a parish building for the parish of St. James, at 38th st. and Market st.; the basement will contain heating and lighting plant and the building will have a gymnasium, etc....A seven story and basement office building is to be erected for Joseph R. Teller at 14 South 4th st....Hall & Ballinger are preparing plans for a five story and basement factory building for Wm. T. Datz & Bro., to be erected at 237-289 North 6th st.; two 75 horse-power boilers, engines, electric light plant, etc.

Reading, Pa.—A meeting of the trustees of all the Masonic lodges in this city was recently held to consider the best methods and plans for erecting a Masonic Hall building in Reading. It is said that some Philadelphia capitalists are interested in the project and it is proposed to erect a building on North 6th st., which will cost $500,000. ....E. Miltimore Morgan has let the contract for the rebuilding of the Mansion House to L. H. Focht.

Tampa, Fla.—A company has been organized to build a $200,000 hotel here, and specifications are now being drawn.

INCORPORATIONS.

The Chicago Western Electric Street Railway Company, Chicago—to operate electric street railways in Cook, Du Page, Lake, Will and Kane Counties, Ill. Capital stock, $5,000,000. Incorporators: Henry D. Beam, Maier Rosenthal, Harlan W. Cooley.

The Electric Railway Construction and Manufacturing Company, Chicago—to build electrical railways, light, heat and power plants. Capital stock, $250.000. Incorporators: John W. Jones, William Riley and Sterling P. Railey.

The Cycle Electric Light Company, Chicago—to manufacture electrical appliances. Capital stock, $100,000. Incorporators: W. A. Crowdus, John Zimmerman, and John D. Thompson.

The Oregon Electric Light and Power Company, Oregon. Ill. Capital stock, $50,000. Incorporators: Albert H. Knodle, William L. Taylor and Lee Allen.

The Champaign and Urbana Phœnix Telephone Company, Champaign, Ill. Capital stock, $40,000. Incorporators: P. S. Replogle, E. Frank Replogle and Jacob Frankel.

The Economy Electric Lighting Company, Geneva, Ohio. Capital stock, $12,000. Incorporators: J. A. Carter, C. H. Munger, Lucien Seymour, C. I. Chamberlin, A. W. Chamberlin.

The Chicago Electric Street Railway Company, Chicago—to construct and operate street railroads. Capital stock, $5,000, 00. Incorporators: Sherman D. Purnia, John Parrott, O. W. Larson.

The Pittsburg, Sheraden and Carnegie Traction Company has been granted a charter by the State Department at Harrisburg, Pa., to build an electric line from the river road in Esplen borough, Allegheny County, to Sheraden, thence to Crafton and Carnegie, a distance of seven miles. The company is capitalized at $42,000. The officers are: President, Harding Kimberland, Sheradenville; directors, Henry J. Wenke, Miller Elliott, Richard B. Scandrett, Pittsburg; D. H. Ferrell, Sheradenville.

The Patterson Heights Street Railway Company, Beaver Falls, Pa.—to build a short electric line. Capital stock, $6,000. President, John Reeves, Beaver Falls; directors, Henry M. Myers, John T. Reeves, Patterson township, Beaver County; Harry W. Reeves, John Reeves, James F. Merriman, Beaver Falls.

The North Trumbull Rapid Transit Company, Kinsman, Ohio—to operate an electric railroad. Capital stock, $10,000. Promoters: James A. Russell, H. L. Perkins, E. N. Yeomans, R. B. Barnes, Geo. E Haine, R. T. Millikin.

The Little Saw Mill Run Street Railway Company, Pittsburg, Pa.—to build an electric street railway in Pittsburg. Capital stock, $36,000. Promoters: M. P. Howley, Geo. W Lewis, Pittsburg; Jonathan Barrett, Allegheny.

The Klamath Falls Light and Water Company, Klamath Falls, Ore.—to furnish electric light service, telephone and a water system for town of Klamarth. Capital stock, $2,000. Promoters: Chas. S. Moore, Geo. T. Baldwin, H.V. Gates.

The Santa Barbara Consolidated Electricity Company, Santa Barbara, Cal.—to acquire, construct and maintain street railways in Santa Barbara County; electricity, cable, gas, or water power, etc. Capital stock, $200,000; Promoters: A. Hope Doly, N. E. Ashton, B. S. Hayne, Santa Barbara.

The Electric Transportation Company, Jersey City, N.J. —to manufacture, purchase and sell electric and other boats to engage in inland navigation. Capital stock, $[illegible]5,000. Promoters: Frank Ribbett, Rahway, N. J.; Samuel D. Collett, Brooklyn, N. Y.; Edw. B. McCleas, Geo. F. Evans, Chas. E. Ainsworth, Jersey City.

The Grand Boulevard Street Railway Company, Philadelphia—to engage in the conveyance of passengers by electric power. Capital stock, $50,000. Promoters: O. M. Thomson, Chas. P. Horr, John McLennon, Thos. C. McConnell, Philadelphia.

The Beacon Lamp Company, Portland, Maine—to manufacture and deal in electric and other machines. Capital stock, $500,000. Promoters: Chas. Shoninger, Tabian Sachs, Leopold Tossbach, New York City; Isaac Weil, Boston, Mass.

The Amplified Electric Company, East St. Louis, Ill.—to acquire, own or use patent rights for electric devices or machines, and to manufacture or sell electrical devices or machines of every sort. Capital stock, $1,000,000. Promoters: Fred'k Ulrich, Edwin J. Paule, John T. Dodwell.

The Defiance Light and Fuel Company, Defiance, Ohio—to operate gas and electric light plants. Capital stock, $30,000. Promoters: Walter R. Faben, Jas. W. R. Cline, Wm. Robt. Morrison, Oscar T. Martin, John S. Shewalter.

The Elliott Magnetic Electric Company, Chicago. Capital stock, $1,000,000. Incorporators: Wm. R. Elliott and Isaac C. Robbins.

The Electric Street Railway Company, Niagara Falls, Ont. Capital stock, $125,000. Incorporators: Alexander Manning, Hume Blake, C. A. Laish, P. A. Manning, Toronto; Charles Black, Welland.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JULY, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.20 P. M.	2	3.30 A. M.
2	11.50 "	3	3.30 "
3	......	..	......
4	12.30 A. M.	4	3.30 "
5	1.30 "	5	3.30 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	8.00 P. M.	9	10.30 P. M.
10	8.00 "	10	10.50 "
11	8.00 "	11	11.10 "
12	8.00 "	12	11.30 "
13	8.00 "	13	11.50 "
14	8.00 "	15	12.10 A. M.
15	8.00 "	16	1.00 "
16	8.00 "	17	1.20 "
17	8.00 "	18	1.40 "
18	8.00 "	19	2.30 "
19	8.00 "	20	3.30 "
20	8.00 "	21	4.00 "
21	8.00 "	22	4.00 "
22	7.50 "	23	4.00 "
23	7.50 "	24	4.00 "
24	7.50 "	25	4.00 "
25	8.30 "	26	4.00 "
26	9.00 "	27	4.00 "
27	9.[illegible]0 "	28	4.00 "
28	9.50 "	29	4.00 "
29	10.[illegible]0 "	30	4.00 "
30	11.00 "	31	4.00 "
31	11.00 "	Aug. 1	4.00 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 9, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

542,228. Trolley-Breaker. Henry P. Ball and Charles A. Lieb, New York, assignors to the General Electric Company. Schenectady, N. Y. Filed Aug. 8, 1894.

542,434. Underground Trolley. Leedham Binns, Philadelphia, Pa. Filed April 11, 1894.

542,512. Electric-Railway System. Robert B. Wilson, Cincinnati, Ohio, assignor of one-half to Jeremiah M. Wilson, Washington, D. C. Filed Jan. 2, 1894.

542,591. Trolley-Finder. Charles C. Lynde, Buffalo, N. Y. Filed Nov. 28, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

542,279. Arc-Light Support. Barton Pickering, Dayton, Ohio. Filed Nov. 15, 1890.

542,490. Electric-Arc Lamp. Samuel E. Nutting, Oak Park, assignor to George W. Furbeck and Joseph Kettlestrings, Chicago, Ill. Filed Sept. 8, 1894.

542,50[illegible]. Arc Lamp. Albert C. Seibold, Mount Vernon, assignor of one-third to Edgar O. Clark and William Sowdon, New York, N. Y. Filed Jan. 7, 1895.

542,589. Electric-Arc Lamp. Frank M. Hildebrandt, Edwin S. Hildebrandt and Henry F. Hildebrandt, Baltimore, Md. Filed Dec. 27, 18[illegible].

DYNAMO ELECTRIC MACHINERY.

542,295 Transformer for Alternating-Current Systems. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company of New York. Filed March 6, 1895.

542,487. Electric-Lighting System and Dynamo Therefor. Morris Moskowitz, Newark, N. J., assignor to the National Electric Car Lighting Company of West Virginia. Filed May 11, 1895.

542,548. Electrically-Controlled Motor. George L Thomas, Brooklyn, N. Y. Filed April 25, 1895.

BATTERIES.

542,259. Electric Battery and Application Thereof to Medicinal Purposes. Seth R. Beckwith, Orange, N. J. Filed April 3, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

542,249. Telephone-Switchboard. James F. Gilliland, Adrian, Mich., assignor to the Gilliland Electric Company, same place. Filed Oct. 26, 1894.

542,262. Multiple Switchboard for Telephone-Exchanges. Milo G. Kellogg, Chicago, Ill. Filed Dec. 21, 1889.

542,454. Telephonic Transmitter. Charles C. Hughes, Baltimore, Md. Filed Sept. 12, 1894.

MISCELLANEOUS.

542,240. Electric Meter. Frank P. Cox, Lynn, Mass., assignor to the General Electric Company of New York. Filed Feb. 15, 1895.

542,258. Electrical Measuring-Instrument. Frank Holden, Schenectady, N. Y., assignor, by mesne assignments, to the General Electric Company, same place. Filed Jan. 22, 1895.

542,268. Electroprotective System for Locks. Morris Martin, Malden, Mass., assignor of one-half to Benjamin W. Wells, Boston, Mass. Filed Oct. 4, 1894.

542,309. Electric Brake. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 20, 1895.

542,406. Electric-Alarm-Gage. William H. Bradt, Troy, N. Y. Filed Feb. 2[illegible], 189[illegible]. Renewed May 8, 1895.

542,462. Electric-Insulating Material. James O. Brown, Chicago, Ill. Filed May 5, 1894.

542,471. Electric-Bath Apparatus. William E. Golden, Auburndale, Ohio. Filed March 5, 1895.

542,[illegible]08. Medical Electrode. Andrew P. Van Tuyl, Jr., Brooklyn, N. Y., assignor to himself and Edward C. Park, same place. Filed May 15, 1895.

542,550. Railway Block-Signal System. George M. Brown, Galesburg, Ill., assignor of one-half to J. J. McKee, Bethlehem, Pa. Filed May 4, 1895.

542,[illegible]65. Press for Making Screw-Insulators. Seraphin Kribs, Brooklyn, assignor to William Brookfield, New York, N. Y. Filed July 5, 1894.

RE-ISSUE.

11,503. Automatic Electric Weighing-Scale. Charles F. Wood, Richmond, Va. Filed Jan. 29, 1894. Original No. 500,045, dated June 20, 1893.

ELECTRICITY.

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EDITORIAL NOTES.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

Signs of the Times. The great desideratum, from a sanitary standpoint at least, of the abolishment of horses from our thoroughfares has been demonstrated by the all but universal substitution in many American cities of the electrically-propelled street car for that drawn by horses. In making this change America has led the world, but our neighbors across the water seem to have taken the lead in extending the *automobile* idea to private vehicles. France took the initiative in the encouragement of this line of invention, and some time ago offered seven prizes, aggregating $10,000, for the best self-propelled vehicle. These were competed for on June 11 last. The distance traversed was from Paris to Bordeaux and back, or 744 miles. The number entered for the contest—16 petroleum carriages, 7 steam vehicles, 2 electric carriages and 2 petroleum bicycles—evidenced the interest manifested by the inventive public in this line of development. Electricity made no showing in the final results, since all of the seven prizes were won by petroleum motors. Now England is going to have a similar competition, and *Engineering* (London) has offered 1,000 guineas (about $5,130) to be competed for under conditions which will be announced later. It is to be hoped that in this latter competition electricity will make a better showing than it did in the former. America is also to have a contest of its own, the *Times-Herald* of Chicago having offered a series of prizes aggregating $5,000 for a run between Chicago and Milwaukee next November. The full text of the regulations is not yet printed, and we hope the report that the first and second prizes are not open for the competition of foreigners is unfounded. There should be no such restrictions. In the interest of progress any man with a horseless vehicle, wherever he may hail from, should be allowed to win the biggest prize if he is able. We hope this restriction will be removed, and believe that the proverbial indomitable Yankee inventive faculty will yet solve the electrical problem which the French tournament showed conclusively has not yet been solved abroad. We scout the idea that any country in the world can beat us at anything.

Electricity for *automobile* purposes is, in the present state of the art, greatly handicapped by the great weight inefficiency of the storage battery. We have faith, however, that some means will yet be devised whereby this weight efficiency may be so far increased as to place the storage battery more nearly on a par with fuel storage. When this occurs, not only will the question of self-propelled vehicles be commercially solved, but many other questions of even vastly more importance than this. The signs of the times point to an earnest grappling with the problem, and this can have but one ultimate result, viz., its solution.

* * *

Judge Dallas's Decision. The decision of Judge Dallas of the United States Circuit Court, Eastern District of Pennsylvania, which we printed in full last week, is one of unusual interest to the elevator industry at large and the electrical industry in particular. While the points at issue involve directly no electrical features, their indirect bearing will be made clear by a few words of explanation. With the old-style, slow-speed elevator the control was conveniently effected by means of a cable running through the cab. By pulling this in one or the other direction the proper valves were operated for starting, stopping and reversing the motion of the driving machinery. With the advent of the modern high-speed elevator such method of control became entirely inadequate and the Elevator Trust acquired almost a monopoly of controlling devices suitable for their higher speeds. In fact it has relied almost entirely upon these controlling patents for its maintenance of the monopoly which it hoped to establish. But an element it had not calculated on entered into the field at about this time, viz., the electric elevator, which could be controlled from the cab by simpler and more effective means than could the hydraulic elevator by the best mechanical appliances yet invented. The Trust's own patents did not cover electrical methods of control, and the possible electrical methods of control were so numerous that it was a hopeless undertaking to attempt to monopolize them all. Here was in fact a competitor which could not be controlled, and the other method remaining was to kill it. This latter is just what the Trust has been attempting to do, and in pursuance of this policy it has employed the dishonorable methods detailed in former issues of this paper. To crush out competition from outside hydraulic elevators its own controlling patents were used as a club, and suit after suit was brought for infringement. The Trust seems to have lost these suits pretty uniformly as fast as they came to trial, until in the present case at one fell swoop it lost four. Without these patents it seems probable that the Trust must go to pieces, as they constitute the "goodest things" possessed by the combination. The single suit which the Trust did win, that involving the validity of the Otis governor patent is an empty victory, since there are many other ways of governing the elevator besides the specific one patented by Otis. The Trust was denied an accounting, however, because the patented devices infringed were not marked "patented" as required by law. This is in fact a victory for the defence, since it has been the policy of the Trust to conceal as far as possible what they claimed as an infringement, as in the A. B. See case, but this decision will force them to declare themselves, so that the opposition may steer clear in future of patented features.

* * *

The Cost of Steam Power. One of the most appropriate papers read at the recent meeting of the Institute at Niagara Falls was that of Dr. Chas. E. Emery on "The Cost of Steam Power." It will be remembered that on March 21, 1893, the same author read a very elaborate paper on the same subject which has since been quoted by nearly every writer on the subject. In the earlier paper Dr. Emery confined himself to the cost of power as generated by different types of engines in units of 500 H. P.

With the approaching completion of the Niagara power plant, planned on a much larger scale, there naturally arose a desire on the part of the public to know how the cost of steam power generated on a similar scale would compare with the figures charged by the Niagara Power Company. It was to meet this desire that Dr. Emery's paper was undertaken. The discussion which followed, while in some cases misdirected through an apparent ignorance on the part of some of the participants, of the earlier paper, was exceedingly interesting and significant. The question seemed to be—not could the Niagara power be delivered at Buffalo at a figure to successfully compete with locally generated steam power, but *could it compete at Niagara Falls* with steam power generated on a similar scale? It was with no little personal gratification that ELECTRICITY noted the general consensus of opinion with the views advocated in the start in these columns, that the enormous fixed charges which the horse power must bear at Niagara until very nearly the ultimate capacity of the tunnel is utilized rendered commercial competition with steam exceedingly problematical. We know that we have taken the unpopular side of this question, for the public likes sensations and wants to believe that Niagara will eventually drive the machinery of New York, Boston and Chicago. We never have been able to convince ourselves, however, that the encouragement of hopes that can never be realized will result in good to anybody. Our contemporary, the *Electrical Engineer*, thinks differently, and nothing is too improbable for it to swallow. In this connection it is instructive to see how the *Engineer* regarded Dr. Emery's paper. In its editorial comments on the Niagara Falls meeting it says:

"Particularly apropos of the time and place of the meeting was Dr. Emery's paper on 'The Cost of Steam Power.' We have of late had so much wild talk on this question, especially in the vicinity of Buffalo, that a calm consideration of the subject by a competent and recognized authority must go far towards putting the quietus on many of the absurd statements and figures which have gained currency. If we read Dr. Emery's figures correctly, a 20,000 H. P. plant of the most modern construction cannot compete in cost of power delivered *at the engine shaft* with the price of electric power delivered *at the motor terminals*, as actually contracted for by the Niagara Falls Power Company."

The saving clause in this is the parenthetical one, "If we read Dr. Emery's figures correctly."

We wonder if any one else than the editors of the *Engineer* can find in Dr. Emery's paper any justification for its (the *Engineer's*) course in the matter of the Niagara-Buffalo transmission?

* * *

New Pin for the Institute. A movement took place at Niagara Falls to reconsider the design of the Institute pin, and this is one of the things which occurred at that time for which we should be truly thankful. The coffin-like design which now constitutes the official crest of the Institute is certainly not appropriate to this most lively of all sciences—electricity. In some respects the present pin is highly symbolical, but of death it certainly should not be. It is in fact open to the objection of being *too* symbolical—it is *bolical* all through, as its designers were careful to show on the presentation of their recommendation to the Institute. We will admit that it is "bolical," and that it is "bolical all through." The expression "all through" is tersely represented by the single Greek preposition "dia," and the force of the statement is not lessened by substituting this terse Greek expression for the longer English one, which would make it read "dia—bolical." Let us have a new design. It's a good idea. Push it along.

* * *

Indirect Electrolysis. In another column we print a translation from the French of Mr. E. Andreoli's paper on what he terms "Indirect Electrolysis." Doubtless the paper has suffered some, as regards lucidity, in the translation, but it lacks that fullness and completeness that would justify a criticism. As we understand Mr. Andreoli, he has observed a series of entirely new phenomena which are difficult to explain upon the accepted theories of electrolytic action. We hope to see later a fuller exposition of the phenomena, and would suggest that since the reactions involved are chemical, the author express them by chemical equations instead of by words, as this method will be less liable to misinterpretation than the one adopted. We withhold comment on Mr. Andreoli's paper until we receive a fuller explanation of what actually takes place.

* * *

Under a recent decision of the appraisers the duty on imported carbons for arc electric lights has been increased from 20 to 30 per cent. It is said New York importers are getting these carbons through the Custom House at the 20 per cent. rate.—*Chicago Tribune.*

AGENTS of foreign carbon makers who are undervaluing their carbons, thus enabling them to undersell their competitors, should be smoked out. American carbons can be made good enough for any purpose, and the American manufacturers should at least have a fair show.

* * *

Our Discontent.

(From the Athens [Ga.] Banner.)

ELECTRICITY is not content with relegating the horses to the pastures.

We do not care a fig what the horses do, but there are *men* who must be "relegated to the pastures."

Under the Searchlight.

Views and Opinions on Timely Topics.

FOUND.

After a Long Search the Alamo Electric Street Railway is Discovered.

In our table July 10 showing the condition of various electric street railway properties financed by the General Electric Company, we referred thus to the Alamo Electric Street Railway Company, $40,000 of stock of which is held as an asset by the G. E. Company, "Road not discovered." We had consulted all the records at hand, but had found no trace of this property.

At last the mystery is cleared away, and we owe an apology to some one, but we do not yet know to whom.

An authority on Texas street railway matters writes us as follows:

To the Editor of ELECTRICITY.

Dear Sir: The Alamo Electric Street Railway Company, San Antonio, Tex., was projected by Messrs. McCrillis and Shepard, of Denver, Col., and financed and built by the T.-H. Company. About three years ago it was sold at receiver's sale, and bought in by the General Electric Company for $25,000. Since that time it has been operated by the G. E. Company as the Citizens' Electric Power and Street Railway Company. It has always run at a loss.

The G. E. Company has up to date about $100,000 invested in this road. They have been offered $20,000 for the property, which is more than it will bring at any subsequent time. Yours truly, ——

July 9, 1895.

Thus it will be seen that the inference induced by our remarks was misleading. We thought the $40,000 item was simply worthless. This is incorrect. It is worse than worthless, having cost the G. E. Company $100,000.

We are glad to make the correction, as we would not knowingly do an injustice to anyone.

* * *

SOME time ago we referred to the windy schemes of Mr. Joseph H. Reall in connection with electric railway enterprises. Last week a receiver was appointed for one of the schemes, named the Central Jersey Traction Company, upon application of a contractor who had done $25,000 worth of work and received no pay except a note which went to protest. This is about what may be expected of any enterprise in which Mr. Reall is interested.

* * *

THE AIR LINE HAS COME TO GRIEF.

The 200-Miles-an-Hour Scheme Dissolves Into Thin Air.

Dr. Wellington Adams's Chicago and St. Louis Electric Railroad has collapsed. There is a "To Let" sign on the company's offices in the Women's Temple, Chicago, and sundry creditors are seeking for some one who will pay them. The only address of the defunct company is now care of the general delivery, St. Louis, Mo.

The above press dispatch has no doubt conveyed to several purchasers of bonds and stock of this enterprise the news that they have lost their money. It is only a month since Dr. Adams announced that $9,000,000 of money had been raised of the $10,000,000 needed, and that as "the bankers were under a constant daily forfeit to raise the balance, the ultimate success of the enterprise was assured."

The prospectus of this swindle was published as an advertisement in the *Electrical World* and several of our contemporaries in 1892, *and declined by* ELECTRICITY. It was a gem in its way, and some parts of it are worth reprinting:

"For the purpose of completing its roadbed the C. & St. L. E. R. Co. now offers for sale 50,000 shares of its capital stock at $6 per share, . . par value $10, and this is all of the stock that will be sold at this figure."

The company "has already acquired [illegible],000 acres of coal rights, . . and will own 9,000 additional acres before January 1, 1898."

"It owns the finest coal mine and brick and tile making plant in the State, which will be utilized as POWER STATION NUMBER ONE."

"It has already commenced the construction of motors."

"It will make the trip from St. Louis to Chicago in three hours."

"The price of the next issue of stock will be advanced to $7."

"CONSERVATIVE ESTIMATE OF YEARLY REVENUE.

Passenger business 600 per day at $5	$1,095,000
Mail "	300,000
Express "	500,000
Light and power distribution (5,000 h. p. at $200 per annum)	1,000,000
	$2,895,000
All operating expenses and fixed charges, including interest on $7,000,000 bonds	$870,000
Leaving	$2,025,000

of net earnings, or 29 per cent. on the capital stock."

The registrars, trustees, depositories, etc., were the Farmers' Loan and Trust Company of New York, the Atlas National Bank, Chicago, and the St. Louis National Bank. We wonder how the officers of these institutions now view their connection with the scheme.

In view of the severe criticisms we have made of our contemporaries for failure to perform their duty to the investing public or to their own trade, it is proper to call attention to the fact that not one American electrical journal save ELECTRICITY ever offered one word of criticism against this scheme. ELECTRICITY treated it properly from the date when Dr. Adams read his paper before the Electric Club.

Among other choice bits in the prospectus was this:

"It has made its surveys and established the permanent location of the road."

This "permanent location" has been kept from the public for three years, but the secret is now out—it is in a small box in the general delivery department of the St. Louis post office.

The episode now ended may seem to the superficial like a huge joke. It is nothing of the kind. Several hundred people who have bought stock and lost their money will forever associate all electrical investments with the great Chicago-St. Louis Air Line. And why should they not? For did not the *Electrical World*, the *Electrical Engineer*, the *Western Electrician*, the *Electrical Review*, all print the catchpenny advertisement and treat the whole scheme with the utmost seriousnesss?

Shame on you all, to thus lend your columns to assist a gross swindle for the consideration of $50 per page. Shame!

* * *

THE New York *Sun* and many other papers gave a conspicuous example of bad and silly journalism by printing what one P. J. Gibbons, of Syracuse, said about the electrical executions at Auburn prison. The officials of the prison have denied about every statement of alleged fact made by Gibbons, and we guess their denials must stand. Probably the *Sun* did not know that at the very time Dr. Gibbons was blowing so much wind through his own whiskers he was trying to sell in Rochester his patented apparatus for resuscitation, which he claims usurps the functions of the Almighty, and brings the dead back to life. The *Sun* should buy an electrical cat. Dr. P. J. Gibbons is *not*, we understand, a member of the Onondaga County Medical Society, and increases his practice by advertising in the local papers. He evidently knows a good deal more about making money than he does about electricity or executions.

* * *

IT is difficult to see what method of reasoning governs our Western friends in maintaining a Northwestern Electrical Association. The northwest although a big place, is not big enough to maintain an association of this kind which can be of much value to the community. The National Electric Light Association, whose president is a Chicago man this year, has open arms for all comers, and it seems to ELECTRICITY that every one interested in the welfare of the electric lighting business should join this association and make it as strong and as potent for great good as possible. The Northwestern Association should come in in a body.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER II.

The Winona General Electrical Company.

In our last preceding issue we presented for the consideration of our readers a fairly comprehensive review of the method employed by the agents of the General Electric Company in financing the Winona General Electric Company, and the results thereof. We set forth the principal facts concerning the condition of the underlying companies on which that operation was based. But the space at our disposal would not permit us to deal with the matter as fully as should be done. We therefore resume the discussion, produce some further facts and present some additional conclusions drawn from a more detailed analysis of the official statements which we then published, thus furnishing more conclusive and convincing proof of the want of good faith on the part of everyone connected in any responsible way with the scheme.

Let those interested in the exposure of what is a really typical Thomson-Houston transaction turn to page 8 of last week's issue and carefully examine a copy of the inventory of the property of the Winona Street Railway Company on November 1, 1892. We think that every one familiar with the details of making an inventory of manufacturing, electric lighting, electric railway companies, or other concerns in any line of business, will admit that the work of making that inventory was done by *experts* in that particular line of work. Nothing possessing any value whatever appears to have been omitted, and things of even little value, as

Three one-gallon jugs, 45 cents;
Hammer chisel, 25 cents;
Three old shovels, 75 cents;
Office wall lamp, 75 cents;
Two screwdrivers, 50 cents;
Coal scuttle, 50 cents;

and other similar small items, were not allowed to escape the conscientious attention of the person or persons charged with the duty of making a list of all the tangible property of the company at that date. But particularly note that the sum total of all the tangible property is $83,902.22. Fix that fact in your mind, and remember that the original horse railway, capitalized for $25,000, had been reorganized and financed by the Northwest Thomson-Houston Company, an offshoot, a dependent, and, practically, only the selling agent of the Thomson-Houston Electric Company of Boston, both of these latter named companies guided by the same hand, their policy dictated by the same mind, and that hand and that mind being those of the notorious C. A. Coffin, now, and for some three years past, the president of the General Electric Company. It had then been electrically equipped, capitalized at $200,000, and the securities transferred. After this trade all the tangible property possible to be rated together as an asset against the $200,000 capitalization amounted to $83,902.22 according to the statement of the company's own agent, thus leaving a deficiency of $116,097.78 between the inventory value of the tangible property at that date and the capital liabilities. This inventory was taken by the agents of the Northwest General Electric Company, the successor of the Northwest Thomson-Houston Company, which had taken control of all the property owned by the Northwest Thomson-Houston Company, including the Winona City Railway, and which was now about to engage in a scheme for further increasing the capital liabilities of this latter company, and for selling the stocks and bonds so issued to the public. There can be no doubt, therefore, that the inventory value was as large as it was safe to make it.

The above noted deficiency of $116,097.78 between the capital liabilities and the official inventory value of the tangible property does not represent the *actual total deficiency*, for, as a matter of fact, the road had never paid its operating expenses, was also unable to pay the interest on the $100,000 of bonds already issued, interest on notes, or to earn money enough to provide a fund for the necessary renewals and repairs to its bad rolling stock and equipment, or, in other words, to provide for any depreciation whatever, to say nothing of its inability to earn any dividends on its stock. Under these circumstances the deficit and the impairment of the capital stock were increasing constantly, and the company was only kept afloat by money raised on its own notes, negotiated at usurious rates of interest by the Northwest Thomson-Houston Company, and later by the Northwest General Electric Company.

It must be further borne in mind that the inventory values given were made at a time when the property of the company was about to pass into the hands of a new corporation, and every experienced person knows that at such a time the inventory values are not likely to be made too low. That the inventory values in this case were not not too low, but were in fact much too high, can be demonstrated by an examination of a few of the larger items. In the inventory the value of four miles of single track is given at $40,000, or $10,000 per mile. This is much too high a figure for track such as that at Winona, laid under the conditions met with in that locality. The roads in that section are dirt, and the soil was of a free loamy or sandy nature, and no paving had to be done. The cost of material and labor was therefore small. The maximum cost of this track with pole lines and overhead equipment should not have exceeded $8,000 per mile, and could easily have been built for $7,000 per mile. Taken at a fair maximum the track and its equipment of overhead construction would be therefore $32,000. The generator used in the plant was of the old Thomson-Houston bipolar motor type known as D 62, and its rated capacity was 62 K. W. The list price of this machine at that time was $5,000, but there was the usual customer's discount of 40 per cent. off from list price. The ordinary selling price of such a generator, therefore, was $3,000 for a new machine; but such machines cost the Northwest General Electric Company from $1,800 to $1,900, and where sharp competition existed they were sold at or very close to these figures. A fair price for a new machine at that time was $2,200 or $2,300, and certainly this old machine was not worth any more. Closed cars then sold at from $800 to $900 each, the trucks costing about $250. New 15 H. P. motor equipments were then selling for $1,500 per car, making the total cost of a new closed car electrically equipped and ready to run $2,550 to $2,650. Open cars cost about $700, the cost of trucks, etc., being the same as on closed cars. The cost of a new open car was therefore about $2,450.

Comparing the inventory value with the most liberal valuation which should have been made, and one far above the prices which the material would have brought in the market, we have the following result, taking into consideration only four of the items mentioned in the inventory:

	Inventory value.	Actual value (if new).	Over-valuation.
4 miles track	$40,000	$32,000	$8,000
80 H. P. generator	3,500	2,500	1,000
5 closed cars	15,000	13,000	2,000
2 open cars	5,000	4,900	100
Over valuation on four items			$11,100

The same scaling down could be fairly, and justly should have been, applied throughout most of the inventory, and as a matter of fact the tangible property of the Winona City Railway Company on Nov. 1, 1892, was much nearer $50,000 than $88,902. Its actual cost to the Northwest Thomson-Houston Company when new was not over $45,000 or $50,000, and as a matter of fact an experienced agent of the Northwest General Electric, who examined the plant just before the deal resulting in its absorption by the Winona General Electric Company, reported it to be worth not over $45,000 to $50,000.

It may be argued, however, that the inventory of the actual tangible property of the company was not a correct index to the value of all of its assets because the franchises were not included in the inventory. In reply to such an argument we ask what was the value of the franchise of a corporation which was unable to earn enough to meet its operating expenses and was steadily falling in arrears on interest due on its bonds and floating debt, and with not a shadow of a prospect of such improvement in its condition as would even enable it to meet its fixed charges and operating expenses without considering interest on stock issued or reserve fund for depreciation ?

Thus it is seen that the Winona City Railway Company, after being electrically equipped and run for over one year by the Thomson-Houston people, was bankrupt when the proposition to merge it into the Winona General Electric Company was first broached. It was wildly over-capitalized, and was ripe for a receivership. The only possible excuse for a further bond issue or a financial deal of any kind was that with the money so raised improvements could be made rendering it a paying property. No such hope existed. It is clear that the company lacked all the elements for possible success.

That the gentlemen engineering this scheme to float worthless bonds could not be excused for ignorance on this point is made clear enough to any man of intelligence when the company's own records are analyzed.

The total income was $20,602.90. It was well understood even at that time that the operating expenses of a road averaged about 75 per cent. of the gross receipts, leaving 25 per cent. for depreciation, interest and dividends. Hence, by taking one-fourth of the gross receipts of this road we would have only $5,000, which would be insufficient to pay even the interest on the bonds.

The *promoters* had *absolute knowledge* of the situation in 1892.

Just how hopeless the case of this property was is readily seen with slight calculation showing what the road *needed to earn.*

The yearly fixed charges were:

Interest on bonds	$6,000.00
Interest on notes	1,200.00
Allowance for depreciation should have been 6 per cent. on $100,000	6,000.00
Dividends on $100,000 stock at 6 per cent	6,000.00
	$19,200.00
Which is 25 per cent. of what the road to be a sound property needed to earn per annum, or	$76,800.00
Actual earnings were	$20,602.90
Or less than one-third of what they must have been to justify the capitalization of even $200,000.	
Deduct from the $19,200, as above, the $6,000 item for stock dividends, which it may be argued did not need to be paid, and we have	$13,200.00
Which is 25 per cent. of what the road needed to earn in order to exist at all, or	$52,800.00
About two and one-half times as much as the road did earn after it had been electrically equipped.	

We trust we have made the case of the $200,000 capitalization of the Winona City Railway and the quadrupled capitalization of the Winona General Electric Company clear enough. It would have been unworthy so much space were it not for the fact that it is typical of the plan of financing which has debased and bedeviled almost the entire electric railway business of the country, resulting in the bankruptcy of scores of roads, the loss of millions of invested money, and the killing of confidence in electrical enterprises of all kinds.

The plan must be abandoned; those responsible for it must be driven out of the business before confidence can be restored; and with this end in view ELECTRICITY will continue to print the records of a score or more similar transactions, both in the West and in the East, making the indictment of the guilty parties so strong that they cannot escape the penalty of their wrongdoings.

Little wonder that the Winona General Electric Company, unable to earn interest on notes, confessed bankruptcy in less than two years after the great plan for raising the capitalization to $900,000 went into effect, or on Feb. 19, 1895, when Mr. Seward D. Livermore, of St. Paul, was appointed receiver.

HOW THE MONEY WAS RAISED.

When the Coffinesque plan of financing had been in operation only a short time, Mr. Coffin conceived the idea of organizing a company especially to handle the securities which his company was taking for apparatus. Accordingly the United Electric Securities Company was organized on Tuesday, May 20, 1890, under the laws of the State of Maine. At the time of organization, James F. Meech was the temporary president and Alfred A. Glazier the treasurer.

The capital of the company was fixed at $1,000,000, and the purpose of the company as outlined in the charter was to do a general banking and brokerage business in stocks, bonds and other securities and obligations.

Another clause in the charter allows the company to issue its own notes, bonds or obligations, to any amount authorized by the board of directors, under authority from the stockholders.

Of the $1,000,000 capital, the sum of $700 was paid in in cash.

At the outset this company was composed exclusively of the active managers and officers of the Thomson-Houston Electric Company. Mr. Coffin himself was the real head of the enterprise.

The plan was for the Thomson-Houston Company to exchange apparatus for bonds, taking the latter at 50 to 60, selling them to the Securities Company at 70 to 85. Then they were grouped together as underlying securities against which the United Electric Securities Company issued its own collateral trust bonds, 15 to 30 years, bearing 5 per cent. interest, redeemable at 103, as the underlying securities were sold to the public.

Without the conception of some such scheme as this the Thomson-Houston Company would have gone into bankruptcy in 1890 with a treasury full of unsalable paper. This Securities Company is therefore worthy of attention as the bridge which carried Mr. Coffin over to his grander opportunities when the General Electric Company was formed.

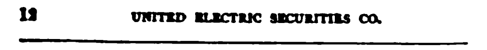
A little study of the plan outlined above shows the peculiar ideas of business rectitude held by the Thomson-Houston management After their own company had made what was supposed to be a fair profit on apparatus they took the proceeds of the sales, went into the market with them as individuals (though under the name of an incorporated company) to make a further profit of 30 per cent., a profit which, if legitimate or actual, belonged to the Thomson-Houston stockholders and to them only.

Mr. C. A. Coffin and Mr. H. A. Pevear, at that time officers of the Thomson-Houston Electric Company, the former now president of the General Electric Company, were and are now directors of the United Electric Securities Company.

With the profits supposed to be in sight, with almost no investment in this Securities Company, is it any wonder that the managers of the Thomson-Houston Company soon acquired the habit of actually *preferring* bonds to cash when selling apparatus, and that when a local company was forming and had several thousand dollars subscribed, they were told to keep their money—"we don't need money; we will advance money for the construction work, sell you all the apparatus you want, and take all the bonds; only make the bond issue *large enough*, and give us the bonds at 60".

The scheme was a deceptive one to local capitalists. Its workings in actual operation are becoming only too evident after five years. How will it appear as the years roll on? How will it appear when the day of reckoning comes, when the railways and lighting plants with ruined credit need new equipment, and when the bonds finally become due? How long will the evil effects of this system of raising money on worthless bonds remain to blight the entire electrical industry of this country?

The $100,000 of bonds of the Winona City Railway Company formed a part of the underlying bonds of the 5th series of $1,000,000 of collateral trust bonds issued and offered for sale by the aforesaid United Electric Securities Company July 6, 1892, as shown by the accompanying facsimile copy of page 12 of a pamphlet issued by the United Electric Securities Company, bearing date August 1, 1894.



12 UNITED ELECTRIC SECURITIES CO.

$1,000,000 COLLATERAL TRUST BONDS.
FIFTH SERIES
Issued July 6, 1892.
Statement of Sales of Underlying Bonds.

BOSTON, MASS., August 1, 1894.

Underlying Bonds.		Sold to Date.
Charleston T. H. E. Co.	$30,000	....
Citizens E. L. & P. Co.	21,000	....
City Elec. St. R'y Co.	100,000	....
Detroit E. L. & P. Co.	100,000	....
Goldsboro E. L. & P. Co.	15,000	....
Knox. S'r E. L. & P. Co.	20,000	$20,000
Louisiana El. L't Co.	140,000	....
Manhattan El. L't Co	123,000	45,000
Memphis L't & P. Co.	200,000	....
North Shore Elec. Co.	22,000	....
Peoples E. L. & P. Co.	69,000	....
Silver Bow E. L. & P. Co.	150,000	150,000
St. Louis & Sub. R'y Co.	200,000	200,000
Winona City R'y Co.	100,000	....
	$1,290,000	$415,000
Less sales to date	415,000	
Owned by the U. E. S. Co.,	$875,000	

Average Price, 87.

To retire outstanding Fives at 103, the remaining underlying Bonds should be sold at 75.3.

Receipts from sales to date	$326,250.00
Collateral Trust Fives redeemed and cancelled $341,000, at a cost of	306,528.59
Balance	$19,721.41

THE COST OF STEAM POWER.—II.*

BY CHAS. E. EMERY, PH. D.

Section 1.—Previous articles of the writer on this subject dealt with the problem as it practically presented itself at the several times. The first article in 1883† referred particularly to results which had been obtained in a number of typical cotton mills by the use of the ordinary condensing engines in vogue at the time. A more recent article in 1893‡ discussed the question of the cost of steam power in 500 H. P. units or multiples of the same developed in different kinds of engines, including the more modern triple compound engines. The first paper was based on actual conditions, the second on assumed conditions, the best experimental results being considered, but afterward modified by judgment so as to give a final result which would approximate the conditions of ordinary average working. In a later and more general article published in 1895|| the method employed to increase experimental results to an approximately practical basis was outlined, but otherwise the inquiry was extended little or no further than before.

Sec. 2. In connection with the proposed supply of power in large units from Niagara Falls and other undertakings of a similar character, the question naturally arises: What would be the cost of steam power if also supplied in large units and generated with modern machinery of the most approved type? The question would be a simple one if it involved only the amount of coal consumed at a definite price and the labor required to handle the coal and attend to the machinery. It is very common to compare the value of two engines simply by the relative amount of coal consumed, assuming that other costs incident to the development of the same power will be the same in all cases. Even if the assumption be substantially correct it has a more important bearing on the results than appears at first sight. The cost of coal is for ordinary engines of moderate size only about one-third of the total cost of steam power, so, if the other costs remain nearly constant, moderate savings in the cost of coal will not proportionally decrease the cost of the power.

Sec. 3. In large plants operated nearly at full capacity, the best types of steam machinery can be profitably employed, the cost of superintendence will be reduced and the cost of labor required for operation materially decreased. The decrease in labor depends largely on the size of steam unit it is found practicable to employ. Triple compound engines of 10,000 to 15,000 H. P. each are used quite successfully in our large ocean steamers, but it is considered that these units are altogether too large for the problem we are considering.

Sec. 4. Any supply of power must be adapted to the nature of the demand, which for most industrial operations is variable, and it is desirable to make the steam units of such size that one or more of the same can be grouped together to carry the load at any time without either overloading or greatly underloading either of such units. In a large plant, upon which presumably many different manufactories depend for power, there should be a spare unit which can be used in case of accident and ordinarily employed in regular turn so that all the machinery can be kept in repair.

Sec. 5. It will thus be seen that the size of the units is limited by the conditions above stated. If 20,000 H. P. as a maximum were to be delivered, two units of 10,000 H. P. each would do the work, but evidently the spare engine would require also to be 10,000 H. P. and this would involve too large an amount of capital in spare machinery. At Niagara Falls four connected turbines and dynamos of 5,000 H. P. each are being erected in a preliminary plant so that only 15,000 H. P. maximum can be delivered if the principles above outlined are strictly carried out, though evidently contracts can be drawn to provide that the power may be stopped in case of accident, the same as in a private establishment, and thereby all the wheels and engines put in service at the same time, but it is probable that one unit will be practically kept in reserve and more units added as the demand warrants. With steam power there would be some advantages for a 20,000 H. P. plant in adopting a unit of 2,500 H. P., on which basis with one spare unit of this size there would be nine such units in all. There is an advantage in having all the engines alike, as the parts required for repairs are then duplicates of each other, the units can be more suitably arranged in the building and the labor better distributed. When it could be done without too much detail, it would be desirable to couple together several engines of 2,500 H. P. each, so that they would be capable also of independent operation. Another method would be to disregard absolute uniformity when so much power is to be delivered and have several duplicates of two different units, say one of 2,500 H. P. and another of 5,000 H. P., which would either require the size of the spare engine to be increased, or that the other engines be slightly overworked in case of accident. For simplicity, however, all the costs will be assumed alike with either arrangement.

Sec. 6. The average cost per H. P. when the load is variable is considerably greater than if the power be furnished continuously. Coal is wasted in building up the fires and in caring for them when not required, all supplies are increased from the necessity of starting new after every stoppage, and there is an important loss due to the interruption of the regular hours of labor. A sufficient force must be kept on hand at all times to provide for any demand and the watches of the men arranged in some practical way so as to proportion the labor to the work to be done as nearly as possible.

Sec. 7. It is desirable at the outset, however, to ascertain what steam power will cost under the most advantageous conditions as to demand, and we therefore submit a preliminary estimate based on the assumption that 20,000 H. P. can be sold for every hour in the year. The details of the estimate are discussed afterward.

Sec. 8.

TABLE I.

Showing cost of steam power on basis of generating 20,000 H. P. continuously every hour in the year.

			Per cent. of total cost.
1.	Yearly cost of coal for 20,000 net H. P. operated continuously every hour in the year, based on a consumption of 1.25 pounds of coal per indicated H. P. per hour (Sec. 10). Cost of coal assumed at one mill per pound, or $2.24 per ton. Sec. 12. Engine efficiency assumed at 92.8 per cent. (Sec. 11)	$237,250	43.4
2.	Estimated cost of labor (Sec. 13)	60,444	11.1
3.	Estimated cost of supplies and regular repairs (Sec. 14)	105,120	19.2
4.	Estimated interest, insurance, taxes and cost of renewals (Secs. 15–16)	144,000	26.3
5.	Total	$546,814	100.0
	which divided by 20,000 gives the following:		
6.	Cost of steam power per H. P. per year, on basis of 20,000 H. P. delivered every hour in the year	$27.34	
7.	Cost of steam power per H. P. per year on above basis, if 5 per cent. of the original cost of plant (Sec. 16) be charged for dividends, and $1.00 per H. P. added for general business expenses (Sec. 18), 27.34 + 3.60 + 1.00 =	31.94	
8.	Cost of steam power per H. P. per year on above basis, if 10 per cent. of the original cost of plant (Sec. 16) be charged for dividends, and $1.00 per H. P. added for general business expenses (Sec. 19), 27.34 + 7.20 + 1.00 =	35.54	

Sec. 9. This cost is, for reasons which will be discussed later, lower than it is probable any plant can be operated under commercial conditions. This price is somewhat higher than those given in the papers previously mentioned, simply because operation is supposed to be continued every hour in the year.

Sec. 10. The cost of coal above outlined is derived as follows: The best triple compound engines have developed a H. P. for a little less than 12 pounds of water per H. P. per hour, and boilers have been constructed which at actual pressure from actual temperature of feed evaporated 10 pounds of water per pound of first quality coal. Both these results are under experimental conditions, but we must assume that in a large plant like this all details will be so well attended to that fair experimental results may be obtained all the time. We therefore assume that the power will be produced regularly for $1\frac{1}{4}$ pounds of coal per indicated horse-power per hour which would be obtained with engines requiring $12\frac{1}{2}$ pounds of feed-water per H. P. if the boilers evaporated 10 pounds of water per pound of coal, or if the boilers evaporated 9.6 pounds of water per pound of coal and the engines only required 12 pounds of water per H. P. per hour.

Sec. 11. For permanent work of the kind assumed, engines of comparatively slow speed should be selected, and although some of the work might be directly connected, part of it at least would necessarily be operated by some method of transmission. The frictional losses of the engines and the more important features of transmission to the work done have been assumed at 7.69 per cent., so that the amount of coal per indicated horse-power above assumed must be increased by $\frac{1}{12}$ to give the coal per net H. P.

Sec. 12. The cost of coal per ton varies greatly in different parts of the country. The actual cost of mining bituminous coal is as low as 25 cents per ton in some locations and the coal can be delivered on the cars at a good profit at 50 cents per ton. At deep mines the cost of mining is greater, but in all cases the principal cost of coal is the transportation, which has been reduced from time to time by increasing the size of the coal cars and the weight of the train and by reducing the grade in the direction of traffic, until it is credibly stated that coal can be hauled on the main trunk lines, at a profit, for one half cent per ton per mile, thus adding only $0.50 per ton for each 100 miles of haul. The lateral roads with undulating grades cannot haul coal at as low a rate as this. There is, moreover, to be added the general selling expenses, so it has been assumed that along the lakes, although comparatively near coal mines, the best quality of coal will cost a little over $2 per ton if purchased in large quantities, though this price must be increased on the seaboard fully 75 cents, and for ordinary consumers of course much more. The price upon which comparison has been made is one mill per pound or $2.24 per ton, to include the cost of delivery directly in front of the boilers. The cost in line 1, Sec. 8, is derived simply by multiplying the net power, 20,000, by $1\frac{1}{4}$, the coal per indicated horse-power, adding $\frac{1}{12}$ to allow for friction, and multiplying the result by 8,760, the number of hours in the year, and $0.001, the price per pound. The next item, that of labor, is made up as follows:

Sec. 13. Without attempting to arrange watches it is assumed that on the average there would be required in such a station at all times—

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* A paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 26th, 1895.

† Trans. Am. Soc. C. E., Vol. XII., p. 425, Nov., 1883.

‡ Trans. Am. Inst. E. E., Vol. X., p. 119, March, 1893.

|| "The Engineering Magazine," Vol. VII., p. 796, Feb., 1895.

One attendant for each 2,500 H. P. engine, or 8 men in all, at 25 cents per hour	$2.00
14 firemen and 3 additional men at the same pay, to care for pumps, etc., and to keep the premises clean; total, 17 men at 20 cents per hour	$3.40
Total cost of labor per hour	$5.40

There would also be required a chief engineer, 3 assistant engineers and some clerical help, which under the head of superintendence would cost, say $13,140 per year, or $1.50 per hour, making a total of $6.90 per hour. The total cost for labor and superintendence for one year of 365 days, or 8,760 hours, at $6.90, is $60,444 as given in line 2 of Sec. 8.

Sec. 14. The cost of supplies and repairs in connection with the boilers and large condensing engines in the cotton mills of Fall River proved upon investigation several years ago to be approximately $\frac{8}{10}$ of a mill per H. P. per hour. With the hope that this cost can be reduced in an immense plant of this kind the quantity in line 3 has been extended on the basis that the cost will be only 0.6 mill.

20,000 H. P. × 8760 hours × $0.0006 = $105,120, as written in line 3 of Sec. 8.

Sec. 15. The above estimates only provide for regular repairs. Independent of this a certain percentage of the first cost should be put at interest every year to provide for renewals of the machinery and provision made also for paying taxes and insurance. Calling these three 5 per cent. of the cost, and considering that a company which can build so large a plant can possibly borrow money at 5 per cent., 10 per cent. of the total cost will be required for these several items.

Sec. 16. The total cost of such a plant cannot be determined accurately in advance. The present prices for steam machinery are very low, and it might be possible to buy engines of the best type with necessary boilers, ready for erection, for $30 per H. P. To this price, however, must be added the cost of the land upon which the plant is to be erected, the cost of foundations, of erection of the buildings, of the chimney, the pipe connections, the general means of transmission and the multitude of minor details required for fitting up such a place ready for use. The probable cost has been fixed at $64 per H.P. and as at least ⅛ surplus power will be put in the station there will be required a steam plant of 22,500 H. P., which at $64 will cost complete $1,440,000, 10 per cent. of which as required above is written in line 4, Sec. 8.

Sec. 17. Referring to line 6, Sec. 8, we find that the "cost of steam power per H P. per year on the basis of 20,000 H. P. delivered every hour in the year" is $27.34. The price at which this power can be sold to consumers will depend upon the way the company furnishing the power is organized. The interest on the cost is already provided for in line 4, so that the net cost given, viz. $27.34, would be that chargeable to power if the same company that built the works used the power, or if an association of individuals should build the plant and simply charge themselves with its cost.

Sec. 18. If, however, a private company with ample means should build the plant on a cash basis and wish to sell power and realize a return of five per cent. on first cost, independent of interest on the money invested, the modified cost would be $27.34 plus 5 per cent. of $72 (Sec. 16), viz. $3.60, to which should be added, say, $1 per H. P. for general business expenses, making the total charge $31.94, shown in line 7, Sec. 8, the same method being used in reference to similar lines in Tables II and III.

Sec. 19. If, however, the promoters desired 10 per cent. profit on original cost or a proportionally less percentage on stocks and bonds issued in excess of first cost, the modified cost per H. P. per year would be $27.34 plus 10 per cent. of $72 (Sec. 16), viz., $7.20, to which adding $1 per H.P. as before for general expenses gives as the total charge under these conditions $35.54, shown in line 8, Sec. 8, the method applying to Tables II and III as above explained.

Sec. 20. We are now prepared to ascertain the variations in result which would be produced if the power were considered variable. For this purpose let us assume there will be sold:

	Daily H. P. Hours.
1. 20,000 H. P., 10 hours per day	200,000
2. 12,000 H. P., 10 hours per day	120,000
3. 5,000 H. P., 4 hours per day	20,000
4. Total daily H. P. hours	364,000

which would probably be required on, say, 309 working days in the year.

5. Total H. P. hours, 309 days	105,060,000
Then if 5,000 H. P. were required for the remaining 56 holidays in the year:	
6. Total H. P. hours, 56 days of 24 hours, 5,000 H. P.	6,720,000
7. Total H. P. hours per year	111,780,000
Average H. P. per hour during the year:	
8. Previous result ÷ 8,760 =	12,760 H. P.

The average H. P. is therefore 63.80 per cent. of the maximum. This percentage is frequently termed the "power factor," and is rather higher than has been found in practical cases heretofore. An estimate of the cost on this basis will be given in advance as before and explained afterward.

Sec. 21.

TABLE II.

Showing the cost of steam power on basis of generating 20,000 H. P. maximum and an average of 12,760 H. P. for every day in the year.

			Per cent. of total cost.
1.	Yearly cost of coal (Sec. 22)	$157,644	37.3
2.	Estimated cost of labor (Sec. 23)	47,652	11.3
3.	Estimated cost of supplies and regular repairs (Sec. 25)	73,584	17.4
4.	Estimated interest, insurance, taxes and cost of renewals (Sec. 26)	144.000	34.0
5.	Total	$422,880	100.0
	Which divided by 12,760, the average H. P. (Sec. 20), gives the following:		
6.	Cost of steam power per H. P. per year on basis of delivering 20,000 H.P. maximum and an average of 12,760 H. P. for every day in the year	$33.14	
7.	Cost of steam power per H. P. per year on above basis if 5 per cent. of the original cost of plant be charged for dividends and $1 per H. P. added for general expenses (Sec. 18), 33.14 + 3.60 + 1.00 = ...	37.74	
8.	Cost of steam power per H. P. per year on above basis if 10 per cent. of the original cost of plant be charged for dividends and $1 per H. P. added for general expenses (Sec. 19), 33.14 + 7.20 + 1.00 =	41.34	

Sec. 22. The cost of coal is made up as follows: By reference to Sec. 20 it will be seen that 15,000 H. P. of boilers out of 20,000 must be shut down daily for periods varying with the demand, and it is considered that it will require an amount of coal equal at least to the average consumption for one hour during regular operation to maintain banked fires, overcome radiation, and bring the fires to average working condition when they are again put in operation. The total daily H. P. hours in line 4, Sec. 20, is therefore increased 15,000 and mutiplied by 309; the horsepower hours for the 56 holidays, line 6, are then added to the same, the sum multiplied by 1.25 pounds of coal per H. P and by one mill per pound and one-twelfth added to the whole for friction, which gives the result written in line 1, Sec. 21.

Sec. 23. The labor cannot be distributed accurately until the variations of loading are developed practically. On any definite basis, such as is assumed in Sec. 20, the watches could be arranged so that there would be little loss of time, but in practice there would be a variation of load at the same hour on different days. For instance, with the electric lighting part of the load, the demand would vary with the weather; with the cable or electric railroad portion of the load the demand would be greater on particular days and seasons, and vary also somewhat with the weather, so to be provided for unexpected demands there must be a surplus of labor. Such surplus will be assumed at 20 per cent. for the 14 hours of reduced power per working day, shown in Sec. 20, lines 2 and 3, equivalent to labor for 28,000 H. P. hours per day, or 8,652,000 H. P. hours for 309 days. Adding only 10 per cent. for 56 holidays gives 6,720,000 × 1.1 = 7,392,000 H. P. hours. Adding both to the total H. P. hours (Sec. 20), viz., 111,780.000, gives a total for the year of 127,824,000 H. P. hours, which at $0.00027 per H. P., easily derived from Sec. 13, gives:

Cost of labor per year	$34,512
Cost of superintendence per year, from Sec. 13	13,140
Total for labor and superintendence per year as written in line 2, Table II, Sec. 21	$47,652

Sec. 24. The cost of labor and superintendence above is 100 × $47,652 ÷ 60,444 = 78.83 per cent. of that required for full operation throughout the year, shown in Sec. 8, although the average power developed is only 63.80 per cent. (Sec. 20).

Sec. 25. The cost of supplies and regular repairs, line 3, will be somewhat greater proportionally than for continuous operation, and is estimated to be 70 per cent. of the similar costs given in Sec. 8, $105,120 × 0.70 = $73,584, which is written in line 3, Sec. 21.

Sec. 26. Evidently the interest, insurance and taxes given in line 4, Sec. 8, are not modified, and the percentage allowed for renewals is so small as not to materially affect the result, so the amount given in line 4, Sec. 8, is repeated in same line of Table II.

Sec. 27. The presentation in Table II will give a fair idea of the prices it would be necessary to secure on installing a large steam plant to furnish power in various quantities to consumers on the premises, or to apparatus for transmitting power to the same, the costs of which transmission are not included. The costs at which the power can be sold under certain specific conditions, as stated in lines 7 and 8, Sec. 1, are the only features that directly interest consumers of power.

Sec. 28. A large proportion of the power in manufacturing establishments is used only 10 hours per day, so this investigation would not be complete if it did not include a presentation of the cost of steam power generated with large units for 10 hours per day. Such an estimate is made in Table III, the explanation of the items being given afterward as heretofore.

Sec. 29.

TABLE III.

Showing the cost of steam power on the basis of generating 20,000 H. P. continuously for 10 hours per day for 309 days in the year.

			Per cent. of total cost.
1.	Yearly cost of coal (Sec. 30)	$92,0[illegible]6	[illegible]
2.	Estimated cost of labor (Sec. 14)	27,198	9.1
3.	Estimated cost of supplies and regular repairs (Sec. 32)	38,080	12.3
4.	Estimated interest, insurance, taxes and cost of renewal (Sec. 33)	144.000	48.0
5.	Total	$300,334	100.0
	which divided by 20,000 gives the following:		
6.	Cost of steam power per h. p. per year on the basis of delivering 20,000 H. P. continuously for 10 hours per day for 309 days in the year	$15.17	
7.	Cost of steam power per h. p. per year on above basis if 5 per cent. of the original cost of plant be charged for dividends and $0.75 per h. p. added for general business expenses (Sec. 18), 15.17 + 3.60 = 18.77; 18.77 + 0.75 =	19.52	
8.	Cost of steam power per h. p. per year on above basis if 10 per cent. of the original cost of plant be charged for dividends, and $0.75 per h. p. added for general business expenses (Sec. 19), 15.17 + 7.20 = 22.37 + .75 =	23.12	

Sec. 30. The yearly cost of coal, line 1, above, is obtained by computing the coal for 11 hours per day, for reasons explained in Sec. 22 and making the calculations explained in the latter part of Sec. 12 for 309 × 11 = 3,399 hours in the year.

Sec. 31. The labor would be occupied 309 working days, and, say, one-half the holidays (Sec. 20). The cost of labor for 337 days of 10 hours or 3,370 hours, at $5.40 per hour (Sec. 13) = $18 198. Two assistant engineers could be dispensed with, compared with Sec. 13, thus reducing the cost of superintendence to, say, $9,000 per year. The sum of these two quantities is written in line 2 of Table III.

Sec. 32. The cost of supplies and repairs is estimated at the rate of 0.6 mill per H. P. hour as per Sec. 14; 20,000 × 3,090 × $0.0006 = $38,080, as written in line 3, Table III.

Sec. 33. The amount written in line 4, Table III, is the same as for the two other cases. The cost of renewals should apparently be reduced, as the machinery operates less hours, but the percentage allowed for renewals is very small and should be increased for the other cases rather than reduced for this. Moreover, renewals are made more frequently on account of new discoveries or changes in business than from the actual wearing out of the apparatus.

Sec. 34. The prices given in the lines 6, 7 and 8 of Table III, Sec. 29, will best compare with those carried familiarly in the mind. The minimum cost derivable from the paper in Transactions for 1893, above referred to, is for coal at $2.24 per ton and ten hours per day, $22.31 per H. P. per year. This should be compared with $18.77 in line 7 of Table III, as the previous calculations provided for 10 per cent. interest and dividends, as is provided in lines 4 and 7 jointly in Table III, but not for general business expenses. The difference is $3.54 per H. P., corresponding to a saving of 15.87 per cent. by generating the power on the larger scale.

Sec. 35. The quantities in the previous paper above mentioned were augmented here and there so as by judgment to try and approximate the various losses incident to average practice, though insufficiently to show the results of such practice in some locations. The prices herein given are as low as it would be safe to expect with very careful management of a very large plant. The comparatively small difference in result is due to the influence of the constant cost shown in line 4 of the several tables. It forms 26.8 per cent. of the total cost for 20,000 H. P. every hour in the year (Table I, Sec. 8), 34 per cent. for variable power, 20,000 H. P. maximum, 12,760 H. P. average day and night, and rises to 48 per cent. for 20,000 H. P. during 10 hours of the ordinary working days in a year. The cost of coal is respectively 43.4 per cent. 37.3 per cent. and 30.6 per cent. of the total cost for the same three conditions. The fixed charges also increase greatly the cost of water power, as the writer has had occasion to call to the attention of parties engaged in these large hydraulic enterprises.

Sec. 36. It should be borne in mind that if water power or power derived from water be sold on a 24 hour basis, but can only be utilized during 10 hours per day, the cost of the water power direct or derived should be compared, not with the cost of steam power on a 24 hour basis in Tables I or II, but with that of steam power on a 10 hour basis in Table III.

Sec. 37. It should also be borne in mind that all these estimates provide for fixed expenses, such as interest, insurance, taxes and cost of renewal, and that in comparing the prices above given with the cost of water power, similar fixed expenses should be added to the price of such power, based on the cost to consumer of installing the water power or the mechanism through which the power is derived. For instance, manufacturers located on the canals of large water power companies necessarily build their own head and tail races and wheelpits and install the gates, screens, turbines and means of transmission for utilizing the power. This when well done in many locations costs as much as to install a steam plant, so the fixed annual charges for this item alone would be $5.00 to $7.00 per H. P., which, together with cost of labor and supplies, must be added to the cost to be paid for the water power in order to compare with the cost of steam power as presented in the tables of the writer.

Sec. 38. When power is electrically transmitted, the consumer is generally required to pay for the electric motor, the general means of transmission therefrom and some incidentals. The cost of this work, together with the portion of the building and even of the real estate occupied should be considered in the same way as has been done above, and at least 10 per cent. of such cost, together with actual costs of labor and supplies, added to the tendered price of net power delivered, in order to compare the cost of power obtained in this way with the cost of steam power shown in the various papers of the writer, which are written on the basis that a manufacturer should receive a profit on the money expended in plant as well as that expended in his business. If interest is left out in one case it should be in the other and it is already included in the tables.

Sec. 39. The last column of the several tables furnishes a ready means of eliminating either of the items of cost desired. For instance, in Table III, which is on a 10-hour basis, we find in line 4 that the "estimated interest, taxes and cost of renewal" is 48 per cent. of the total cost, which cost to the parties owning the power in such table $15.17 per year (line 6). The cost of steam power per H. P. per year from large units for 10 hours per day, without considering the above items, is therefore only 0.52 × $15.17 = $7.89, which is the cost to be compared with the price of power from an external source when the items above referred to are excluded in each case as they are in the popular discussion of the subject. The similar cost from the estimate in the Transactions of American Institute of Electrical Engineers above referred to is $22.31 (Sec. 34) less (3.31 + 7.17) = 22.31 — 10.48 = $11.83, the difference being due principally to the assumption that the power is generated on a larger scale in the first case.

ELECTRIC POWER IN FACTORIES AND MILLS*—II.

BY F. B. CROCKER, V. M. BENEDIKT AND A. F. ORMSBEE.*

The question of running machine tools by individual motors or grouping a number of machines together and driving them by one motor, does not seem to allow of a general solution. It would not be advisable, for example, to use the individual system where there are a number of small tools, each one of which requires only a small fraction of a horse-power. On the other hand, if we have a large tool that requires considerable power it would seem to be far more economical to run it by a single motor, using as little belting and shafting as possible.

Many of the manufacturers of machinery are now supplying boring mills, punching presses, drill presses and other machine tools arranged to be driven by electric motors. In most cases all that is necessary is a shelf or bracket on the tool to support the motor and a gear wheel in place of the main pulley, unless a belt connection is preferable. A press or other tool having a large fly-wheel may be driven very conveniently by cutting teeth on the edge of the wheel which gear with a pinion on the motor shaft.

ELECTRIC POWER IN THE NEW ENGLAND COTTON MILLS.

The introduction of the electric system of distribution of power in the cotton industries of New England is now fairly begun. Although there are no large mills driven entirely by this system a number of them have an electric plant and certain sections of the mill are driven by motors. An electric plant was installed four or five years ago in the works of the Silver Spring Bleaching and Dyeing Company at Providence, R. I., but it was intended chiefly for lighting. But motors were placed in the carpenter and repair shops and several other places until at present there are about 100 H. P. of motors installed in eight units. The generating plant consists of three 100 H. P. U. S. dynamos belted together from a countershaft which is driven by a Corliss engine. Two of the machines are 110-volt dynamos which are used for lighting and running most of the motors at present. The third machine which has just been installed is a 500-volt Westinghouse power generator of the same type as the lighting machines. There is only one machine at present connected to the 500-volt circuit, a 30 H. P. motor which drives a centrifugal pump supplying a storage reservoir with water for use in the bleacheries. The electric plant in this mill is not of much importance yet, but its chances for development are very bright since there are a number of machines now run by individual steam engines. These could be most advantageously replaced by electric motors as they are in some cases a great distance from the boilers, involving large losses from condensation.

A visit was made to the works of the Donnell Manufacturing Company, at Pawtucket, R. I., where a very fine electric plant has recently been installed to drive the calico printing machines. The problem of running this class of machinery by electric motors has been a very difficult one to solve, for the motor must be capable of running at a number of different speeds and running constantly at any given speed with a variable load. In this case it has been solved by the use of a modification of the Leonard system of motor regulation. The outfit for each printing machine consists of a motor and a dynamo of the same size, the field rheostat of the dynamo being placed alongside the printing machine. The speed of the motor is thus changed by varying the voltage of the particular dynamo which supplies it with currents.

The dynamo room contains eleven dynamos of the new moderate speed four-pole type, made by the General Electric Company. They are run by a Corliss engine through a system of belting and ceiling countershafting. Six of these are 20 K. W. machines and four are 25 K. W. The eleventh dynamo is a similar 20 K. W. machine used for exciting the fields of the other dynamos. The normal potential is 250 volts, and is lowered in any particular dynamo when slower speed of the motor connected to that circuit is desired. This plant has been completed but a short time, and it was not possible to obtain any accurate figures showing the power used by the motors under various conditions of speed and load. Formerly the machines were run by individual engines and much difficulty was experienced in starting them, as the pressure of the printing rolls against the cloth is so great. With electric motors this difficulty is overcome, as the motors will stand a very heavy overload for a short time, and the starting torque is very great. The great advantage of the electric system as here used is not so much in the saving of power as in the convenience to the workmen, and hence the increased production.

The saving of power, however, is quite considerable as in the old system steam was piped several hundred feet to the small individual engines, which were necessarily inefficient under the best conditions, and added to this the engines were run part of the time with partly closed throttle, still further decreasing the efficiency. With the present system the attendant at the machine may quickly vary the speed any amount by turning the rheostat near the machine.

Although this plant has been in operation only a short time, it is claimed by those in control that the production is materially increased. In a paper by Mr. S. B. Paine in *Power*, June, 1895, he states that the increase in the production amounted to more than 25 per cent. and that the quantity of "seconds" (inferior product) was also considerably reduced.

This is very important as the men in charge of printing machines are skilled workmen of the higher order and a small saving of wages for a given production is of more value than a considerable saving of power.

A visit to Baltic and Taftville was also made to see the practical working of the well-known power transmission plant between these places. At Taftville, where the Ponemah mills are located, there is not sufficient water power to drive all the machinery, so an electric plant was installed at Baltic, 4½ miles up the river, where a dam had been built giving an available head of 34 feet. The wheels are horizontal balanced turbines, two of them being rated at 800 H. P. each, while the third one is rated at 300 H. P. The wheels are belted to a long line shaft, which is in turn belted to the dynamos. The generators, of which there are two, are placed in a separate room. They are of the three-phase General Electric type and are capable of supplying 250 K. W. at 2,400 volts. They have ten poles and run at 600 R. P. M., giving a frequency of 50 cycles per second. The field is excited by a 3 K. W. bipolar dynamo belted from the generator shaft. The power is transmitted to Taftville by a well constructed pole line. The motors are located in the basement of the Ponemah mill near the engines which they replace. They are belted to pulleys which are connected to their respective shafts by friction clutches in order to enable the motors to be started without load, as they are of the synchronous type. The motors are identical with dynamos except in having an induction winding of heavy bars sunk in the pole-pieces, to cause them to be self-starting. In starting the motors, the switch in the induction circuit is closed and then the line is connected to the armature, causing it to start as an induction motor, without a very great torque, however. When the motor has nearly reached full speed the field is excited and it will speed up until it falls into step and then the induction switch is opened. This method of starting has two advantages: first, no auxiliary motor is needed; second, no device is required to tell when the motor is in synchronism with the generator.

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* A paper presented at the twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

One of these motors drives 1,200 looms requiring an expenditure of about 155 H. P. The other drives 500 looms and also the railway generators for the Norwich Electric Railway Company. The introduction of this plant has enabled the company to concentrate all its power for use in one mill, tending to decrease the cost of production, diminishing transportation charges and avoiding the use of any coal for steam power.

CONCLUSIONS.

First Cost.—Practically the only objection which can be urged against the electric system is the fact that the first cost of installation is greater than with ordinary belting and shafting, but even this is questionable since the authors know of cases in which the estimated total cost of installing the necessary belting and shafting was actually greater than the equivalent electric motor outfit. The electric system would be cheaper, for example, in the case of very long or scattered buildings or those containing many stories or rooms, in any of which cases the belting and shafting required would be very complicated and expensive. The use of belting and shafting requires a much stronger and more expensive roof or ceiling than the electric system.

Saving of Power.—It might seem that the electric system would actually consume more power than the ordinary plan since it involves two transformations of energy. In most cases, however, if the power has to be distributed to a number of machines, particularly if they are located at any distance from the engine, the loss of power is less with electric transmission. This is explained by the high efficiency of the dynamo and motor compared with the low efficiency of belt transmission as ordinarily practised, involving as it often does very imperfect alignment and lubrication of the shafting. Perhaps the greatest saving, however, of the electric system is due to the fact that the consumption of energy entirely ceases when the tool stops. This stoppage in the case of the busiest tools amounts to at least 25 per cent. of the nominal working hours throughout the year, and with large or special tools which are not used so steadily the stoppage is often as high as 50 to 75 per cent., since there are many whole days when they are not used at all.

Idleness due to strikes as well as to slack times must also be considered and would usually amount to quite a large percentage in ten years, for example. This assumes, of course, that a portion of the shop is running, which is usually the case even under such conditions. In short, with the mechanical system there is an enormous amount of shafting, idle pulleys and belting which runs for long periods of time doing little or no useful work but consuming considerable power.

Wherever electric motors can be substituted for a number of small engines scattered about, the saving in power is very great, not only because of the low efficiency of small steam engines, but also by the avoidance of condensation in long steam pipes.

Increased Output.—This is, perhaps, the most important advantage gained by the electric system since after all the cost of power is a very small item, being, according to Mr. Richmond* only about 1 per cent. of the wages paid in average machine shop practice.

This increased output is secured by greater convenience and promptness in starting and stopping as well as in regulating the speed of the machinery. The workman can, for example, temporarily increase the speed when the conditions are favorable, thereby saving considerable time.

Flexibility.—The great convenience of moving the tools and placing them in any desired position is another great advantage of the new system. The great adaptability of this system is particularly well shown in the case of a factory which was almost completely destroyed by fire, nevertheless a few uninjured tools in a remote end of the building were operated successfully by means of electric motors within two days after the fire.

Speed Regulation.—The ordinary type o motor used in factories is the plain shunt wound machine fed with constant potential current. The motor is started and varied in speed by means of a rheostat in the armature circuit. This simple arrangement answers very well in most cases, but for variable speed between wide limits a series wound motor controlled by a rheostat as in railway practice may be preferable. In other cases some special method of regulation, such as the Leonard system, or the "boost and retard" plan may be adopted.

In concluding, the authors wish to express their sincerest thanks to the various companies for the courtesy shown by them and for the kind assistance which they rendered during the tests.

Multiple Current Dynamos.

BY RANKIN KENNEDY.

This long neglected class of dynamo seems at last to have met with that favor to which its merits entitle it. No particular description or notice having hitherto been given of a dynamo of this kind built on up-to-date lines of electrical engineering, the author hopes that the following description of his own design will be of interest.

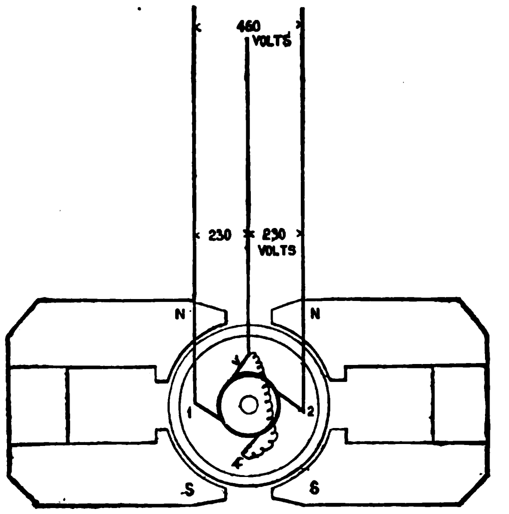
In most isolated electrical plants in mills, factories, mines, shipbuilding yards, railway stations, etc., we find arc lamps, motors, and incandescent lamps, and if the installation is of any magnitude, it very soon becomes apparent that the common constant pressure 110-volt dynamos alone are not sufficient for the work being carried out with efficiency and at reasonable cost. Then it is found desirable to run the arc lamps in series, and also to run the motors at a pressure of between 400 and 500 volts, while the lamp pressure is limited to 230 volts at the present moment, and quite recently were limited to 120 volts.

The consequence of this is that different machines are required for the different purposes, and the expenses of first cost and maintenance are thereby greatly increased.

I cannot do better than quote Mr. W. Langdon in his paper on "The Employment of Electric Light for Railway Purposes," read before the I. E. E. on March 28:

"A further advance is to be looked for in the unification of the class of generator. At the present moment it is necessary, where series arc and incandescent lighting has to be provided, to lay down independent power and independent machines for each, or to drive the arc lights from alternating or transformed alternating currents. To drive arc lights on the series-parallel system for any material distance from the generating plant would entail so large an outlay in cables as to strongly militate against its adoption for such small plants as railway companies require. It would appear that what is needed is a generator the energy derived from which may be applied alike to incandescent lighting, arc lighting, or motive power—for the latter is an application which will have to be provided for. Is this to be most economically and most successfully met by an alternator or by a direct current machine? Are we to look for help in this direction from 'rectified' currents? If a system having for its basis one common generator can be established without too great a sacrifice in efficiency, small installations, such as would be of great service to railway companies in many busy centers, could then be brought within a more economical compass than is now the case. Three units—one for the light load, another for the full load, and a third of similar capacity as spare—would probably meet the requirements of every depot, whereas at present spare units for both arc and incandescent work are necessary.

"For instance, at Birmingham (Lawley street), the plant, when all is complete, will consist of six 50-light arc lighting machines and two incandescent machines. Now, if all this could be met by three generators—one for the light load, arcs and incandescents combined, another for the full load, and a third as spare—the engine and dynamo space would be largely reduced, the labor and repairs correspondingly lessened."



These are the expressions of an engineer who has had, perhaps, more experience in working isolated plants than any other man.

For municipal plants this class of machine also has advantages, but as it generally takes about 10 years' education to reach the point at which municipal engineers open their eyes to improvements, we cannot just yet expect the adoption of this class of machine in these plants; nevertheless, it can be recommended to their notice as a means of working high pressure and continuous currents without complicated plants. The distribution system could thereby be worked at 200 or 230 volts, and the transmission feeders or outer mains at 460 volts.

The miserable performance of many of the municipal plants would be infinitely improved in the matter of constant pressure and freedom from sudden drops when current is turned on to motors and large installations, while the carrying capacity of the copper mains would be quadrupled.

Of course all this can be done by coupling two ordinary dynamos in series—quite true; but it requires no arguments to prove that if it can be done with one dynamo the improvement will be great. The orthodox fashion of coupling two dynamos in series for three-wire working seems to be deeply rooted in the minds of the engineers about central stations, but there has never been a satisfactory explanation given as to why this practice cannot be improved upon, nor any rational account of its advantages.

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* *Engineering Magazine*, January, 1895.

The multiple current dynamo was first constructed and patented by the author in 1882, Specification No. 1,640, but it has never been fully understood until now when the progress of electric power renders such a machine a necessity; hence others have now come forward with similar plans to meet the want and claim it as a novelty.

If we take a four polar dynamo, and instead of making the poles alternating N, S, N, S, make two upper ones N, N, and the lower ones S, S, it immediately becomes a multiple current dynamo, and we can take a current at 460 volts from one pair of brushes, and another at 230 volts from the second pair, or 120 and 240 volts may be so obtained.

Referring to the Figure, the brushes 1 and 2 supply pressure at the full volts, say 460, and between the brushes 1 and 2 and the brushes 3 and 4 a pressure of 230 volts is obtained; the brushes 1 and 2 are connected to the outer mains of the three-wire system, while both 3 and 4 are connected to the third or middle wire.

The brushes 3 and 4 set up no disturbance whatever in the field, and are sparkless so long as the load on each side of the system is fairly balanced.

Similarly a five-wire system can be formed by having three pairs of poles and five sets of brushes.

The coils sweeping across the gap between the similar poles, N, N, or S, S, are not generating E. M. F., the brushes 3 and 4 do not therefore cause any trouble by their short-circuiting these coils, and there is neither any polarity nor magnetic distortion of the field caused by the current entering or leaving the brushes 3 and 4.

Such a machine built to the designs of experienced and skilled electrical engineers meets the requirements of Mr. Langdon in his ideal railway plant. It also fills the want at collieries, mines, factories, mills, etc., for a machine capable of running incandescents, arcs and motors, simultaneously, with the highest efficiency and at the lowest possible cost and maintenance.

Prize Essay on Heaters.

The German Hygienic Association, says the *Gas World*, offers a prize of £225 for a research essay on the heat given out by heaters. The programme is: "The heat given out in heating installations by heaters in their various forms and modes of use is to be ascertained. The investigations are to be described in detail in respect to the arrangement of the heaters, the nature of the heating agents, and the observations made; and they are to be illustrated by drawings. The heating values obtained are to be stated in units of heat given off per hour per unit of surface. In the case of heat given out to air, the investigations must be conducted with currents of air at speeds as different as possible. The heaters are to be described in detail as regards form and measurement, and the relation of their heating efficiency to their weight is also to be ascertained." Essays to be written in German, with a motto and sealed envelope, and sent to Prof. Konrad Hartmann, Charlottenburg, Fasanenstrasse, 18, before July 1, 1896. The essay will remain the property of the successful competitor, but he must publish it within six months, and give the prize offerers 100 copies gratuitously. The prize may be divided or withheld.

Philadelphia's largest trolley party made a round of the suburban roads in fifty cars one evening last week. Nearly every car carried musicians, and several brass bands were in the outfit.

Monocyclic Patents in Doubt.

IS THE STEINMETZ SYSTEM A COPY OF A GERMAN DEVICE?

Notes on the So-Called Monocyclic System.*

BY HANS GOERGES.

The article in No. 23 of the *Electrotechnische Zeitschrift* prompts me to make a few remarks concerning the so-called monocyclic system, on account of the references that were made in that article to the installation at the Dresden railway station.

The author of that article sees the leading thought of Steinmetz's system in: "A multiphase system of distribution, in which the energy for the lighting service is taken from two main conductors, while for the motor service these two conductors and a third auxiliary conductor is used."

This system does not only "*resemble*" the Dresden system, but it is absolutely the same. This system of distribution was offered to the firm of Siemens & Halske by the constructor of the installation, Prof. Dr. Ulbricht, in the latter part of 1892. Siemens & Halske made at once experiments in their factory which demonstrated the practicability of this system and they concluded its application for the Dresden plant.

The Dresden plant, which was described in the *Electrotechnische Zeitschrift* in 1893, commenced operations in April, 1894, with two dynamos of 300 H. P. each. This it will be noted was about the time of the first applications of the Steinmetz patents. In the meantime the installation has been increased to four dynamos of 300 H. P. each, and is operating at present about 200 arc lamps, 800 incandescent lamps and 44 motors of 180 aggregate H. P. Only that part of the system which furnishes energy for the lighting circuit is regulated for pressure.

When this installation was first considered, a proposition was also made to use multiphase dynamos and multiphase transformers for the power service and alternating current machines and alternating transformers for the lighting service, and connect these in multiple. Experiments proved that such an arrangement is entirely feasible and practicable. In consideration of the large power service, however, and the large reserve power, all dynamos and transformers were built for the multiphase current.

The plan and system of distribution of the Dresden plant were described in 1893 in No. 28 of the *Electrotechnische Zeitschrift*, or in other words, nine months prior to the application of the first Steinmetz patents. In the article referred to, it is stated that the question was raised whether it would not be advantageous to use for the lighting the ordinary alternating current and add to it a second phase for the motor service. It will be observed that we have here the very idea expressed in a general form. We also find in this article a diagram of the system. The Dresden plant was furthermore familiar to a number of technical men who visited this plant on occasion of the annual meeting of the Association of German Electrical Engineers in June, 1894.

Therefore I wish to emphasize again that the idea was practically executed in a large plant in Germany, and had been described nine months prior to the date of the first American patent application of Mr. Steinmetz. The idea is therefore of German origin and its priority belongs to Prof. Ulbricht, in Dresden. I make this remark without any intention on my part to reflect on the originality of the work of Mr. Steinmetz.

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*Abstract from the "Electrotechnische Zeitschrift," June 27, 1895.

THE EFFICIENCY OF BOILERS.*

BY F. W. DEAN.

There is no common matter about which there are fewer accurate and scientific ideas than about boilers, their actual performance, the reasons therefor, the proper criterion by which to judge of their performance, and the economical merit of a boiler. There is also, in the minds of many who ought to know, no idea of the limitations of boiler evaporations nor of the magnitude or nature of boiler losses. Extraordinary, if not impossible, guarantees are made, and evidently only for the purpose of securing contracts and trusting to good fortune to escape a penalty. Such guarantees produce injury to other boilermakers, mislead the consumer, later causing him, when he finds out the impossibility of the guarantee, a great deal of annoyance, if not expense, and are in fact immoral.

It is not uncommon to use a particularly rich quality of coal on a boiler trial, and to use the result, which is wonderfully good, in advertising the boiler, and thus to deceive the public. Any coal-dealer, probably, will furnish a picked lot of coal for tests, and will send it sealed in a box car to the place of consumption. Nobody feels the advantage more than the writer of having a standard coal of uniform quality for boiler trials in this country, as they have hand-picked Nixon's navigation coal in England, but there could scarcely be anything more misleading than results sometimes published. A poor boiler tested with good coal may give a greater evaporation than a good boiler with poor coal.

Results may be vitiated for comparison by drying samples of coal, for moisture allowance, different lengths of time. Sometimes the sample is dried twenty-four hours, and thus is favorable to the boiler, while other samples may be dried six or eight hours. In order to do away with this difficulty I recommend that a well-selected sample, weighing six or eight pounds, be dried six hours in a clean pan placed in the boiler flue. This sample should be weighed with a scale which is accurate to quarter-ounces.

Considerations of this kind lead to the inquiry How can a boiler trial be reported so as to show the true value of the boiler as a generator of the possible heat in the fuel and as an absorber of the heat generated, independent of the quality of the fuel? The reply to this question is that its "efficiency" must be determined and reported. The definition of "efficiency" is as follows: "The efficiency of a boiler is the ratio between the total heat which any given coal can generate by complete combustion, and that part of it which is absorbed by the water and steam heated and generated."

The next question is: How can dealers be made to base their guarantees upon efficiency, and how can purchasers be made to understand the meaning of efficiency? The answer is: Through the efforts of this Society.

This naturally leads to a discussion of the report by a committee of and to this Society, recommending a standard method of making and reporting boiler trials, as printed in Volume VI of the "Transactions."†

That report is emphatic in expressing the desirability of a standard method, and particularly of the importance of expressing the value of the boiler. On page 259 the report says: "The scheme must also be so complete that, if carefully and exactly followed, the precise value of the boiler may be ascertained with certainty." Yet after this the word "efficiency" is scarcely mentioned, much less recommended, as a measure of value, thus wholly missing the point. Wherever used, it is in the most general sense. In one discussion it appears with its proper signification.

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* Abstract of "A Criticism of the Society's Standard Code of Reporting Boiler Trials," presented at the Detroit meeting of the American Society of Mechanical Engineers. From "The Engineering Record."

† "Report of a Committee on a Standard Method of Steam Boiler Trials." "Transactions," Volume VI, p. 256, No. 168.

The report recommends, on pages 262-263, that its standards of power and economy be respectively the "commercial horse-power" and "unit of evaporation," both of which are explained. It then says, page 263, that the relative economy of boilers is expressed by the number of units of evaporation obtained by a pound of combustible. Nothing could be farther from the truth. In fact this conveys only the roughest idea of the relative economy of boilers, and takes no account of the fact that combustible, as well as coal, varies in heat value per pound. In a recent case that came under the writer's notice a pound of combustible contained 14,177 units of heat, and another 15,398. The latter is 8.6 per cent. greater than the former, and therefore ought to evaporate at least 8.6 per cent. more water from and at 212 degrees. If the evaporations per pound of combustible in the two boilers using these coals had been equal, according to our Society's code they would have been equally good boilers. It is evident, however, that they would have been far from equally good. In one case the evaporation was 11.85 pounds on this basis, while with the better coal in the same boiler it would have been 11.85 × 1.086 = 12.87, thus changing it from a fairly good to a remarkably good boiler. The boiler using the better coal gave a better result than it is in general entitled to, and has apparently misled both its designer and builder, as well as the public, while if its merits had been judged by its efficiency it would have taken its proper place as a generator.

Next to be considered is, How can the efficiency be determined? This is determined by knowing the number of units of heat that a pound of coal and a pound of combustible will give out when burning under perfect conditions, and the number of heat units that the water evaporated has received. In doing this the heat that goes up chimney should not be deducted from the possible heat of the coal, as is sometimes done, for different boilers allow different amounts to escape. It should be the function of a boiler to reduce this heat as much as is consistent with the temperature of the steam.

There are two methods of obtaining the heat value of the coal, one by burning a representative sample in some kind of oxygen calorimeter, and the other is to analyze the coal and equate the elements with their heat values. The oxygen calorimeter is generally preferred, but as it is considered to be the better the nearer its result comes to that computed from the analysis, the writer prefers to use the analysis and thus avoid the imperfections of the calorimeter. As most engineers will wish to have their coal analyzed, it is best to use this for heat value and avoid the expense of a calorimeter determination. This is a point, however, that the Society must determine.

Our standard method recommends coal analysis, but is silent as to what use is to be made of it. Neither does it mention the oxygen calorimeter nor does it speak of computing the heat value of the coal from the analysis.

Having now called attention to the defects of the standard method of making trials and judging of the value of boilers, I wish to add that wherever there is an economizer a boiler trial should in general include a determination of the effect of the economizer. These devices are now very common, and in many cases have sufficient heat to work upon to convert a wasteful plant into an economical one.

DISCUSSION.

The discussion of Mr. F. W. Dean's paper on "The Efficiency of Boilers" was opened by Mr. George H. Barrus, who expressed himself as being in sympathy with Dr. Dean's recommendations, and he thought the committee should make special study to recommend a standard form of calorimeter tests of coal. He strongly believed in a calorimeter rather than a chemical analysis of coal for the reason that the work would have to be intrusted to a chemist, while the engineer should be responsible for the test from first to last, and he cannot, as a rule, satisfy himself regarding the chemical determinations so as to be able to vouch for them himself. On the other hand he thought the calorimeter test quite as simple as the boiler test itself.

Prof. J. E. Denton sent in a written discussion, which was read by Secretary Hutton, in which a method was described for comparing the heat values of different coals as obtained by an oxygen calorimeter with the heat obtained by burning the coal under a boiler. Prof. Denton believed that the method employed by Mr. Dean, to determine the efficiency based upon combustion, would be correct only when the percentage of ash by the analysis was the same as the percentage of ash under the boiler, which in general was not the case. He thought it well to consider the evaporation per pound of coal, as the efficiency of the grate then entered into the result.

Prof. Jacobus began the oral discussion by taking exception to Mr. Dean's proposition to base the efficiency of a boiler on the pound of combustible, and he thought that if the boiler performance was based upon efficiency a specific method should be proposed in regard to what should be done to determine the latent heat of the moisture in the products of combustion due to the hydrogen in the coal. He thought it better to determine the heating value of coal from a calorimeter than by chemical analysis, because of the uncertainty of the composition of the volatile matter, and did not believe in changing the commercial horse power from 34½ to 35 pounds on the ground that there were many tests that were figured upon that basis and constantly referred to.

Mr. William H. Bryan, of St. Louis, objected to drying a sample of coal under a high temperature for so long a period as six hours, as he thought it would drive off some of the characteristic moisture in the coal. He thought it best to have chemists make a coal analysis, but instead of changing 34½ pounds to 35, thought it ought to be lowered so as to correspond with the lower steam consumptions of the present day.

Prof. R. C. Carpenter thought a chemical analysis of little use for bituminous coals, as you do not know the composition of the volatile matter, and it is impossible for this reason to obtain a reliable result. He believed in changing the standard as regards efficiency of boilers, but not as to commercial horse power.

Mr. George I. Rockwood thought that the Society was getting away from what was wanted, inasmuch as he thought it more to the purpose of boiler manufacturers than users to have boilers tested in this refined manner. He thought the evaporation per pound of coal, which was the vital point to the user, of more importance than a refined efficiency test.

Mr. R. W. Hunt was inclined to side with Mr. Rockwood and thought the term combustible decidedly elastic, inasmuch as a considerable amount of unconsumed coal might go through the grate and thus raise the efficiency of the boiler. He thought that the committee should look into the question of starting and stopping tests, and he expressed his preference for the running start instead of hauling the fires. He believed the results of a test should be worded with a view of making steam with the least money instead of the highest efficiency.

Mr. J. C. Platt thought the duration of a test should be considered.

Col. E. D. Meier then read a communication from Prof. Potter of St. Louis, who objected to drying a sample of coal in a temperature higher than 220 degrees on the ground that the coal would lose all of its accidental and part of its characteristic moisture, and if the coal was finely divided he thought that it would also lose quite a little of its volatile matter. He thought that some coal of good quality should be adopted as a standard for each section of the country. Col. Meier said he also objected to the use of the term "combustible," and that engineers in charge of street railway and lighting stations thought it of no value. He said that he had known of parties deliberately poking coal through the grates when the result of the tests were to be based on pounds of combustible.

Mr. D. L. Barnes referred to some recent experiments of a railroad company which had shown that there was no certain relation between the results obtained by burning coal in boilers and by chemical and calorimeter tests.

Mr. G. C. Henning thought that the question of testing boilers with liquid and gaseous fuels should also be considered.

After some remarks by Mr. William Kent on the work of the earlier committee, it was voted, on motion by Mr. Henning, that the council appoint a committee of nine members to reconsider the report of the standard methods proposed in 1885 for conducting boiler trials and to report their results to the Society.

ELECTRIC TRACTION BY ACCUMULATORS.*

BY J. SARCIA.

I confine myself, in my communication on electric traction by accumulators, to the description to you of the industrial application which has been made by the Tramway of Paris and the Department of the Seine on the lines of Saint Denis to Paris and of Saint Denis to Neuilly.

Electric traction has been substituted in a complete manner for the old animal traction since June 1, 1892.

The three lines have their termini in the vicinity of the depot of Saint Denis. They bear the names of: 1, Saint Denis—Madeline; 2, Saint Denis—Opera; 3, Saint Denis—Neuilly.

The first two are of a length of about 6 miles each, of which half is in the interior of Paris. The third is nearly 3.6 miles long; it is entirely situated without the enclosure of Paris.

The number of car-miles actually travelled in service by the electric cars exceeds 1,200,000.

Since the month of June, 1893, the average monthly travel by the electric cars is 48,000 car-miles for the three lines. It is not therefore a mere experiment, but an actual industrial application. . . . . .

The two principal lines include grades up to 3.8 per cent. In certain places the radius of curvature is less than 20 meters.

Each axle is actuated by a motor by means of two trains of double helical gearing. The ratio of angular velocities of motor and axle is 12 to 1.

The accumulators are of the Laurent Cely system, made by the "Societe Anonyme pour le Travail Electrique des Meteaux."

The battery is placed under the seats of the car. It is composed of 108 elements of 11 plates, contained in jars of hard rubber.

The dimensions of the plates are as follows: Height, 7.9 inches; width, 7.9 inches; thickness, negative plates, 0.24 inches; thickness, positive plates, 0.315 inches.

The weight of plates in one element is about 39.6 lbs.

These 108 elements are distributed in twelve wooden boxes, six for each side of the car. The nine elements of one box are grouped in tension, and the poles of the little batteries thus formed end each in a strip of copper fastened to the side boards of the box. . . . . .

The battery room has twenty-four spaces for batteries. Each of them is connected to a switchboard by a special circuit containing an ammeter and an indicator of the direction of the current, and on each pole a circuit-breaker and an interrupter.

The handling of the batteries between the charging tables and the cars is done by means of trucks rolling on "Decanville" tracks, which run parallel to the tables and car tracks. . . .

The dynamo generator gives at a speed of 600 revolutions a current of 230 amperes, with an E. M. F. of 260 volts. They are grouped in quantity after the manner of the batteries in charging.

Since the beginning of the year 1895 the charging dynamos have been supplemented by two dynamos connected in series with the first and acting in the capacity of volt-raiser. The charging is done at two potentials—at the beginning at the potential of 250 volts, and after two hours of charging at about 280 volts.

The charging of the batteries is prolonged until they have absorbed a number of ampere hours equal to those delivered in service, with an increase corresponding to the current efficiency of accumulators, which is 85 per cent. The number of ampere-hours discharge for each route is determined experimentally by means of a recording ammeter. The duration of charge is five hours for a battery which has furnished all its capacity, which is 230 ampere hours, that is, 52 horse-power hours. The energy efficiency of batteries reaches 70 per cent.

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*From "The Bulletin de la Societe Internationale des Electriciens" for April.

Two engines are arranged for a charge lasting twenty-three hours per day, the third engine is only in use six hours. The batteries furnish in service an E. M. F. above 200 volts; the discharge, which attains 100 amperes, is more than 2 amperes per pound of plate.

It reaches 120 amperes on the steep grade, or in case of towing a second car under unfavorable circumstances. The average discharge for the entire line is about 35 amperes.

One battery will furnish without recharge a trip of about 36 miles on the common Borca rails, or 70 miles on the Vignole rails.

The daily service of the Madeline line includes 104 trips, that is, 52 round trips. Seven self-contained cars travel on the line, some 8 and the others 9 trips, or 88.8 miles and 97.5 miles, whereas the horse cars traveled at the most not over 60 miles.

The conditions of operation are the same on the Opera line, except on the part of that line situated outside of Paris, where the motor cars tow an ordinary car with 50 sittings, so that the number of passengers to a train is 100.

Three cars are in service on the Neuilly line. The service of each car is assured by two batteries, making without recharge two trips out and back on the Opera and Madeline lines. In the last case the battery furnishes a run of about 30 miles. The duration of a trip, including stopping and standing at terminal stations, is 55 minutes. The weight of a car complete is 15.4 tons, of which 6.6 is battery and accessories and 3.75 passengers. The mean tractive effort is 26.4 lbs. per ton on the Borca rails and 13.2 lbs. on the Vignole rails.

I now come to the more important part of my communication in showing you the actual cost per car-mile of electric traction by accumulators on the lines (in actual service) from Saint Denis and Paris, and the diminution of which it is susceptible.

The actual cost is separated in the following manner:

1. Maintenance and handling of accumulators.	3.2	cents.
2. Power	3.6	"
3. Maintenance of trucks and motors	1.0	"
4. Labor	1.6	"
Total	9.4	"

The round price of 3.2 cents for maintenance and handling of accumulators may be separated into 2 cents for maintenance properly speaking and 1.2 cents for handling. This last figure is susceptible of a notable diminution.

The replacing of a discharged battery by a fresh battery requires the handling of 24 trucks, and it is sometimes necessary to roll the latter to the other end of the charging room, which represents an important expenditure of labor. For the smallest part of the installation it was possible to place the charging tables along the car tracks, and that new arrangement in suppressing the rolling of trucks permits a saving of not less than 0.6 cent per car-mile if it were applied to the whole system. Unfortunately, the depot at Saint Denis, formerly used for horse car traction, was an old stable not fit for a charging room, and it is not possible to completely modify the installation of the latter. Moreover, we have considered for a long time the substitution, for the 12 boxes of the battery under the seats of the car, of a single box suspended from the frame between the two axles of the truck. We have realized that arrangement in our new car, and it so notably reduces the labor of handling that we will hereafter adopt it in all future applications. The place of the single case of accumulators, between the two axles under the frame, is moreover the natural place. It obviates all danger of spilling of acid in the car in consequence of a too sudden stop or violent shock.

The maintenance, properly speaking, costs 3.3 cents per car-mile. It includes the renewal of the plates and of the accessories of the batteries. Naturally the renewal of the plates constitutes the principal item in the expense, and after the first month of service we fear that the power diminishes sensibly. In fact, our first plates, both negative and positive, were pastille plates, in which the active material was obtained by the reduction of chloride of lead to spongy lead. This spongy lead on the positive plates was then peroxidized by formation of the Planté type.

The life of the negative plates exceeds 90,000 car-miles, and their wear, accruing from chemical reactions produced both in the charge and discharge, is practically nil. It only enters in the maintenance item in the order of thousandths.

It is not the same with the positive plates. After the formation, their active material is composed of peroxide of lead as crystalline as the original spongy lead, and, in consequence, of great mechanical solidity; but by the normal succession of charges and discharges the crystalline peroxide of lead becomes powdery and in consequence falls to the bottom of the jar.

This fall of peroxide is fatal, and every manufacturer of accumulators who tells you of positive plates with an indefinite life deceives himself or deceives you. The average life of the first plates of tramway batteries was about 8,400 car-miles. After this travel all their peroxide of lead was fallen and their perforated support unfit for service. This latter trouble is a great deal more serious, because the peroxide of lead may be easily repasted on the support. For utilizing the latter property, we have adopted for them the primitive form which Faure gave them. It is composed essentially of a solid core on which are cast inclined shelves. These last constitute actual little reservoirs which do not hinder the fall of peroxide of lead when it has all become powdery, but which retards it. The lead of the support contains about 10 per cent. of antimony for increasing on the one hand its rigidity, on the other hand for limiting the surface oxidizability.

With the new plate the peroxide of lead separates from the support at the end of the 8,400 miles, but the latter is intact. In order to convince you, I have brought from Saint Denis some supports of plates taken at random from which all the peroxide is fallen and which is ready to submit to the operation of repasting. They are practically in the same state as when first put in service.

From experiments made here with extreme rates of discharge we are prepared to say that after ten repastings the supports of plates are not yet worn out.

We can therefore affirm that the new positive plates with shelves last at a minimum 60,000 car-miles, with the simple expense of labor for their repasting every 8,400 car-miles.

The conductivity of the positive plate with shelves is greater than the old plates with pastilles. That new quality permits us to increase the delivery per square centimeter of plate of the battery in the new car, of which I have already spoken to you regarding the handling, composed of no more than 56 elements of nine plates 200/200, of which the total weight is 3,740 lbs. The weight of old battery was 6,600 lbs.

This diminution of total weight of the battery contributes again to diminish the cost of maintenance.

In the new applications the latter falls to $3\frac{1}{3}$ cents per car-mile, handling included, which represents an economy of 40 per cent. on the actual cost of the maintenance and handling.

In our first experiment with the new car we have consumed but 70 per cent. of the energy required by the old. The factor 6 cents, which represents the consumption of actual motive power, falls therefore to 4.3 cents in the new car.

British Steam Railway Men and Electric Traction.

The International Railway Congress which has recently been meeting in London, gave comparatively little attention to electric traction. There was one good discussion on the matter of the substitution of electrical for steam locomotives on railways, and it was evident from the remarks of speakers that they realized the need for an economical and efficient locomotive. The upshot of this discussion was the adoption of a resolution to the effect "that it appeared from the result of certain trials that the establishment of a service of self-propelling carriages with transmission by means of electric conductors, somewhat similar to the system used in electric tramways, did not offer great technical difficulties." The trials are to be continued. There was one feature of the congress which augurs well for electric traction and may be regarded as a sign of the times, denoting as it does the feeling of European and other railway men in regard to the importance of electricity in its use for traction purposes, i. e., it was thought advisable that a special section of the congress should at the next meeting be alloted to the question of electric traction. If this is done, and railway men consider the matter seriously themselves as a body, we may expect some great advances within a short period.

INDIRECT ELECTROLYSIS.*

BY E. ANDREOLI.

When the central compartment of a box, A, divided into three compartments by two porous walls B B′ (Fig. 1), is filled with any solution whatever, as long as the side compartments C C′ contain, the first an anode E and the second a cathode F, in either similar or different electrolytes, the decomposition of these electrolytes in C C′ takes place as though the center compartment were entirely absent, and the solution which is in the middle compartment remains unchanged while the electrolysis takes place on both sides; it undergoes no reaction, is on the contrary inert, and is entirely unaffected by the decomposition of the anode or of the cathode solutions in the lateral compartments. But if one or more metallic plates are plunged in the solution of the middle compartment D (Fig. 2) it immediately produces reactions which can only be attributed to an indirect or secondary electrolysis.

Notwithstanding the researches that I have made, it does not appear that this phenomenon has ever been mentioned before in any work relating to electro-chemistry. I believe that I am the first, not only to announce but also to utilize this new method of electro-chemical decomposition, to which I have given the name of *indirect or secondary electrolysis.*

I shall give some explanations of what takes place between the two walls which separate several liquids.

Suppose the right and left compartments C C′ contain salt water, and that the middle one is filled with either a weak or strong solution of cyanide of gold. On the positive side C′ the electrode is a carbon spiral (charbon de cornue), and the cathode opposite is of iron.

When the current enters the box A the electrolytic decomposition takes place with the formation of chlorine at the positive pole E, and of caustic soda at the negative pole F, the solution of cyanide of gold remaining unaffected by the passage of the ions.

But if I plunge a metallic plate in the centre compartment, or what is better, several metallic plates, G G G G G, it will produce a deposition of gold on these plates, which, however, bear no relation either to the positive or negative pole of the generator or to the anode or the cathode of the neighboring compartments.

The solution of cyanide of gold in the middle, D, will not be contaminated with either chlorine from the compartment C′ or sodium from the compartment C. The middle solution, according to the density of the current and the number of plates, will be sooner or later completely exhausted.

The section (tranche) of liquid alongside of the negative compartment becomes positive, and the proof of this is that the side of a lead plate which faces this diaphragm is completely peroxydized (?) while the other side is completely covered with a sheet of gold. Metal plates placed either horizontal or vertical in the liquid section situated near the positive compartment which becomes negative, will be covered with a deposit of gold.

It follows from this that reactions of a special character may be produced, which will be evident; but I shall not consider here how these may be avoided or obtained. The only fact to which I desire to call your attention is the deposition of a metal upon metallic sheets by electro-immersion in the solution which contains it.

I have replaced the salt water of the positive and negative compartments C C′ by a solution of gold exactly similar to that which was in the middle; the anode was of lead and the cathode of iron. At the end of several days I have taken 100cc. of the solution from the side compartments, evaporated, scorified and cupelled the residues, and have established that the quantity of gold obtained was absolutely the same as that found in 100cc. of the gold solution before treatment. On the negative plate there was no trace of gold, nor was it affected by the deposition of gold from the positive to the negative pole, as occurs ordinarily in galvanoplastic operations, while during the same time I have been able to exhaust nearly 100 litres of the gold solution in the central compartment?

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* Translated from "Le Genie Civil."

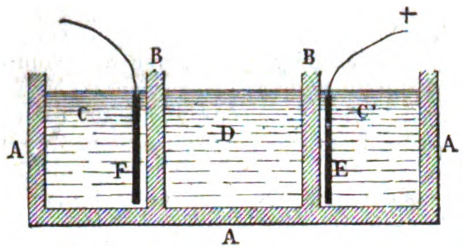


Fig. 1.

Another adaptation of this indirect electrolysis has enabled me to transform bisulphide of sodium into hydrosulphite. We know that the ordinary electrolysis of the compounds of sulphur, and consequently of the sulphides or bisulphides, is impracticable. Indirect electrolysis effects in the most simple, easy and rapid manner the change of a solution of bisulphite into hydrosulphite without the need of having it concentrated to 35 or 40 degrees Baumé.

Here again the nature of the liquids in the lateral compartments is of little importance. The best conductors should be chosen which do not require special electrodes. The decomposition of the solution of bisulphide of sodium alone is interesting. From a special reservoir I have led the solution into the central compartment D, and, as in the deposition of gold, no effect was produced when only one metallic plate was plunged in the electrolyte (I generally used perforated plates); but as soon as I had immersed two, one on the positive side and the other on the negative, the reaction took place with a marked evolution of gas; the liquid soon acquired bleaching (discoloring) properties which it did not have before, and if it was poured from the central compartment into a reservoir containing wool it rapidly whitened it. When it is partially or totally exhausted it may be revived in the compartment where the indirect electrolysis takes place, and this for a number of times before it will be necessary to reinforce the liquid by adding bisulphite to it.

The old books teach us that in an electrolyte the operation takes place between the two poles like an unbroken chain of molecules, and that each metallic plate interposed between the anode and the cathode becomes positive on the side which faces the negative pole, and vice versa. But it is evident that in the measure that a plate is farther from a pole so the resistance increases, until finally there will be no result.

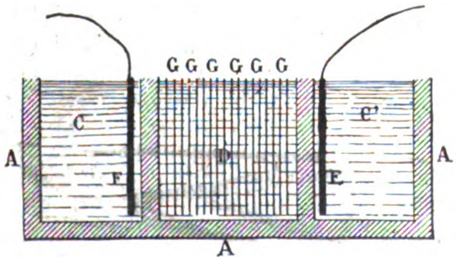


Fig. 2.

Finally, in this transmission of current between two poles separated by the plates there is but *one liquid*; and I mention this so that no one will mistake an old experiment in electrolysis for the indirect electrolysis which I have summarized here, and which shows the curious phenomenon, in contradiction to the scholars, of transferring the ions from one extreme compartment to the other, and vice versa, across an inert electrolyte which they do not affect; that is to say, they make it neither acid nor alkaline. It is sufficient in preparing and utilizing this electrolyte, whatever it may be, to place the plates or the metallic conductors—perforated or not—or the grids (grillages) so that a very long section of the electrolyte will be influenced by the change of polarity, to act, so to speak, like a negative liquid electrode alongside of the positive compartment, and reduce gold, silver, etc., which it deposits on the plates that are not connected to the anode, the cathode, or to the generator of electricity.

As I said above, there are several precautions to be taken in order to secure good results. I will indicate them in the future. I say nothing good or ill of this indirect electrolysis now, which has its defects as well as its advantages. I have used it for some time, and it has led me to adopt some modifications in electrolytic work which have commended themselves to me. My aim has been simply to indicate a method of electrolysis which I believe is new, and which differs considerably from the ordinary, since instead of two compartments my box contains three, and that between these two electrolytes, one supplied with an anode and the other with a cathode, there is another which operates independently in a compartment without anode or cathode connection to the electrical generator, and in which the decomposition of any liquid whatever may be effected.

If we only consider the question of electro-deposition, secondary electrolysis does not at all resemble the ordinary process, for the liquid in which my anode is plunged is neither a gold nor a silver bath. It is not on the electrode of the cathode compartment that the deposit is effected; it is, on the contrary, on the pieces of metal which are in the central compartment where the gold or silver solution is found, which can be as weak as desired without impeding the operation that I can carry on until the electrolyte is exhausted. This method is applicable to other operations than the deposition of metals and the formation of hydrosulphite for the bleaching of wool, etc.

I hope this explains with sufficient clearness the function of indirect electrolysis, which I have freed from all explanations relative to certain reactions which are inevitable, and I shall be pleased to hear the criticisms of the electro-chemists who may take an interest in this new method of electrolytic decomposition.

LONDON NOTES.

(From our Special London Correspondent.)

THE BOARD OF TRADE AND ELECTRIC LIGHTING REGULATIONS.

Copies of proposed new rules have lately been sent around to town councils and local governing bodies which already have their own electric lighting stations, for them and their engineers to send in suggestions of any further alterations or additions they consider advisable. The proposals of practical electrical engineers, actually engaged in electric lighting work should constitute a useful supplement to the tendered suggestions of the Board of Trade officials.

The Islington Vestry considers one clause in particular highly objectionable. It is to the effect that all conduits and receptacles should be so constructed as to prevent an influx of gas from adjacent soil. The Vestry thinks this will give too much freedom to the gas companies, instead of making them prevent escapes from the mains.

The Dundee authorities consider the leakage current allowed (one-thousandth of the maximum supply current) too small.

THE ROWLAND-FORBES CONTROVERSY

In the *Electrical Engineer* of July 3 last there appeared a letter from Prof. Henry A. Rowland in answer to some remarks made by Prof. George Forbes in an interview published in London *Lightning* on the connection of the two gentlemen with the work on the Niagara Falls plant. The following reply from Prof. Forbes appears in *Lightning* for July 11:

PROF. FORBES'S REPLY.

The above letter requires refutation on two points—(1) that Prof. Rowland had anything to do with the plans adopted for Niagara, (2) that the extract from one of my confidential reports is the specification which I sent out to manufacturers to bid upon.

I.—PROF. ROWLAND'S CLAIMS.

1. The officials of the Niagara Company have informed me and others that he was employed only to get him to withdraw his opposition to alternating currents. To do this they gave him one (and only one) of my reports to them which dealt with this point, and they got me and others to instruct him. At our first meeting he stated *ex cathedrá* that the Tesla motor was of no use; but cross-examination proved that he did not understand the principle of its action. Seven months of instruction reversed this decision.

2. So useless was his report to the company that it was not shown to me until I had completed all my plans and decided on the dynamo design.

3. His report did nothing except to recommend the dynamo proposed by a certain firm, to whom, at the same time, he was trying to sell some patents for transformers. This dynamo was totally unsuitable.

4. His pitiable lawsuit showed, by the evidence of the company's officials, that he had nothing to do with the plans for our work, and that the directors relied entirely upon the advice and inventive capacity of their electrical consulting engineer.

II.—MY SPECIFICATION FOR A DYNAMO.

1. *The quotation in Prof. Rowland's letter is not the specification I sent to manufacturers.* This accounts for much of his misunderstanding. That specification filled twelve pages of printed foolscap, was accompanied by twelve sheets of drawings, and was never shown to Prof. Rowland. My paper in 1893 to the I. E. E. contains an abstract.

2. The report of thirty-six pages which he read says at the end that it is *not* a final report; but it is a very good general account of the plans we have adopted. It is absurd to say I opposed what we have done. As the consulting engineer, I originated it and carried it all through.

3. What he quotes as my specification was a suggestion I made when a separate fly-wheel was thought necessary, as this was the only type (like the Siemens or Ferranti) which could possibly bring the weight down to what we were absolutely limited to, and if it could be made strong enough it was the best type electrically. That suggestion of a specification was guarded by the prefatory words, "*if* a thoroughly good machine, electrically and mechanically, can be designed on these principles, it ought to comply with the following specification." From designs I worked at it seemed possible, but I was not over sanguine, and I had not then hit upon the novel design of alternator with external revolving field, which did away with the necessity for a fly-wheel, which completely solved the problem, of which I sent out specifications which I caused to be constructed, which was described and illustrated in my paper to the I. E. E. about which Mr. Kapp in the discussion said it was the best possible design for the purpose, and for which the Company formally thanked me in writing as having saved them from a most awkward dilemma. I could not, however, with this design use so low a frequency as I desired.

I could say a great deal more, but do not wish to take up more of your valuable space. I wish it to be known, however, that Prof. Rowland's misconceptions are largely due to the fact that we did not think it necessary or advisable to inform him of what we were doing.

George Forbes.

34 Great George st., Westminster, July 9, 1895.

NORTHWESTERN ELECTRICAL ASSOCIATION.

The meeting of the Northwestern Electrical Association at the Leland House, Chicago, on the 17th, 18th and 19th was not largely attended. Papers were read by Messrs. J. S. Stephens, A. V. Abbott, W. D. Jameson, George Cutter, J. C. McMynn and Prof. D. C. Jackson.

The following officers were elected: President, George Grimm, Jefferson, Wis.; Vice-Presidents, Pliny Norcross, Janesville, Wis.; P. H. Korst, Racine, Wis; Secretary, William Goltz, Milwaukee; Treasurer, John Schuette, Manitowoc; Trustees, F. A. Copeland, La Crosse; O. M. Rau, Milwaukee; E. M. Highlands, Clinton, Iowa.

The next meeting will be in Milwaukee in January.

Prof. Forbes's Serious Charge.

In the "reply" of Prof. Forbes to Prof. Rowland, printed on another page, the former says: "The officials of the Niagara Company have informed me and others that he (Rowland) was employed only to get him to withdraw his opposition to alternating currents." This is a serious charge, the truth or untruth of which is a far more important matter to the community than any other question at issue in this whole matter. We expect Prof. Rowland to take such action as men of repute do when grossly libelled. It is, even if untrue, a public confession that the Niagara Company does not hesitate to resort to bribery in the conduct of its business.

New Electric Road at Niagara.

The Niagara Falls and Lewiston Electric Railroad was opened for passenger traffic last week. The road is located in the Gorge, and is only twenty feet above the level of the river. The cliffs which overhang the road vary in height, being in some places nearly 300 feet high. The line is double-tracked, and carries passengers so close to the Whirlpool rapids that the spray is dashed upon the cars.

Personal.

Mr. J. Z. Miller, Jr., who is interested in the establishment of an independent telephone exchange at Belton, Tex., was a New York visitor this week.

Mr. Henry Sachs, late manager of the Beacon Vacuum Pump and Electrical Co., is now established with offices in the Equitable Building, Boston, where he will conduct a general brokerage business, electrical stocks being a specialty.

Mr. James W. Godfrey sails for Europe to-day, July 24, to meet his family, who have been abroad for some months.

JAMES W. GODFREY.

On Monday evening a score of friends joined Mr. Godfrey at dinner at Moquin's in Ann street, where he received a good deal of instruction as to his trip abroad. ELECTRICITY hopes to print a brief account, from time to time, of Mr. Godfrey's travels, which can not fail to be interesting.

THE SIEMENS & HALSKE ELECTRIC COMPANY OF AMERICA.

New Officers Chosen.

At the election of the Siemens & Halske Electric Company of America on the 15th inst. the following gentlemen were chosen:

President—A. W. Wright.
Vice-president—Charles E. Yerkes.
Secretary—F. B. Badt.
Treasurer—O. W. Meysenburg.

Directors—Arnold von Siemens and Georg Wilhelm von Siemens, of Berlin; O. W. Meysenburg, A. W. Wright, Charles E. Yerkes, W. F. Furbeck, David B. Lyman and F. B. Badt, of Chicago; Martin Maloney, of Philadelphia.

Of the new officers Prof. Badt needs no introduction to our readers. Since his retirement from the G. E. Company, a year or so ago, he has been manager of the sales department of the Siemens & Halske Company. Mr. Yerkes is a son of Charles T. Yerkes. Mr. Furbeck represents the Yerkes interest, and Mr. Lyman is the trustee of the Grant Locomotive Works. Sir William Van Horne who retired from the Board, retains all his interest in the company but was unable to give further time to the business. Mr. Meysenburg positively refused to serve again as president, as he desires to give a portion of his time to other enterprises, chiefly the Wells & French Company.

The statements made in the daily papers that the Yerkes interest in the Siemens & Halske Company is the dominating one is absolutely incorrect. There is no struggle for control, but while Mr. Yerkes is the largest individual stockholder, the Wright-Meysenburg and Berlin interest is still easily larger than all others.

It is finally determined that an important feature of the business shall be the manufacture of steam locomotives.

Annual Meeting of the Westinghouse Co.

The annual meeting of the Westinghouse Electric and Manufacturing Co. was held at East Pittsburg on July 17. A large delegation of stockholders and visitors was present to inspect the new works and the surface-contact railway system which has been described in ELECTRICITY.

The old Board was re-elected, as were the former officers. The results of the year's business were printed two weeks ago.

No New Trial for Henri Bier.

Judge Moise, at New Orleans, has refused to grant a new trial to Henri Bier, recently convicted of perjury and sentenced to the penitentiary.

LEGAL NOTES.

The W. S. Hill Electric Co. of Boston has assigned for $20,000 to Attorney F. A. Wyman. Mr. Wyman says he can make no statement at present of the liabilities and assets of the company. Mr. Wyman believes that the company, which he says is doing a good business, will continue.

The Eastern Electric Cable Company of Boston has begun a suit in chancery to force the trustees for the creditors of the defunct Detroit Electrical Works to sell the assets of that concern and divide them among the creditors.

An attachment has been filed in the Essex (Mass.) Registry against the General Electric Company of Boston by Lewis M. Packer of Lynn in the sum of $50,000 in an action of tort.

Duncan Edwards has been appointed receiver for Neftel, O'Connor & Co., electrical contracting engineers, whose office was formerly at 126 Liberty street, New York, on the application of John A. Roebling's Sons Company. Bernard F. O'Connor, the treasurer of the company, obtained an attachment against it some time ago for $11,000.

General News.

What is Going on in the Electrical World.

Lowell, Mich.—The village authorities are advertising for bids for an electric light plant.

Delhi, N. Y.—The survey for an electric road from Delhi to Bloomsville has been made by Engineer Peters.

Columbus City, Ala.—A Boston company is putting in a plant to manufacture electric apparatus in this town.

Humboldt, Tenn.—The citizens of Humboldt by a large majority have voted bonds for waterworks and electric light.

St. Johns, Mich.—This city has voted to bond itself for $35,000 to purchase a local electric light plant (R. M. Steele's).

McComb, O.—W. A. Shelt, of Napoleon, has made the village of McComb a proposition to put in an electric light plant.

Mt. Sterling, O.—The people of this place at the special election voted in favor of bonding the town for electric lights and waterworks.

Brooklyn, N. Y.—The State Electric Light and Power Company has been granted an extension until November next to begin work.

Fort Fairfield, Me.—Steps are being taken toward establishing an electric light system in Fort Fairfield, the plant to be at Stevens's mills.

Norfolk, Va.—The electric railway line from Norfolk to Ocean View, the favorite seaside resort of the F. F. Vs., has been opened to traffic.

Mankato, Minn.—The proposition to issue $10,000 bonds for an electric light plant was carried by a large majority at the recent special election.

Brunswick, Ga.—Negotiations are in progress here for the franchise of the old horse-car line, with the view of changing the line to an electric road.

Escanaba, Mich.—The city is negotiating for the purchase of the electric lighting plant now owned by a private corporation. Mayor Gallup strongly urges the purchase.

Scranton, Pa.—Representatives of a New York syndicate have been here lately making examinations as to the advisability of locating a large electrical plant in the city.

Westport, Conn.—The Westport and Saugatuck Horse Railroad has gained legislative authority to increase its capital stock to $100,000, to extend its line and to equip it with electricity.

Utica, N. Y.—Application has been made by the Utica and Herkimer Street Railway Company for consent to build and operate a surface railway in Utica to be operated by electric power.

Zanesville, O.—Ex-Auditor Patterson, A. W. Evans and L. W. Doane, of this city, have presented a petition to the county commissioners for a right of way to construct an electric railway to Hebron.

Westfield, Mass.—The directors of the local street railway have intimated that the equipment of the road with electricity by the middle of September or the 1st of October is very probable.

Woodbine, Pa.—The electrical appliances for the clothing factory here have been completed. All the sewing machines are now run by this power and even the sadirons are heated by electricity.

Pittsburg, Pa.—The Pittsburg and Finleyville Traction Company is the name of a company projected to build an electric railway bringing Finleyville into closer connection with this city.

Allentown, Pa.—It is stated that President Al. Johnson of the Traction Electric Railway Company of this city and Bethlehem has bought all the stock of the minority stockholders in that corporation.

Panama, Col.—Several Americans have submitted to the Government proposals for the construction of the electric light plant, and the Government seems disposed to accept them.—Carthagena advices state that a boiler in the electric light plant in that city exploded on the 2d inst., wrecking the building and machinery.

Staunton, Va.—Some Eastern men interested in constructing a trolley railroad from Basic City to Bridgewater have recently been over the route and arranged for right of way; they met with much encouragement.

Bloomington, Ill.—The principal stockholders of the two local electric light companies have held consultations lately in regard to uniting the companies, and it looks as if the union would take place.

Greenfield, Mass.—The Greenfield, Turner's Falls and Montague Electric Street Railway Company has just filed its third petition with the selectmen, praying for a franchise to enter the town of Greenfield.

Sparrows Point, Md.—The Maryland Steel Company, at Sparrows Point, have found the use of electrical power in their shops preferable to steam, and have decided to make a number of changes along this line.

Guthrie, Ok.—The citizens are clamoring for better light than that furnished by the present electric light plant, and demand that the plant be enlarged or entirely replaced by improved machinery and equipment.

Fairfield, Ky.—About $20,000 has been subscribed towards the stock for building the proposed electric road from Louisville to Fairfield. B. H. Bridwell of Fairfield and James McKinney of Louisville are interested.

Kansas City, Mo.—It is reported that the old East Fifth street railway, which has not been in use for several years, is to be rehabilitated, but it has not been decided whether electricity or steam will be used in its operation.

Athens, Ga.—The city council has decided to call upon the people to vote bonds to the amount of $25,000 for the purpose of putting in an electric light plant. The contract with the lighting company is about to expire.

Mt. Vernon, N. Y.—The North Mount Vernon Surface Railroad Company has voted to increase its capital stock from $20,000 to $250,000, for the purpose of extending its trolley line to Tuckahoe, Bronxville and White Plains.

Paragould, Ark.—R. M. Harrison of the Harrison Electric Company of Chicago, with J. D. Block and others of Paragould, are promoting an electric line from Siloam Springs, Ark., through Paragould to Gayoso, Mo., on the Mississippi River.

Ocala, Fla.—Meetings have been held here to discuss the project of an electric road from Ocala to Silver Springs. There was a general expression of opinion in favor of the scheme. Mayor Reardon, of Ocala said there was great need of the line.

Shawano, Wis.—Sealed proposals will be received at office of city clerk, until August 1, for furnishing electric lights and waterworks for Shawano, the bids to be separate and in accordance with specifications on file in the office of the clerk of the city.

Derry, N. H.—At a meeting of the directors of the Chester and Derry Electric Railroad Company, Charles Bartlett of Derry and A. B. Wilcomb of Chester were appointed a committee to have a survey of the proposed road made. The estimated cost of the road is $50,000.

Charleston, S. C.—It seems probable that the deal by which a Northern syndicate was to get control of the street railroads here and change the motive power to electricity has fallen through owing to failure to make money arrangements. The syndicate had put up $5,000 as a forfeit.

Black River Falls, Wis.—The La Crosse and Neillsville Electric Railway Company has secured a thirty-day option on the Spaulding water power in this city, with a view of purchasing the same. The power is one of the finest in the State and has been valued as high as $100,000.

Shelbyville, Ind.—The Batesville and Oldenburg Electric Railway Company has perfected its organization by electing the following officers: President, B. S. Sutton; vice-president, A. A. Wackman; secretary, John A. Tindall; treasurer, Jonas Joseph. The capital stock is $100,000.

Kingston, N. Y.—An examination of the proposed route for an electric railway between Newburg and Kingston has been made by parties interested. Farmers have given assurances of a free right of way. It is understood that the West Shore Railroad people would like to see the road built.

Gardiner, N. Y.—There is some talk of building an electric railway from the condensery at Wallkill to Ireland Corners, chiefly for the accommodation and benefit of the milkmen in this vicinity. The road, according to the story afloat, will be constructed and controlled by the New York Condensed Milk Company.

Dayton, Ky.—The board of councilmen of this city will receive sealed proposals until August 5 for lighting the city with 38 or more electric arc lights for a term of five years from October 29, under the conditions set forth in the present electric light ordinance and contract on file in the office of C. H. Hayward, city clerk.

Pittsburg, Pa.—Bernardo Paladini, formerly Consular Agent of the Italian Government for the western district of Pennsylvania, who also held an important position with the Westinghouse Electric and Manufacturing Company, has resigned and is now on his way to Caracas, the capital of Venezuela, to establish trolley railways and electric lighting in that country.

Long Branch, N. J.—The commissioners have voted to give the Atlantic Coast Railway Company permission to run their trolley road through Long Branch. The road was opposed by the wealthy cottage owners at Elberon and Long Branch, but the business men favored the scheme and demanded that the authorities give the company the franchise.

Ann Arbor, Mich.—Sealed proposals will be received until August 1 for lighting the streets and public places of this city for a term of five years, beginning December 31, with not less than 96 arc lamps of 2,000 candle power and 3 incandescent lamps of 65 candle power each, for 265 nights all night, 365 nights from twilight to 12.30. Glen V. Mills, city clerk, will furnish information.

Washington, D. C.—The electric equipment of the 9th street branch of the Metropolitan Railroad is nearly in place and the officials of the company are confident that the cars will be running regularly under the new system by August 1, as required by law.—Steps have been taken toward the building of an electric road connecting Silver Spring, Woodside, Linden and Forest Glen with Washington.

Riverhead, N. Y.—A syndicate of New York and Philadelphia capitalists want to construct and operate, subject to the statutes of the State, a trolley railroad in the main highway, extending from Riverhead to Orient, L. I. It is proposed to build the road, providing a right of way will be given by those living on the highway. Several prominent local capitalists have been interested in the scheme.

Milwaukee, Wis.—A resolution has been introduced in the city council authorizing the board of public works to advertise for bids for lighting the city with electric lights. The contract with the Badger Illuminating Company expires January 1. The Milwaukee Arc Light Company, successor of the old Milwaukee Electric Light and Power Company, will probably make a bid for the contract in competition with the Badger Company.

Erie, Pa.—The *Herald* says: "The electric railway people are being attracted by the prominence of Conneaut Lake as a pleasure resort. Capitalists have a scheme on foot to construct a road from Meadville and another from Meadville to Titusville. If carried out as outlined, the road will measure 45 miles in length, and Meadville, lying between the termini, will be the headquarters. Application for a franchise has been made to the Meadville councils."

Baltimore.—The big electric locomotive in the Belt line tunnel was put to a severe test a few days ago and came off with flying colors (at a gait of 17 miles an hour). A train of 23 cars and 2 "dead" engines was hauled through the tunnel at that speed by the big machine. The estimated weight of the train was 1,300 tons. After the trip through the tunnel was made two large steam locomotives were required to pull the train.

Columbus, O.—A fee of $16,000 was paid at the State Department on the 13th inst. It came from the new Cincinnati, Hamilton and Dayton Railroad Company, formed from the consolidation of the Cincinnati, Hamilton and Dayton, the Cincinnati, Dayton and Ironton and the Cincinnati, Dayton and Chicago railroad companies. The consolidation was perfected some time ago, but the formal articles were not filed until the date given.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Atlanta, Ga.—Salem Graham, of Palatka, Fla., will build in this city a 140 room hotel.. . Venable Bros. will remodel the Venable Building into a 200 room hotel with electric light plant and other conveniences.

Boston, Mass.—John B. Thomas and Edward Read, representing a syndicate of which Francis Peabody, Jr., Alfred Bowditch and others are trustees, have secured a site at 413-421 Boylston st. for a building devoted exclusively to the medical and kindred professions; estimated cost $550,000....Charles F. Atkinson, of the Bowdoin Square, has closed negotiations, plans, etc., for the erection of a first-class theater on the site of the old public library on Boylston st.

Brooklyn, N. Y.—George Campbell will erect a five story brick flat and store, south side of Fulton st.. west of New York ave.; also 2 five story brick flats and stores on south side of Fulton st., west of New York ave....John Frazier, 45 Rochester ave., will erect a four story brick flat at northeast cor. of Park Place and Nostrand ave....Emily Mannecke will build 3 five story brick apartment houses on north side of Fulton st., east of Arlington Place....Frank Freeman, 808 Vanderbilt Building, New York City, is the architect for the new police station to be erected cor. Throop and Gates ave., Brooklyn; heated by steam and lighted by electricity.

Burlington, N. J.—H. H. McNeal, Philadelphia, Pa., is to have a handsome colonial residence erected here.

Cape May, N. J.—A new brick hotel, to cost $150,000, will be erected this fall on the site of the new Columbia which was burned in 1880.

Chicago.—Moulton & Richardson, who are building the Guaranty Building at Buffalo, N. Y., have broken ground for an eighteen story building in Chicago.

Hartford, Conn.—Architect Dwyer has prepared plans for the Linden apartment building to be erected on Capitol ave.; lighted by electricity.

Harper's Ferry, Va.—The Baltimore & Ohio Railroad Company are contemplating the construction of a summer hotel on Maryland Heights, opposite Harper's Ferry.

Irvington, N. Y.—A number of millionaires living along the Hudson have decided to build a casino at Irvington.

Maysville, Pa.—The Shamokin and Mt. Carmel Electric Railway Company contemplate erecting a large pavilion on the park at Maysville. It is to contain a place for theatricals, a cafe, etc.; lighted by electricity.

New York City.—The Central Real Estate Association, which purchased the southwest cor. of 4th ave. and 19th st., will immediately erect thereon a twelve story fireproof building to cost about $750,000....Architects Parrish & Schroeder, 1 Madison ave., have prepared plans and specifications for the new club house for the Y. M. C. Association at 321 West 56th st....It is reported that Charles Buek, who filed plans for two private houses on 72d st. between the Boulevard and West End ave., has changed his mind, and will build a nine story flat on the two lots instead....The seven story and basement mercantile building to be erected at 7-9 West 18th st. for H. Corn will be lighted by electricity; passenger and freight elevators, etc....Julius Franke, 287 4th ave., is the architect for the seven story store and loft building to be erected at 179-183 Wooster st....Ralph S. Townsend, 1298 Broadway, has plans for a fifteen story fireproof office building, to be erected on the northeast cor. of Cedar and William sts., for Blake & Downing....Horenburger & Straub have made plans for a six story factory building to be erected at 81-83 Ludlow st., for Purdy & Co., of Boston. ....A seven story brick and stone and iron factory building will be erected at 20-24 North Moore st., to be equipped with power plant and machinery....Architects Clinton & Russell, 32 Nassau st., have completed plans for 5 four story buildings to be erected in 55th st., west of 5th ave.; they are to be lighted by gas and electricity and equipped with the latest improvements....Dr. Thomas E. Satterthwaite will build a five story and basement residence south side of 55th st., west of 5th ave.; Architect Wm. Strom....W. E. Thompson, 309 Columbus ave., will build 4 five story dwellings at 302 to 306 West 78th st.

Paterson, N. J.—Francis Seymour and others will build a new hotel and theater cor. Clark and Ward sts.

Philadelphia.—The edifice to be erected in Germantown at Frank and Green sts. by the Summit Presbyterian Church will be lighted by electricity.

Pittsburg, Pa.—Burnham & Co., of Chicago, have furnished the plans for the new hotel to be erected on Penn ave. by John Walker and Henry Phipps, Jr.

Pottsville, Pa.—The county commissioners have received the plans for the electric light and heat plant for the new hospital building.

Providence, R. I.—It is proposed to erect a large hotel on a site leased from the Britt estate in Washington st.; estimated cost $1,500,000.

Rockaway Beach, N. Y.—Henry Ives Brown, of New York City, has made drawings for a new hotel to be built at Rockaway Beach for John Hanley; lighted by electricity.

Wheeling, W. Va.—The Pythian Temple Association of Wheeling has selected a site upon which to erect the proposed temple; Capt. George W. Weisgerber is chairman of the committee on construction.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JULY, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.20 P. M.	2	3.30 A. M.
2	11.50 "	3	3.30 "
3	......	..	......
4	12.30 A. M.	4	3.30 "
5	1.30 "	5	3.30 "
6	No light.	6	No light.
7	"	7	"
8	"	8	"
9	8.00 P. M.	9	10.30 P. M.
10	8.00 "	10	10.50 "
11	8.00 "	11	11.10 "
12	8.00 "	12	11.30 "
13	8.00 "	13	11.50 "
14	8.00 "	15	12.10 A. M.
15	8.00 "	16	1.00 "
16	8.00 "	17	1.20 "
17	8.00 "	18	1.40 "
18	8.00 "	19	2.30 "
19	8.00 "	20	3.30 "
20	8.00 "	21	4.00 "
21	8.00 "	22	4.00 "
22	7.50 "	23	4.00 "
23	7.50 "	24	4.00 "
24	7.50 "	25	4.00 "
25	8.30 "	26	4.00 "
26	9.00 "	27	4.00 "
27	9.20 "	28	4.00 "
28	9.50 "	29	4.00 "
29	10.20 "	30	4.00 "
30	11.00 "	31	4.00 "
31	11.00 "	Aug.1	4.00 "

INCORPORATIONS.

The West Brokerage Company, San Antonio, Texas—to construct a telegraph line. Capital stock, $10,000. Promoters: J. M. Ryan, Paul Richards and J. R. Ransom.

The Conway Telephone Company, Conway, Ia.—to operate a telephone exchange. Capital stock, $5,000. Promoters: Arthur Hayne, president, and M. H. Simmons, secretary.

The Iowa Harrison Telephone and Construction Company, Council Bluffs, Ia. Capital stock, $100,000. Promoters: C. E. H. Campbell, S. B. Wadsworth, A. W. Johnson and C. M. Hurd.

The Douglas County Telephone Company, Madison, Wis.—to operate a telephone exchange system. Capital stock, $30,000. Promoters: Russell Baxter, P. Benson and P. G. Stratton.

The Southern Electric Construction Company, Richmond, Va.—to construct and equip telephone plants, electric light and power plants, and do a general electric business. Capital stock, $25,000. Incorporators: J. M. Collingworth, president; C. F. Wingo, vice-president; G. S. Maxwell, secretary and treasurer.

The Electric Shower Bath Company, Chicago. Capital stock, $30,000. Incorporators: Levi Beemer, Michael J. Lyons and William A. Cunningham.

The Peoria and Fort Clark Street Railway Company. Peoria, Ill.—to acquire, build, buy, own and operate street railways and plants for producing electricity, and to use, furnish and sell electricity for operating street railroads, for light, heat and power purposes. Capital stock, $150,000. Promoters: Wm. Burry, Emory D. Frazer, Chas. S. Williston.

The Hall Electric Power and Transportation Company, Des Moines, Iowa. Capital stock, $510,000. Incorporators: T. G. Hall, G. R. Burbank, A. H. Hatch, R. H. Laird, L. C. Dancey and T. M. Hall. Mr. Laird is the president and treasurer, Mr. Dancey is secretary and T. M. Hall is vice-president.

The American Synthephone Company, Chicago, Ill.—to manufacture, buy and sell electrical appliances and all kinds of machinery and products, including inventions and letters patent therefor. Capital stock, $1,000,000. Promoters: Wm. S. Adams, Ada C. Adams, Louis M. Stone.

The Ideal Electric Corporation, Camden, N. J., and Philadelphia, Pa.—to manufacture, install and maintain electrical apparatus. Capital stock, $100,000. Promoters: Geo. L. Colgate, Fanwood, N. J.; Jas. D. McIntosh, Franklin, N. J.; Geo. S. Loutey, Wm. C. Toplin, James Collins Jones, Philadelphia.

The Coro and Lavela Railroad and Improvement Company, Jersey City, N. J.—to construct, build and operate a railroad to be operated by steam or other motive power between Coro and Lavela, Venezuela. Capital stock, $500,000. Promoters: Adolph Pereira, Francisco Bonilla, Brooklyn, N. Y.; Geo. L. Dayton, Jersey City.

The Crandall Electric Signal Company, Jersey City, N. J., and Washington, D. C.—to manufacture and sell electrical devices for the display of signals, monograms, figures, words, designs, etc. Capital stock, $500,000. Promoters: Lucien S. Crandall, Parish, N. Y.; James Curran, Hoboken, N. J.; Geo. B. Fielder, Jersey City; Chas. F. Manderson, Omaha, Neb.

The C. E. Woods Company, Chicago, Ill.—to engage in electrical and mechanical engineering, contracting and general supervision of mechanical and electrical construction work. Capital stock, $100,000. Promoters: Chas. E. Corrigan, Clinton E. Woods, James R. Corrigan.

The Yarmouth Telephone Company, Yarmouth, Maine—to manufacture and deal in electrical goods and supplies and construct and maintain telephone lines, etc. Capital stock, $10,000. Promoters: Albert H. Coombs, John Coombs, Geo. E. Coombs, Yarmouth.

The Metropolitan Gas and Electric Light Company, San Jose, Cal.—to manufacture, purchase and sell gas; generate and sell electricity, electric light and power; build or purchase and operate railroads to be run by electricity. Capital stock, $500,000. Promoters: J. V. Mc. Kiernan, Frank Whitaker, E. C. Randall, W. W. Wood, C. K. Fleming, San Jose.

The Big Horn Gold Mining Company, Los Angeles, Cal.—to operate and improve lands, mill sites, mining claims, electric lines, water rights power plants, etc. Capital stock, $2,000,000. Promoters: L. W. Blinn, E. M. Ross, Stephen M. White, F. L. Moore, all of Los Angeles.

The Webber Brake Company, Jersey City, N. J.—to manufacture, buy and sell railway supplies, which pertain to construction, equipment, etc., of electric and street railways. Capital stock, $50,000. Promoters: Geo. O. Lord, Clifton, N. Y.; Fred'k S. Greene, Bayonne, N. J.; Otto R. Saint, New York City.

The Lampasas Electric Light Company, Lampasas, Texas—to supply light, heat and power. Capital stock, $10,000. Promoters: J. T. Donovan, Sr., E. A. Maxwell, W. L. Donovan, W. H. Browning, J. C. Matthews, Lampasas.

The Kane Street Railway Company, Kane, Pa.—to build an electric street railway. Capital stock, $6 (00. Promoters: C. H. Kemp, Thos. L. Kane, W. P. Weston.

The Arcade Mutual Electric Light Company, Cincinnati, Ohio—to manufacture, sell and furnish electric light, heat and power. Capital stock $15 000. Promoters: Oliver E. Conner, Louis F. E. Hummel, Fred. Seibert, John C. Greene, M. L. Robertson.

The Easton Power Company, Jersey City, N.J.—to manufacture and sell electrical machinery and appliances. Capital stock, $100,000. Promoters: Howard Lacy, Albert B. Carter, Thos. A. H. Hay, Wm. O. Hay, Easton, Pa.; Asa W. Dickinson, Hackensack, N. J.

The Mexia Lighting and Power Company, Mexia, Texas—to furnish light and power by electricity. Capital stock, $15,000. Promoters: Jno. W. Shoaf, W. L. Murphy, W. L. Hall.

The Alton Railway and Illuminating Company, Alton, Ill.—to construct, maintain and operate street railways by animal, dummy or other motive power; generate and provide steam, gas and electricity for the purpose of operating street railways; sell and distribute steam, gas and electricity for light, heat and power. Capital stock, $250,0.0. Promoters: Jos. F. Porter, Charles W. Milnor, Henry R. Phinney.

The West Shore Railway Company, San Francisco, Cal.—to construct and operate a railroad to be operated by steam, electricity or other motive power; construct and operate telegraph and telephone lines and operate steamboats. Capital stock, $2,000,000. Promoters: C. H. Sanger, San Leandro; Behrend Joos, John W. Eisenrieth, San Francisco; Louis F. Dunand, San Rafael; R. S. Thornton, Colma, Cal.

The Merrill Telephone Company, Merrill, Wis.—to construct and maintain a telephone line in Merrill and adjacent points. Capital stock, $10,000. Incorporators: H. A. Foster, H. P. Fohlandt, C. A. Norway and others.

The Washington, Sandy Springs and Baltimore Electric Railway Company has filed a certificate of incorporation at Annapolis, Md. Capital stock, $1,500,000. In addition to operating an electric railroad, the projectors propose in their papers of incorporation a telegraph and telephone line, also to furnish electric light and water power.

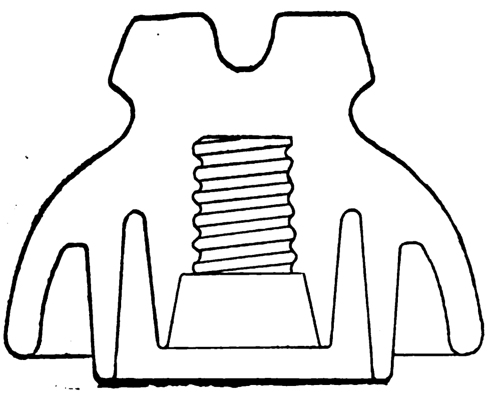
The Montgomery County Telephone Company, Hillsboro, Ill. Capital stock, $6,000. Incorporators: Charles A. Ramsey, Jacob J. Frey and William S. Barry.

The Manheim Electric Light. Heat and Power Company, Manheim, Lancaster County, Pa. Capital stock, $20,000.

The Radnor Electric Passenger Railway Company, chartered at Harrisburg, Pa.—to build an electric road beginning in Radnor township, Delaware County, and extending westerly along the old Lancaster road to its intersection with the Philadelphia and Lancaster turnpike. Capital stock, $80,000. President, Henry Douglass, of Philadelphia; directors: Andrew J. Reilly, Albert Layton, David Pepper, Frank E. Schermerhorn, Frank H. Hawkins, Lincoln L. Eyre and H. A. Mullen.

High Potential Porcelain Insulators.

Fred M. Locke, Victor, N. Y., manufacturer of a high class of line material and specialties, is now filling an order for 3,600 of his special High Potential Porcelain Insulators. They are to be used on the long distance transmission line between Nevada City and Grass Valley. Col., the voltage of which is to be 5,500.



INSULATOR—CROSS SECTION.

These insulators are of a new pattern, as shown by the accompanying cross sectional plan. They are made from the highest grade of porcelain, are 5¼ inches in diameter and weigh about two and one-quarter pounds each. The design of the insulator especially adapts it for use where structural strength and high insulation are necessary.

Partridge Motor Brushes.

The Partridge Carbon Company, Sandusky, O., reports that much of the carbon motor brush trade is coming its way, more brushes being sold now than ever before in the history of the company. Even the Carbon combine cannot get along without this company's goods and buy them when they strike a customer who insists on having a good article.

The New "Standard" Arc Lamp.

Probably no exhibit at the Northwestern Electrical Convention attracted more attention than the new Arc Lamp recently placed on the market by the Standard Electric Company of Chicago, and of which more than a thousand are now in use. In exterior appearance it is similar to the former type of Standard lamp, but when the cover is lowered the marked simplicity of the mechanism is apparent. As this lamp is a prime favorite with Mr. Perry, it was perfectly natural that he should find pleasure in debating on its good qualities; how the potential of the arc remained just the same regardless of the position of the clutch, the lamp magnets always being in perfect electrical balance; how an instantaneous and silent arc was always assured; how the present arrangement of the magnets does away with the necessity of perfect cleanliness to insure economical and satisfactory service, a point that ought to be brought to the attention of Mr. Roche, who controls the lamps in the La Salle street tunnel, the dustiest place in Chicago. It is claimed that the potential of the arc never rises above 50 volts or drops below 46, and though the amperes should vary from 5 to 15 still the arc will form silently and instantaneously at the normal voltage and so remain. As the contact points in the automatic cut-out are of platinum there can be no corrosion and the lamp cuts out without a spark. For conducting the current to the carbon rod there is a substantial brush capable of carrying more than 20 amperes. The brush is so arranged that the friction upon the rod is reduced to a minimum. For outdoor service each lamp is provided with a double pole weatherproof switch which is enclosed in a compact "detachable cap," and is so constructed as to permit the lamp being instantly removed from the line without opening or breaking the circuit.

Comparative Tests of Columbia and Edison Lamps.

A recent comparative test of Columbia and new type Edison lamps shows that the Columbia is not only of longer light and higher sustained candle power than its cheap rival, but that after 780 hours' burning it shows a saving of .5 watts per candle. Four Columbia and five Edison lamps were entered in this test. All the former were burning after 730 hours; only two of the latter were burning after 600 hours. At 786 hours the Edison lamp developed 9¾ C. P., the Columbia, 12¾, demonstrating that one Columbia lamp is equal to three Edison lamps. Columbias sell at 2[illegible]c. On the basis of their efficiency the Edison lamps should be sold at 6⅜c.

Mr. Wm. H. Pike, Jr., so long connected with the Brady Manufacturing Company of Brooklyn, N. Y., and who has been their superintendent for the last two years, has resigned and is now taking a much-needed rest. He is succeeded by Mr. Oluf Tyberg, M. E., so long and favorably known as a practical and theoretical engineer and as the designer of many labor-saving machines, automatic and otherwise. Mr. Tyberg has acquired an interest in the company.

THE TELEPHONE WORLD.

The Missouri and Kansas Telephone Company has commenced work on it underground system in St. Joseph. Mo.

Baltimore capitalists are projecting an independent exchange system at Bridgeport, Conn. It is presumed that they will acquire the charter rights of the Connecticut Telegraph and Telephone Company, which was chartered in 189 .

The city council of Port Huron, Mich., has rescinded its action demanding the removal of all Bell telephones from the city offices and departments.

The Pennsylvania Telephone Company of Harrisburg, Pa , is preparing to establish an exchange at Mechanicsburg. Pa

The Citizens' Telephone Company, St. Joseph, Mo., has asked for an extension of six months in which to complete its plant.

The New York and Pennsylvania Telephone and Telegraph Company is making extensive improvements in its lines between Buffalo and Erie.

The board of trade of Saginaw, Mich , is behind the movement to organize a local telephone company at that place.

The Southern Bell Telephone Company is making an effort to establish exchanges in Girard and Phœnix City, Ala.

The Citizens' Telephone Company has completed its line between Carbondale and Honesdale, Pa. *Anthracite*, of Carbondale, says: "This branch is but a local branch of the great national telephone system which is spreading slowly over the whole country. From this city the line will probably soon be extended down the entire valley and then be connected with the main system."

The Columbian Standard Telephone Company, to operate in Maryland, District of Columbia, Virginia and West Virginia, has been organized at Washington, D. C., with L. C. Hine. of Washington, president; Gen. Felix Agnus, of Baltimore, vice-president, and George W. Cross, general manager. Its headquarters are in Washington, with branch offices in Baltimore and Richmond.

The Wayne Telephone and Telegraph Company is being organized at Newark, N. Y., with a capital stock of $5,000.

The Chesapeake and Potomac Telephone Company is contemplating the enlargement of the Central Exchange Building, at St. Paul street and Bank Lane, Baltimore, Md.

A. B. Ferdinand, representing the Milwaukee Construction Company, has secured a telephone franchise at Sheboygan, Wi .

The Wisconsin Telephone Company has asked for a franchise at Baraboo, Wis.

F. P. Crocker has been made manager of the Wausau Telephone Company, Wausau, Wis. It is the purpose of the company to operate exclusively in Wausau, and to furnish service to subscribers at actual cost, the company being formed on the co-operative plan.

The New England Telephone and Telegraph Company will erect a new exchange and office building at Worcester, Mass.

The Globe Telephone and Construction Company is being organized at Des Moines, Ia., with a capital stock of $20,000. It will manufacture telephones under the patents of John Serdinko of San Antonio, Texas, and establish exchange plants. C. K. Mead is at the head of the enterprise.

J. H. Fous will establish a telephone exchange at Mt. Vernon Springs, N. C.

The establishment of a telephone exchange at Ashburnham. Mass., is contemplated.

The police signal and the fire alarm wires in Boston are to be placed in one duct of the New England Telephone Company's conduit.

H. M. Brinkerhoff, electrical engineer for the West Side Construction Company of Chicago, known as the Metropolitan Elevated Railway Company, has awarded the contract for furnishing a telephone system to the Western Telephone Construction Company, Chicago. This system contemplates about thirty telephone outfits, one at each railway station.

The Home Standard Telephone Company has been incorporated to operate in Albany and Rensselaer counties. N. Y. The company will construct lines of telephone and telegraph to connect the cities, towns and villages in Albany county and the villages of Bath-on-the-Hudson, East Albany and Greenbush in Rensselaer county. The central office will be in Albany. The capital is $850 000, and the directors are Henry Russell, John H. Farrell, Charles Whitney, William H. Keeler, John M. Bailey, William McM. Speer, James Rooney, Howard Hendrickson, William Barnes, Jr., William N. B. Sanders, William P. Budd, James B. Lyon, William A. Graves, John A. McCarthy and William J. Walker, of Albany.

A telephone company with a capital stock of $100,000 has been organized in Lewisburg, Pa.; the purpose is to extend the lines to every part of Union County, the central station being a Lewisburg. President, J. T. Baker; secretary, C. H. Hassenburg; treasurer, C. Shaffer.

The Phœnix Telephone Company has asked permission to erect poles and wires in Altoona and Hollidaysburg, Pa.

The Long Island telephone service of the New York and New Jersey Telephone Company has been completed to Orient village.

The wires of the Central New York Telephone and Telegraph Company in Utica, N. Y., are soon to be placed underground in the business part of the city. The subway is now under construction.

Pilot Mound and Fraser, two Iowa towns, are being connected by a new telephone line.

The Home Telephone Company, Uniontown, Pa., is ready to make contracts for its exchange and line equipment. Evans Johnson is manager, and can give necessary information to bidders.

An extensive inter-rural telephone service is to be established at Salisbury, Md. Franchises have already been granted to S. E. Gordy, Major Humphries, W. H. Jackson and other gentlemen residing near that place, to connect their farms with the local lines and exchange in Salisbury.

Telephone Improvements at Syracuse.

Plans for the Central New York Telephone and Telegraph Company's new building at Syracuse, N. Y., have been approved. The structure will be of iron, stone and brick, four stories high, fitted throughout with modern electrical appliances. Work will be pushed so that the wires and offices may be transferred to the new building early next spring. The building will cost $35,000.

The metallic circuit of this company connecting Syracuse, Auburn and Skaneatelas has been completed. A force of men is now stringing a new copper circuit between Syracuse and Utica. As soon as that is completed, a new line will be constructed between Lowville and Watertown. Next year the metallic circuit will be extended to Gouverneur, Carthage and Ogdensburg, and on down the river to Clayton, Thousand Island Park, Alexandria Bay and other resorts along the St. Lawrence. At Ogdensburg cable connections will be had with Canada.

The Independent Movement in Iowa.

The independent telephone companies are taking business right away from the Bell Company in Iowa, as shown by the following:

BOONE, IOWA, July 14, 1895.

Publishers ELECTRICITY.

Gentlemen: We have an exchange of 120 subscribers in this city, nearly completed, and have replaced all but about a dozen of the Bell instruments. They had, prior to our beginning business, dwindled down to about fifty subscribers in this town of 10,000 people, which was due to their prohibitive prices and the fact that the care of the local exchange was lost sight of in their attention to the toll lines. They had been operating here some twelve years without a regular franchise. When our construction work began they commenced rebuilding, setting poles down the principal street, whereupon the city council served notice on them to cease work until they could show authority for using the streets. They then applied for a franchise, which has been granted them, but with the following restrictions: that the rental for 'phones in business houses shall not exceed $2.50 per month, residences $1.50 per month; that the toll for five minutes' use of line to points within the county shall not exceed fifteen cents, and to points within a radius of 5) miles twenty cents. Prior to the granting of the franchise they notified the city fathers that they would not accept a franchise that was limited in rate, threatening to pull out of town, etc., etc. It now remains to see what action they will take in the matter.

We are using the equipment of the Western Telephone Construction Company which is giving splendid satisfaction.

Kindly send to our address your paper for one year. We are much pleased with your position on the telephone question, and hope you will continue on the side of "the people." Yours truly,

BOONE COUNTY TELEPHONE COMPANY,
CHAS. E. WELLS, Secretary.

Telephone Directory

List of Independent Manufacturers Who Make and Have Telephones and Accessories For Sale.

THE 'HUNNINGS' DUST TRANSMITTER
AMERICAN ELECTRIC TELEPHONE CO.,
Kokomo, Ind.

COMPLETE TELEPHONES, PARTS, &c.,
MIANUS ELECTRIC CO.,
Mianus, Conn.

M. & B. TELEPHONES,
THE U. S. TELEPHONE CONSTRUCTION CO.,
Bullitt Building, Philadelphia, Pa.

COMPOUND MAGNETO TELEPHONES,
WESTERN TELEPHONE CONSTRUCTION CO.,
South Clinton St., Chicago, Ill.

STANDARD TELEPHONES,
PHILADELPHIA TELEPHONE CO.,
Box 707, Philadelphia, Pa.

ALUMINUM DIAPHRAGM TRANSMITTERS,
PITTSBURG TELEPHONE CO.,
90 Penn Ave., Pittsburg, Pa.

LOUD TALKING TELEPHONES,
THE MASON TELEPHONE CO.,
Richmond, Va.

EVERYTHING FOR TELEPHONES,
DE VEAU & CO.,
32 and 31 Frankfort St, New York.

COMPLETE TELEPHONE EXCHANGES,
THE HARRISON INTER'L TELEPHONE CON. CO.,
Chicago, Ill.

THE CENTURY TRANSMITTER,
THE CENTURY TELEPHONE CO.,
299 Devonshire St., Boston.

ARM REST MAGNETO BELL,
VIADUCT MANUF'G CO.,
Baltimore, Md.

BLAKE TRANSMITTERS,
PHŒNIX INTERIOR TELEPHONE CO.,
181 Liberty St., New York.

THE MILDE MICROPHONE,
THE STANDARD TELEPHONE & ELECTRIC CO.,
Madison, Wis.

BATTERY TELEPHONES,
UNIVERSAL TELEPHONE CO.,
Indianapolis, Ind

AUTOMATIC SWITCHBOARDS,
STROWGER AUTOMATIC TELEPH. EXCHANGE,
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ELECTRICITY.

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EDITORIAL NOTES.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

The Double Arc Lamp Decision. Judge Showalter handed down last week an opinion in the case of the Brush Company vs. the Western Electric Company which will be read with interest by a very large circle of the electrical fraternity. Unlike many of the recent important decisions in electrical patent cases, the validity of the militant patent is not questioned, but the effect of the decision will be scarcely less far-reaching than it would be were the Brush patent entirely overthrown. It will be remembered that on September 2, 1879, Mr. Charles F. Brush patented a means by which in an arc lamp two or more sets of carbons could be successively thrown into action so that the succeeding carbon should not burn until the preceding one had been completely consumed. The wording of the patent disclaims any specific device by which this shall be accomplished although describing one device by which it can be accomplished, but distinctly describes the sequence of steps by which the desired result is to be obtained, leaving the mechanical devices entirely open. In brief, Brush's device was this, that where two pairs of carbons were involved and initially the two members in each pair were in contact, in striking the arc one pair were separated slightly before the other pair and therefore maintained by the actuating device at a slightly greater distance apart than the second pair after the arc was struck. By this arrangement, although both of the feeding carbons were actuated by the same controlling mechanism and suspended by clutches dependent upon the same, the carbon which was maintaining the arc might feed for that purpose until consumed without rendering it possible for the succeeding carbon to be thrown into action. According to the reading of Brush's patent, the order in which the various pairs of carbons should be successively thrown into action was predetermined by the mechanism employed and not accidental. This patent further provided for the proper throwing into action of the predetermined pair of carbons when those already in action were consumed, so as to maintain without serious interruption a continuous light until all of the carbons had been successively consumed.

The interpretation of the Brush Company of this patent was that it covered the use of successively burning pairs of carbons whatever the procedure by which the arc was first struck, maintained and afterwards transferred from a consumed pair of carbons to an unconsumed pair. According to this interpretation, two pairs of carbons actuated in any possible way, whether by a common mechanism or separate mechanisms, if combined in a single structure, was an infringement, provided the simple shifting of the arc from the consumed pair to an unconsumed pair occurred at the proper moment to maintain practically unimpaired a continuous illumination during the combined life of the several pairs of carbons. Thus interpreted, the patent was so broad as to practically monopolize the manufacture and use of all-night or long-burning arc lamps, and the Brush Company have so assiduously maintained their views of the case that nearly every manufacturer who has attempted to accomplish the same thing has had either to pay royalty to the Brush Company or stop business. The lower courts have freely granted injunctions without hearing upon the complaint of infringement by the Brush Company, and thus many were deterred from going into the business either by the fear of legal consequences or the expense of immunity purchased in the shape of royalties.

Judge Showalter's opinion, which is given quite at length elsewhere in this issue, places a very much restricted construction on the patent, and while its validity, so far as its verbal claims are concerned, is tacitly maintained, other obvious methods, such as those covered by the Scribner patents, are held to be not infringements. While this trial was not in a court of last resort, Judge Showalter's opinion is so clear and evinces such a comprehensive and acute understanding of the elements involved that it seems scarcely probable that an appeal will be taken.

Entirely aside from the result of this case, which is gratifying to us, it is a pleasure to read the opinion, which, in its lucidity of expression and apparent complete comprehension of all that was involved, stands in such bold contrast to some opinions on electrical patents handed down within the past few years.

The Rowland-Forbes Controversy. Up to last week ELECTRICITY had seen little or nothing in the controversy between Prof. Henry A. Rowland and Prof. George Forbes over the designing work on the Niagara plant worthy of newspaper comment. We looked upon it as an unfortunate episode, and hoped to hear the last of it soon. The charges made by Prof. Forbes in London *Lightning*, and printed in full last week in ELECTRICITY, have changed our views--at least in one particular. We should seriously regret now to have it end where it is, not that any newspaper reply from Prof. Rowland is called for or would be even permissible. Other measures are now demanded.

Prof. Forbes has, however, even if grossly slandering Prof. Rowland, performed a real public service in tearing the mask off the heretofore concealed financial plans of the Niagara promoters. We do not know who originated the expression "brutal frankness" or we would give him credit for it as we apply it, for no other words known to us can so clearly express Prof. Forbes's offence against his company. He is guilty of brutal frankness.

We have to do with only one sentence in Prof. Forbes's letter. Meantime we will go back a few weeks to recount recent events.

On June 12 ELECTRICITY said:

> But after all this babble about franchises and transmission which the *Engineer* indulges in is cleared away, there is another feature of the situation which is also entirely beyond the comprehension of our contemporary—the *stockjobbing* part of the Niagara enterprise, which has already proceeded far enough to be conspicuous to those who give any real thought to the scheme, and which will soon be even more apparent.

The *Engineer*, we believe, characterized this expression of opinion on our part as vulgarity.

On July 3 we reported the remarks of Mr. Rankine of the Niagara Company before the Buffalo Common Council, as follows:

> We are not going to sell or distribute any power ourselves, even to Niagara Falls, but intend to *organize* and CAPITALIZE A COMPANY to conduct our business here, and we want authority to transfer our franchise to them.

This was perhaps a plain enough declaration from the company of its intentions. Now Prof. Forbes comes to our defence (though we did not need any) by saying:

> The officials of the Niagara Company have informed me and others that he (Rowland) was employed only to get him to withdraw his opposition to alternating currents.

Now we would like Prof. Forbes or "the officials of the Niagara Company" to explain, if they can, how the opposition of Prof. Forbes or any other man to alternating currents could hinder the success of the Niagara plant in its legitimate workings? Would this opposition hoodoo the gigantic dynamos, create bugs in the transmission lines, or play hob with the transformers in any mysterious manner? Would it make the line losses greater between Niagara and Buffalo?

We think not. What it might have done, however, would have been to point out the weak spots commercially in this enterprise, and make it more difficult for the original promoters to unload a few millions of securities on the public.

To prevent the expression of opposition of this nature the company were willing, by the confession of their own consulting engineer, to commit bribery.

We are certain of Prof. Rowland's innocence of these serious charges. We do not believe he could be bribed. But that does not change the facts. The Niagara Company would stop at nothing to insure the success of its plans—to sell stocks and bonds on an enterprise which is as sure to be unprofitable as the water is to continue to flow over Niagara when they extend their service to Buffalo or further.

The conviction grows upon us that ELECTRICITY will never need to offer one word of apology for any strictures made upon the Niagara promoters.

Canal Towage. Mr. Frank W. Hawley has gone abroad to raise money for equipping four miles of the Erie Canal for electric towage. The plan now is to run a motor carriage in the air on a 1½ inch cable for towing purposes—a scheme which would be picturesque even if unpractical. We wonder what advantages Mr. Hawley can show to proposed investors in running his machine in the air over running it upon the well-graded and level towpath on a track. There would be about as much sense in towing our Broadway surface cars from a balloon as there is in hauling a canal boat from mid-air.

What the Erie Canal needs first is more water—more width and greater depth. Then the question of towage can be easily settled. A track on the towpath with ordinary electric motors would be a certain success. Unless Mr. Hawley puts up his own money, and we guess he hasn't got much, his method will probably hang just where it is now—in mid-air.

Under the Searchlight.

Views and Opinions on Timely Topics.

MR. J. HOBART HERRICK, formerly vice-president and commissary of the Edison General Electric Company, says that G. E. stock is a good buy and will soon sell at 50. But we do not believe Mr. Herrick is putting his own money into it.

* * *

THE receivership of the Royal Arc Electric Company, which Mr. Louis Howard organized to do business "through the universe," has been closed. The receiver, Foster M. Voorhees, gets $200.

* * *

THE receiver of the Schuyler Electric Manufacturing Company, of Hartford and Middletown, Conn., has been ordered to sell the plant as the claims against the company are so complicated that there is no other means of effecting a settlement. We shall throw a little light on this subject sooner or later, proving again that ELECTRICITY has a way, not open to the courts, of getting at the facts. This Middletown deal was one of Mr. Coffin's earlier attempts at "consolidation" and was not carried out with his accustomed cunning. It savors more of the burly highwayman with a club than of the confidence man who afterwards learned how to induce people to give up their money cheerfully.

* * *

Dr. Adams's Troubles.

Stockholders in the Air Line Protest.

St. Louis stockholders in the Chicago-St. Louis Electric Road are organizing to recover their money if possible, and will bring suit if any way is found to prove fraud.

Dr. Adams says he first made a contract with a former third vice-president of the General Electric Company to sell $8,000,000 of bonds, but the latter failed to do so. Then a Chicago firm agreed to place $9,500,000. They also were unable to carry out their contract. All told, the company has received $112,000, which has been spent, several hundreds of it in advertising in our esteemed contemporaries. Dr. Adams says that the misfortunes of his enterprise are largely due to the fact that General Electric stock has fallen from 119⅞ to about 30, which is as good a reason as any we can expect from him.

* * *

THE decision of Judge Showalter in the double-carbon arc lamp patent removes effectually the only remaining grip which the General Electric Company has had upon any branch of the electrical manufacturing business. It was the only patent they had upon which a royalty was collected, nearly every manufacturer of double-carbon lamps, including the Fort Wayne Company, having paid $5 per lamp. When the Load Line is redrawn next year, the Brush Patent will be added to the record—Feeder and Main Patent, Edison Lamp Patent, Thomson Regulator Patent, Brush Double-Carbon Lamp Patent—all now gone. What is there left for a foundation for the General Electric's Patent asset item of over $[illegible],000,000?

* * *

British Obtuseness or American Puffery.

(London Electrical Review, May 31.)

An "interesting" type of battery is (says the American *Electrical Review*) made by the Multivolt Battery Company of Brooklyn. In brief, this battery consists of a number of independent cells, the containing vessels of which have holes in them, and which are all immersed in a single vessel containing an excited fluid; in other words, there are a series of leaky cells, each on partial short-circuit, and the electromotive force of the combination is that of the cells in series diminished by the partial short-circuiting. The result of this wonderful and "interesting" arrangement is, that a 6-cell battery, which should have given normally 12 volts, actually gave only 5, at which the *Electrical Review* expresses astonishment. Truly, our American friends have something yet to learn in elementary electricity.

(London Electrical Review, June 14.)

The *Western Electrician* believes that we underrate the intelligence of our readers even if they are English, and speaks of enlightening British obtuseness. No one, however, can accuse us of overrating the scientific qualifications of certain of our American contemporaries. We need only refer to the Boynton "multivolt" battery, to a note on page 685 of our issue of May 31, and to page 424 of the New York *Electrical Engineer* for May 29.

(London Electrical Review, June 28.)

The Boynton "semi short-circuited" battery (to which we alluded in a recent issue), devised by our ingenious American friends, is being run the gamut of the American electrical papers, and is being described in the most approved "circular" style. Do the editors wilfully blind their eyes to the absurdity of the arrangement, or are they grossly ignorant of elementary electrical facts?

We guess our British friends have the laugh on our American contemporaries this time.

* * *

UP to a few weeks ago the trolley systems in Brooklyn ran at speeds giving the greatest satisfaction to the majority of people in the city. Owing to the niggardly policy of the railway companies in hiring cheap men to run the cars, accidents were too frequent. Then mass-meetings, composed chiefly of the residents of the Heights section who rarely ride in the cars, were held to protest against the high speeds, which were reduced to an extremely slow rate. Now the prominent real estate men have joined in a petition to the Board of Aldermen urging a modification of the ordinance restricting the speed of trolley cars to six and eight miles an hour. They contend that the reduced speed is detrimental to business interests and the development of the outlying districts of the city, and their views are absolutely correct.

* * *

IT IS reported that a movement is on foot among those employees of the G. E. Company who receive the highest salaries providing for the offer by each of a month's salary to the company if the works shall be moved to some other place. The joys of life in Schenectady are evidently not appreciated by the G. E. boys. And no wonder.

* * *

WE were in error in stating that the *Electrical Review* printed the advertisement of Dr. Adams's air-line scheme, and we cheerfully offer apology to our esteemed contemporary, which has sins enough to bear without being unjustly accused.

* * *

But They Are Being Learned Rapidly.

(From Rochester Democrat and Chronicle.)

There are a good many things yet to be learned about the effects of ELECTRICITY.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER III.

The St. Cloud City Street Car Company.

INTRODUCTORY.

In taking up for consideration the affairs of the St. Cloud City Street Car Company, and the relations which that enterprise bore to the great scheme of electrical financing which this series of articles is designed to elucidate, it is proper to revert to the story of the operations at Winona published in our last two issues.

When the Thomson-Houston financiers decided to begin operations at Winona, that town had an unprofitable horse railway, capitalized at $25,000. There were 18,200 people in the town. The first financing move was to buy the horse railway, equip it electrically, and capitalize it at $200,000. There were four miles of track and no power house. There was also a lighting plant in the town. After a year or more this was bought for $35,000, the two companies put together under the name of the Winona General Electric Company, and capitalized at $900,000.

The trade at St. Cloud City, which we will now consider, differed in some respects from that at Winona. The town had only 7,686 people. The railway company only was bought, as the scheme did not hold out long enough to permit of buying the lighting company and making another of Mr. Coffin's grand consolidations. There was thus only one capitalization. The operation was not therefore, a large one, but it is even more instructive than the one at Winona, in that it shows effectually that the probable or possible success of a local enterprise did not enter at all into the calculations of these Thomson-Houston financiers. That was a subject in which they had no interest, and to which they gave no thought.

For suppose a small system did have the possibilities of moderate success, and was able to earn, say $2,000 a year net, it would then have been a little more difficult to buy it, and it would have taken fifty years to make $100,000 out of it legitimately. Moreover, for purposes of bonding and realizing money quickly a paying plant was little if any better in the hands of Mr. Coffin than any other plant.

The Thomson-Houston scheme was worth fifty honest deals—could not $100,000 be realized in fifty days? All that was needed was to find a railway whose owners had lost so much money that they were willing to sell it cheap, equip it electrically, bond it for five or ten times its value and sell the bonds; and Mr. Coffin knew how to sell them. What was earning capacity to him or his associates? Easy purchases and plenty of bonds was their watchword. If the bonds were worthless, what of that? Any one could sell good bonds. But to build up a reputation as a Napoleon of finance it was necessary to sell something which no one else could sell. This Mr. Coffin did, and the reputation is his.

We shall show, we think, that there never existed a shadow of chance for the St. Cloud Street Car Company even to pay interest on its bonds, unless the electric railway was to be a human incubator and quadruple the population of the town in one season.

THE SCHEME.

When those eminent financiers, Messrs. E. R. Gilman and C. A. Coffin (president of the G. E. Co.), first discovered the splendid possibilities waiting for their master minds for full development in the village of St. Cloud City the town had a population of 7,686 people. It had had for several years a horse railway with 4 miles of track, and the cheapest possible equipment. It had lost money every month of its existence, and had a nominal capital of $100,000. The owners were easily induced to part with this property for $16,000, not in cash, but in bonds of the new enterprise which were to be (and were) issued. Then the usual plan of financing was followed. The change to electric power was made with the strictest regard to the customary plan in these schemes, i.e., giving the road as little value in the way of equipment as possible. One type D, T.-H. generator was provided, pole line construction was completed, and power was rented from the local lighting company, there being no power house provided. There was also in this case an extension of the system to the thriving city of Sauk Rapids, 3 miles away, which had a population of 1,185 souls, mostly lumbermen, the chief industry being a sawmill. The value of the horse railway as an earning property is perhaps made clear enough from the fact that during the change of equipment, taking several months, no cars whatever were run.

When the Sauk Rapids extension was completed, it was found that the engineering talent in charge of the enterprise had failed to take into account the perturbing fact of rottenness in the wooden bridge over the Mississippi connecting St Cloud City, Stearns County (pop. 7,686), and Benton County, where Sauk Rapids (pop. 1,185) was located, which was totally unfit for carrying the weight of electric cars. Thus during the life of this enterprise the host of passengers between these two points have been compelled to change cars, walking over the bridge, which is 600 feet long, a circumstance which was not likely to and which has not "induced" much travel.

Water power was used by the lighting company and leased to the railway company at 2½ cents per car mile. Mr. C. S. Benson, one of the largest stockholders in the lighting company, was made superintendent, and as every car mile more meant added revenue to his own company, we suppose that the citizens had at least enough cars to ride on.

We think the question of population and general conditions have been made clear. And it was with these conditions, fully understood both by the managers of the Northwest Thomson-Houston (General Electric) Company and by the managers of the parent Thomson-Houston Electric Company at Boston, which latter company did the financing, that $100,000 of stock and $125,000 of bonds were issued upon the St. Cloud City Street Car Company.

With 6.72 miles of track the capitalization of $225,000 was at the rate of $33,500 per mile—just about double what it should have been even if a brick or stone power house had been provided, with first-class construction in every detail. But it must be remembered *no power house was built.*

CONDITION OF THE PROPERTY.

Let us now consider the actual physical condition of the property after it came into the possession of the Northwest Thomson-Houston (General Electric) Company, electrically "equipped," and the capitalization raised to $225,000. We submit a copy of the trial balance of the company, taken directly from their records:

[COPY.]

ST. CLOUD CITY STREET CAR COMPANY.

TRIAL BALANCE FOR TEN MONTHS ENDING APRIL 30, 1893.

Electrical railway plant	$204,540.00	
Franchise	20,460.00	
Northwest General Electric Co	7,204.36	
Track equipment	3,469.92	
Car equipment	3,092.65	
Snow plows	2,088.97	
Buildings	496.77	
Overhead construction	439.30	
Cash	314.50	
Organization expense	151.50	
Benson, C. S	99.30	
Tools	71.42	
Transportation	4,840.68	
Motive power	3,896.93	
Maintenance of cars and motors	2,946.09	
Maintenance of way	799.61	
Office and superintendence	764.39	
Insurance	329.50	
Taxes	309.86	
General expense	138.46	
Interest on notes	795.00	
Interest on bonds	1,072.42	
		$258,321.71

Credits.

Capital stock	$100,000.00	
Bonds	125,000.00	
Notes payable	21,182.82	
Earnings	11,788.89	
Advertising	50.00	
		$258,321.71

It will be remembered that in the official trial balance of the Winona Company when bonds were issued the property account was placed at $193,803.80, notwithstanding that their own inventory made it $83,9[illegible]2.22, which latter sum was at least $30,000 too high. In the St. Cloud deal the overvaluation was even more flagrant.

Electric railway plant is given at $204,540.

The company had been given as a bonus some wild land both at Sauk Rapids and St. Cloud which was of slight value. It had a wooden car shed in St. Cloud worth perhaps $500, and a slab shed at Sauk Rapids costing $150 to $200. There were 6.72 miles of track, with 40-pound T rails, one generator and ten cars, one of which was second-hand. The above mentioned items cover nearly everything of any value in the inventory. Summarizing, we find the total value of the tangible property of the company about as follows:

Property.	Value.
7 miles single track, with overhead construction @ $7,000 per mile	$49,000
10 motor cars	25,000
Type D T.-H. generator, 62 K. W.	2,250
Car sheds	700
Unimproved real estate	500
Miscellaneous	5,000
	$82,450

as against the $204,540 claimed, an inflation of $ 22,090, or over 100 per cent. in the property account.

In the statement given by this company to the *Street Railway Journal* the track mileage is given at 13.2—10 for St. Cloud proper and 3.2 for the Sauk Rapids branch. Mr. Byllesby's young men must have measured both rails in making up these figures, as the actual mileage is for St. Cloud 4.04 and for the Sauk Rapids branch 2.68, or a total of 6.72.

The franchise is valued at $20,460. Just what this was worth will be made clear later in examining the earning capacity of the road.

The franchise need not be taken into account at all in arriving at the real condition of the property, which is shown by the following:

CONDENSED BALANCE SHEET, ST. CLOUD CITY STREET CAR COMPANY APRIL 30, 1893.

Liabilities:		
Capital stock	$100,000.00	
Bonds	125,000.00	
Notes	21,482.82	
		$246,482.82
Assets:		
Real estate, franchise and plant		$82,450.00
Deficit		**$146,032.82**

It is, however, apparent that the "Trial Balances" of all these enterprises meant little more than that the officials delegated to make them up had a severe trial to make them balance at all. The balance was only brought about by making an arbitrary valuation of the property and franchise accounts as large as was necessary to accomplish the object in view.

EARNING CAPACITY.

But while the property of any company may be too small apparently to justify its capitalization, it sometimes happens that the earning capacity is so great as to fully justify it. Was this the case at St. Cloud City? In answer we print the official statement of earnings, expenses and interest for a period after the capitalization of $225,000 had been placed upon the property.

[COPY.]

ST. CLOUD CITY STREET CAR COMPANY.

STATEMENT OF EARNINGS AND EXPENSES FOR TEN MONTHS ENDING APRIL 30, 1893.

Earnings.		
Earnings from fares collected	$11,788.89	
Earnings from advertising	50.00	
		$11,838.89
Expenses.		
Transportation	$4,840.8	
Motive power	3,896.98	
Maintenance of cars and motors	2,946.09	
Maintenance of way	789.64	
Office and superintendence	764.9	
Insurance	3.9.50	
General expense	188.46	
Taxes	3 8,8	
		$14,025.60
Deficit (for 10 months)		**$2,186.71**
Interest.		
Interest on bonds	$1,072.2	
Interest on notes	795.00	
		$1,867.42

It will at once be noted that there was a deficit according to the official report then made in actual operations for ten months of $2 186.71, and of $1,867.42 additional for interest *paid* on bonds and notes. Clearly the *earning capacity* of this road did not present any offset for the deficit in assets as against capital liabilities, and it is equally clear that there is nothing unfair in leaving out of consideration altogether the franchise, which was valued in the preceding official statement at $20,460. The franchise of a railroad company earning only $11,838.89 gross in ten months and losing $2,186.71 in operation alone can scarcely be said to have any value.

Moreover, the official statement of earnings, etc., as above is not at all a correct showing. The actual situation, taking into account the essential items omitted in preparing the above statement was as follows:

PROFIT AND LOSS ACCOUNT ST. CLOUD CITY STREET CAR COMPANY APRIL 30, 1893.

	10 mos.	Yearly rate	
Earnings	$11,838.89	$14,206.56	
Expenses	14,025.60	16,830.2	
Loss from operation	**$2,186.71**		**$2,624.16**
Fixed charges:			
Interest on bonds, $125,000 @ 6 per cent		$7 500.00	
Interest on notes, $21,482 82 @ 10 per cent		2,148.28	
Loss			**$9,648.28**
Add:			
6 per cent. depreciation on inventory of $204,540			$12,272.40
Dividends on $100,000 stock at 6 per cent			6,000 00
Total deficit in operation			**$30,564.84**

NOTE.—The official statements of the St. Cloud City enterprise with which we have at hand are all made up for the ten months ending April 30, 1893. For the sake of a clearer understanding of the figures, we carry them out at the proportionate rate for the full year.

The company could scarcely have been kept afloat for the 30 days during which the bonds were being issued except by giving its notes to the Northwest Thomson-Houston Company for money advanced. These notes were then discounted at the St. Paul and Minneapolis banks by the Northwest Company, and renewed over and over again as they became due.

The computation of 10 per cent. annual interest on notes may seem to our Eastern readers as being entirely too high a rate. Quite the contrary is true, however. The rates paid by the Northwest Thomson-Houston (General Electric) Company were rarely less than this, and often ran as high as 20 per cent., proof of which we shall soon present. In fact, these high rates of interest are quite common in that section, even in legitimate lines of business, *cash* being scarce, and nearly the entire business community being borrowers. When the rates paid for discount by the Thomson-Houston people were abnormally high, the paper was usually handled by *insiders*, thus preventing the fact of the company's pressing need of money from reaching the banks.

WHAT THE ROAD SHOULD HAVE EARNED TO MEET ITS OPERATING EXPENSES AND FIXED CHARGES.

In order to leave no loophole for the escape of the people who engineered this deal, by which it was hoped to sell $225,000 of worthless securities to Eastern investors, and to swell the paper profits of the General Electric Company, we will consider the official statements of the St. Cloud City Street Car Company in the light of well-established laws as to per capita capitalization and percentage of earnings to fixed charges.

It is and always has been well known that a railway company cannot succeed at all in a community of less than 1 ,000 people. Mr. E. E. Higgins, whom we have often quoted, says the securities of no railway in a town of less than 25,000 people are worth the consideration of other than local investors who can watch their own property closely. In towns of 25,000 to 35,000 people he finds, from the records of all the roads in that class, that a capitalization of $12.50 per capita is the maximum permissible. This St. Cloud road should, of course never have been built at all, hence neither Mr. Higgins's figures nor any other figures can be used in estimating what the road and its financing ought to have been. They ought never to have been heard of, and would not have been heard of if their existence had been dependent upon the personal investments of the men who planned the trade, and who relied on shifting the burden upon the ignorant purchasers of the securities.

Probably the one law of street railways best established is this, that the operating expenses must be about 75 per cent. of gross earnings, leaving 25 per cent. for interest on bonds, floating debt, depreciation, and dividends, if any. Applying this law to the St. Cloud property as we did to the Winona enterprise, we have the following result:

The yearly fixed charges were:	
Interest on bonds	$7,500.00
Interest on notes @ 10 per cent	2 148.28
Allowance for depreciation should have been 6 per cent. on $204,540	12,272.40
Dividends on $100,000 stock at 6 per cent	6,000.00
	$27,920.68
which is 25 per cent. of what the road to be a sound property needed to earn per annum, or	$111,682.72
Actual earnings were (yearly rate)	$14 206.56
or about one-eighth of what they must have been to justify the capitalization of $225,000.	
Deduct from $27,920.68, as above, the $6,000 item for stock dividends, which it may be argued did not need to be paid, and we have	$21,920.68
which is 25 per cent. of what the road needed to earn in order to exist at all, or	$87,682.72
about eight times the gross receipts of the road after it had been electrically equipped, managed by supposed experts and capitalized for $225,000.	

CONCLUSIONS.

We think our original proposition, that "the probable or possible success of a local enterprise did not enter into the calculations of these Thomson-Houston financiers," is fully proved. A comparison of the scheme at St. Cloud with that at Winona shows that the more hopeless the prospect of success the more the capitalization was piled on. At Winona (pop. 18,200) the electric railway system alone was capitalized at $200,000, whereas at St. Cloud and Sauk Rapids (combined pop 8,868) it was capitalized at $225,000. This difference was possibly due to the fact that St. Cloud was further from civilization, and that the actual value of the property was less easily determined by Eastern investors.

We have been unable to learn just where the securities of this grand enterprise have been negotiated. That they have been negotiated is apparent, for in the recent list of General Electric assets there appears only a small portion of them, "Bonds St. Cloud City Street Car Company, $5,000." None of them appear to have been turned over to the United Electric Securities Company, the Electrical Corporation or the Street Railway and Illuminating Properties. Hence we infer that they are up as gilt-edged collateral with some of Mr. Coffin's banking friends for a loan either to Northwest General Electric or General Electric.

The officers of the St. Cloud Company are: President, H. M. Byllesby; vice-president, C. K. Stearns; secretary and treasurer, George C. McKnight; superintendent, C. S. Benson. Of these gentlemen, Mr. Byllesby was the manager of the defunct Northwest General Electric Company, which failed to make a success of its remarkable plan of financing, and Mr. McKnight was chief bookkeeper for the same concern.

Two of the ten cars given in the last report of the company seem to have fallen to pieces, or perhaps they are still up as collateral in the hands of the authorities, as on May 31 last, according to our reports, the cars of this company were levied on by the sheriff for personal taxes. At any rate, the Mayor of St. Cloud City wired us as follows on July 25: "The St. Cloud City Street Car Company has eight cars; service excellent."

Probably the Mayor is a good pedestrian, and does not mind walking across the 600-foot bridge, or possibly his official duties never take him to the terminus of the St. Cloud City (pop. 7,683) Street Car system—Sauk Rapids, Benton County (pop. 1,185).

Those who follow us through this series of articles must not lose sight of their ultimate object. It is to prove that the very scheme of financiering which has become so conspicuous through the sensational career of the Northwest Thomson-Houston (General Electric) Company is not different in any particular from that followed by the Thomson-Houston Electric Company of Boston, and that Mr. Coffin's chief reason for desiring a consolidation of his company with the Edison Company was that the game had been played almost to its limit in Boston and with exclusively Thomson-Houston local properties. The consolidation of the two parent companies—Thomson-Houston and Edison—gave Mr. Coffin such opportunities as he had scarcely dreamed of in the earlier days for amalgamating innumerable local companies, either paying ones or otherwise, changing the name to the —— General Electric Company, doubling the stock and tripling the bonded debt. And the scheme was worked at such a rapid rate after the formation of the General Electric Company that the $10,000,000 cash raised from the bond issue disappeared as if it had melted, the treasury became filled with worthless securities, the company came within 24 hours of confessing bankruptcy, and the fallacies of the scheme were made known to the world.

ELECTRICITY has almost proved, we think, that the results were no accident, but the inevitable end of a preconceived plan for swindling the public.

The Last Vestige of Monopoly Gone.

WESTERN ELECTRIC CO. WINS IN THE DOUBLE CARBON ARC LAMP CASE.

Double Carbon Lamps May Now Be Made by Anyone.

In the suit of the Brush (General Electric) Electric Company vs. the Western Electric Company, for infringement of the Brush double-carbon lamp patent, Judge Showalter, in the United States Circuit Court at Chicago, on July 24, decided that there is no infringement in the Western Electric's double-carbon lamp, and put an entirely different construction upon the Brush patent from that of Judge Brown and Judge Gresham in previous cases:

THE DECISION.

In each of these causes [The Brush Electric Company vs. the Western Electric Company, in equity, Nos. 21,545 and .2,211, U. S. Circuit Court Northern District of Illinois] the ground of action is an alleged infringement of patent 219,208 for an electric lamp or light regulator, issued September 2, 1879, to Charles F. Brush, said patent being the property of complainant company.

It is claimed that electric lamps made by defendant company pursuant to patents 416,758, 502,585 and 502,586, issued to Charles E. Scribner and assigned by him to defendant, infringe the said Brush patent.

There are seven claims in the said Brush patent. On the contention of complainant an infringement of each of these, numbered from one to six, is shown in each of the present causes. But this contention rests upon a construction of the Brush patent, extending in common to each of said claims, which is earnestly disputed by the defendant. The controversy, so far as it involves in common each of the six claims as contested in each suit, hinges upon this one point of construction.

If two parallel pairs of carbon pencils with the points of each pair touching are placed in an electrical circuit so that in case either pair were removed the current would still pass through the other such current will divide between the pairs. If such pairs be now separated at once and by a common and uniform movement, the arc will appear between the points of but one pair. It is not practicable to make the points of the carbons impinge so that the resistances through each pair shall be mathematically equal, nor is it practicable to separate the points so that the parting on one side shall be identical in time with that on the other. The reason why the arc forms between one pair only may be said to be that the other pair in fact parts first, thus throwing the entire current through the pair between which the arc forms.

While the partings may be in appearance simultaneous they are not so in reality, or, if we say the partings are in fact simultaneous then the resistance, being accidentally greater on one side, determines the formation of the arc on the other.

On May 7, 1878, complainant's assignor, Brush, patented a contrivance for feeding one carbon pencil toward the other so as to preserve a practically uniform distance or length of arc between the burning points till the carbons should be consumed.

On September 2, 1879, Brush secured, as before stated, the patent in suit. To his invention as above described he added a second pair of carbons, a second pair of carbon holders and a second movable or feeding carbon rod. Each carbon rod passed down through its ring clamp, marked the one C and the other C' in the new patent. The lifter, marked D in the new patent, was triangular in form with a stirrup at the top in which was fastened a lever which was to be operated by magnetic attraction. At each lower corner of said lifter D was an opening formed by two short projections, one above the other, each opening enclosing the edge of its appropriate ring clamp C or C'. The lower arm or section of one of these openings was below the plane of the corresponding part of the opposite opening, so that, when the current passed through the carbons, as the lifter D was pulled up it first engaged the ring clamp of the added carbon rod separating the added pair of carbons, and after an interval of continuous movement the ring clamp of the other carbon rod was engaged by the other corner of said lifter D. The two rods continued thence to move together until the lifter D stopped, and the arc was formed between the carbons which were last separated. The latter pair of carbons being fed together and continuing to burn until consumed, the added pair of carbons then part and form the arc and continue to burn until consumed, in manner as stated in said first patent to Brush. After the first pair of carbons have been consumed and have ceased to burn, the lamp in parting and burning the remaining pair is substantially identical with the invention described in said prior patent.

The ideas of the Brush invention in suit were apparently these:

(1) By separating the added pair of carbons first he threw the entire current down the other pair, and thus determined that the arc should form between said other pair, or pair last separated.

(2) By separating the added pair at a greater distance apart than the other pair he avoided accidental alternation in the arc between the two pairs.

(3) By permanently holding the added pair in such separated relation the first pair could be fed together and consumed without stop.

In his specification, Brush says:

"My invention comprehends broadly any lamp or light regulator where more than one set of carbons are employed, wherein—say in a lamp having two sets of carbons—one set of carbons will separate the other."

Again: "The operation of my device as thus far specified is as follows: When the current is not passing through the lamp the positive and negative carbons of each set A. A' are in actual contact. When, now, a current is passed through the lamp the magnetic attraction of the helices E will operate to raise the lifter D. This lifter, operating upon the clamps C and C', tilts them and causes them to clamp and lift the carbon holders B, B', and thus separate the carbons and produce the voltaic arc light, but it will be especially noticed that the lifting and separation of these carbons is not simultaneous. One pair is separated before the other, it matters not how little nor how short a time before. This separation breaks the circuit at that point, and the entire current is now passing through the unseparated pair of carbons A', and now when the lifter, continuing to rise, separates these points, the voltaic arc will be established between them and the light thus produced."

As already stated, after the first pair of carbons has been consumed so that the first carbon rod holding the stump of the burned carbon ceases to feed and the added pair of carbons thereupon part and burn, the lamp of the new patent, the special feature of the new invention being now superfluous, is substantially identical with the lamp of said first patent.

In the new patent—that in suit—Brush does not, in the specifications, describe, or in the claims refer to, the manner of burning the added pair as being a part of his new invention.

During the burning of the added pair the lamp has become substantially the invention protected by the said first patent.

The patentee says further, in the specification of the patent in suit:

"The lifter D, in the present instance, is so formed that when it is raised it shall not operate upon the clamps C, C' simultaneously, but shall lift first one and then the other (preferably the clamp C first and C' second, for reasons which will hereafter appear). This function of dissimultaneous action upon the carbons or their holders, whereby one set of carbons shall be separated in advance of the other, constitutes the principal and most important feature of my present invention."

The claims in controversy are as follows:

"1. In an electric lamp two or more pairs or sets of carbons, in combination with mechanism constructed to separate said pairs dissimultaneously or successively, substantially as and for the purpose specified.

"2 In an electric lamp two or more pairs or sets of carbons, in combination with mechanism constructed to separate said pairs dissimultaneously or successively, and establish the electric light between the members of but one pair (to wit, the pair last separated), while the members of the remaining pair or pairs are maintained in a separate relation, substantially as shown.

"3. In an electric lamp having more than one pair or set of carbons, the combination with said carbon sets or pairs of mechanism constructed to impart to them independent and dissimultaneous separating and feeding movements, whereby the electric light will be established between the members of but one of said pairs or sets at a time, while the members of the remaining pair or pairs are maintained in a separate relation, substantially as shown.

"4. In a single electric lamp, two or more pairs or sets of carbons, all placed in circuit, so that when their members are in contact the current may pass freely through all said pairs alike, in combination with mechanism constructed to separate said pairs dissimultaneously or successively, substantially as and for the purpose shown.

"5. In an electric lamp wherein more than one set or pair of carbons are employed, the lifter D or its equivalent, moved by any suitable means, and constructed to act upon said carbons or carbon-holders dissimultaneously or successively, substantially as and for the purpose shown.

"6. In an electric lamp wherein more than one pair or set of carbons are employed a clamp C, or its equivalent, for each said pair or set, said clamps C adapted to grasp and move said carbons or carbon-holders dissimultaneously or successively, substantially as and for the purpose shown."

The patentee said further in his specification:

"I do not in any degree limit myself to any specific method or mechanism for lifting, moving, or separating the carbon points or their holders, so long as the peculiar functions and results hereinafter to be specified shall be accomplished."

The specification and claims were evidently prepared with the idea that *the mode of movement*, to wit, the rapid, successive and continuous separation between the pairs of carbons terminating in the arc between the pair last separated could be secured to Brush regardless of the mechanism by which this mode of movement should be produced. In Brush Electric Company vs. The Fort Wayne Electric Light Company, Judge Gresham held, answering the contention that the first, second, third and fourth claims were for functions or results and hence void, that mechanism such as described in the drawings and specifications, or a substantial equivalent, was an essential element in each of said claims. I am not called on to determine these constructions, but the conclusion reached apparently in the Toledo case, that no one of these claims contains the element of dissimultaneous or successive separations between the members of each pair of carbons for the purpose of forming the arc between the pair last separated, seems to me unsound.

The patentee says:

"In the lamp as shown in the drawings the support K is in the form of a tube surrounding the carbon holder B and this support K is made of such a length that when the carbons A' shall have been sufficiently consumed a head upon the carbon-holder B will rest upon the top of the support K, whereby the weight of the carbon-holder B and its support K shall at all times and under any circumstances be supported by the lifter D."

In other words, and without going again over the mechanism, the lamp is constructed so that the carbons A shall first burn. By reason of the support K being carried on the upper carbon-holder of the first pair of carbons to burn, and of the greater distance between the two carbons of the added pair, said added pair could not be burned first.

It is, in other words, the characteristic feature of this lamp, the very purpose signified by its construction, that the position of the first arc shall be determined before lighting as between the two pairs of carbons.

Yet in the opinion in the Toledo case this is declared to be "a wholly immaterial and useless feature."

Even if it were, in fact, immaterial which pair of carbons burned first—supposing it to be true that if the carbons were separated simultaneously instead of dissimultaneously the lamp would still operate—the fact remains that the patentee took from the Government claims in which the dissimultaneous separations are the special feature. Moreover, the feature of dissimultaneous arc-forming separations—referring here to the interval of hours between the arc forming separation of the first pair to burn and the arc-forming separation between the added pair—is not in any one of the claims. In order to make out a case of infringement, the former element must be gotten out of and the latter must be gotten into each claim. This in my judgment cannot be done. The lamps made under patent 418,758 do not contain mechanism constructed to cause the dissimultaneous initial separations of the carbons, nor do the lamps made under patent 502,585, nor do the lamps made under patent 502,586. I hold, therefore, that no infringement is made out in either suit. The order will be in each case that the bill be dismissed for want of equity.

PREVIOUS LITIGATION ON THE BRUSH PATENT.

The first suit brought upon the Brush double-carbon lamp patent 219,208 was that against the Fort Wayne Jenney Company upon the Cain lamp, which was then manufactured by the Fort Wayne Company. This suit was decided in the latter part of 1889, and was begun, we believe, in 1886 or early in 1887. A decision in favor of the complainant was rendered by Judge Gresham at Indianapolis, the only defence in this case being the invalidity of the patent. Infringement was practically admitted. Suit was also brought against a user of the Indianapolis Jenney Electric Light Company's double carbon lamp, which also was practically admitted an infringement, and of course a decision was reached in favor of the complainant

In 1887 suit was begun against the Western Electric Light Company of Toledo, Ohio, which used the Scribner lamp, manufactured by the Western Electric Company under patent 418,758. Here an entirely new question was brought up, but the court failed to understand the matter correctly and a decision was reached finding the defendant's lamp to infringe. This was in August, 1890. Prior to that time suit had been begun in the Northern District of Illinois against the Western Electric Company, and upon the finding of the court in the suit at Toledo, Judge Gresham granted a preliminary injunction upon this same Scribner lamp which had been found to infringe in the Toledo case.

In getting the Brush double-carbon lamp patent sustained, the Brush Company's counsel and experts had limited the claims to a single lamp controlling two sets of carbons. After the decision in the Toledo case, and after Judge Gresham had granted a preliminary injunction in the suit against the Western Electric Company, at Chicago, the Western Electric Company began the manufacture of double lamps, that is, lamps which, instead of being single, each controlling two sets of carbons, were two separate lamps enclosed in one case, each separate lamp controlling one set of carbons. The Brush Electric Company attempted to get a snap judgment of infringement against these devices by making a motion for attachment for contempt of court. This motion was made and argued before Judges Gresham and Blodgett in February, 1891, and marked the turning point in the career of the Brush double-carbon lamp patent in the attack of the Brush Company on the Western Electric Company. After this motion for attachment for contempt of court had been dismissed, a new bill was filed by the Brush Electric Company against the Western Electric Company upon the two forms of lamp above described, in which each set of carbons was controlled by a separate electro-magnetic mechanism, and the proofs in the two cases, the one involving the original lamp which had been adjudged to infringe at Toledo and the other involving the so-called twin lamp above described, have been proceeding for the four or five years since that time. The two cases were finally brought to hearing the first of last May, and resulted in the decision of Judge Showalter limiting the Brush patent and finding that neither the original Scribner lamp involved in the Toledo case nor the twin lamp involved in the subsequent suit infringed the Brush patent.

For the purpose, apparently, of intimidating intending purchasers and harassing a competitor, the Brush Electric Company has filed bills against a large number of users of double-carbon lamps, in which cases no steps have been taken by complainant at all. There are some fifteen or more of these cases, some of them against municipalities in various parts of the country. Of course, in view of the decision of Judge Showalter, nothing further will be done with these suits.

Litigation against some other manufacturers of double-carbon lamps has been proceeded with in other circuits, and in some instances settlements have been made, the defendants being influenced thereto by the opinions of the courts in the various cases which had been contested.

Photographs of Lightning.

We have from time to time published interesting photographs of lightning flashes. The officials of the Weather Bureau are now making photographic experiments which they hope will prove valuable, not only to science, but also from a practical point of view as giving an idea of the necessary protection for houses in the city and country. Alexander McAdie has been engaged in investigating thunder and lightning since 1882. He has made a large number of interesting photographs of lightning, and this summer proposes to carry out an idea which was original with him. He hopes, with the aid of three cameras stationed at different points, to ascertain the actual dimensions and power of lightning flashes. The tip of the Washington monument has been selected as the point on which Mr. McAdie's three cameras are sighted. It is the most exposed object in the District of Columbia, the play of lightning around the tip being very frequent. One of Mr. McAdie's cameras is on the roof of the Weather Bureau, another in one of the committee rooms of the Capitol and a third is at a station back of Fort Myer, across the Potomac River. The distance from the three stations to the monument is accurately known, and Mr. McAdie's object is to get photographs from the three stations simultaneously of flashes of lightning around the Washington monument.

With the three cameras, the flash which is foreshortened from the Weather Bureau station will be visible in its entire length from the station at Fort Myer, or at the Capitol committee room. If Mr. McAdie should succeed in getting a photograph of a lightning flash from the three stations, the bolt itself will be afterward remodelled and set up at the Weather Bureau. Computations as to that particular bolt can be made with considerable accuracy and the bolt would be valuable for comparison

Mr. McAdie has also devised an interesting apparatus for measuring the duration of the flash. Inside of a camera there is a small tin plate with fasteners to receive a sensitized plate. This plate is made to revolve very rapidly. When the flash is photographed on the revolving plate it will describe a curve making a certain number of revolutions around the center of the plate. As the number of revolutions per second is accurately known, the number of revolutions on the plate will give the exact part of a second the lightning flash has lasted. The results from this contrivance have been very successful. The Weather Bureau will shortly issue a pamphlet on protection from lightning, which was written by Mr. McAdie. It will give some important statistics of actual losses, together with the theory of protection.

There will also be directions for procedure in cases of apparent death from lightning stroke. Statistics show that in five years, from 1890 to 1895, 1,120 lives were lost, an average of 224 lives a year. The greater number of accidents occur in the five months from April to September. The report will show that many persons injured by lightning stroke die because of a lack of proper attention. In many cases animation is merely suspended, the shock causing the sudden arrest of the respiratory and heart muscles. The directions are based upon Dr. Augustin H. Goelet's book, "How to Deal with Apparent Death from Electric Shock," revised and modified for cases of apparent death from lightning by Dr. W. F. R. Phillips of the Weather Bureau.

Things Seen by an Engineer in a California Electric Light Station.

An engineer who recently "looked over" an electric lighting plant on the Pacific slope had this to say about it when the inspection was at an end:

A barn seems to be the proper kind of a building in which to place electric machinery, engines, boilers, etc., for a central station, that is, if the barn happens to be located in the central part of the city.

I think this station one of the best and most conveniently arranged places I have ever seen—for a man in poor circumstances, who has an accident insurance policy, or is desirous of assisting his family by sacrificing a few limbs for good fat damages. High speed belts are more plentiful than passageways, and there are no guards nor rails to prevent a man from trying the speed of the belts. In fact, there are some things that would be of considerable assistance to him in such an undertaking. There are belts running just a little below the surface of the floor, which is well lubricated and slushed.

If a man got into one of the belts, or took a few turns around the unprotected ends of one of the shafts, I think that his family would be entitled to all that the law allows.

Speaking of the floor, it was impossible to tell what it was made of. However, there was oil and dirt in a great number of layers. One of the attendants was directed to clean up the floor, and started in with a hoe. I advised him to get a plow to start with, but he thought he could find bottom after a while without it. No rubber mats are used around the dynamos, and on asking if there were none around, I was informed that oil insulation was the latest fad. This is certainly an economical idea in a place where two 50-light arc machines are run in series.

All station and switchboard wiring is done with weatherproof wire, whether it be a 1,000-volt alternating circuit or a 4,000 volt arc circuit.

The switchboard connections are a puzzle beyond solution, and the arc switchboard is located in a small bay, with the incandescent switchboard in front, making practically a closet of it. This closet seems to me peculiarly adapted for electrocution purposes.

Light where it is manufactured seems to be a luxury. There are in this station eleven 16 c. p. incandescent lamps and one poor arc lamp to give the necessary light to operate five engines and ten dynamos. As for reading the instruments during the tests, I found it necessary to use a lantern. This lantern was, I suppose, the emergency light of the station, and had a globe which I was told was broken last winter. All the lantern oil in the place was in the lantern, and lasted for about two hours. The interesting points were very numerous, but their general tenor was monotonous and uniform, and it is needless to say that the station was not paying very large dividends.—*The American Gas Light Journal.*

M. Berthelot announces that he has succeeded in making argon combine with bisulphide of carbon under the action of the electric discharge. M. Berthelot subsequently recovered the argon that had combined with the bisulphide of carbon.

Attempted Elevator Monopoly.

MR. FRANK J. SPRAGUE REPLIES TO MR. R. T. CRANE.

To the Editor of ELECTRICITY.

DEAR SIR: Your issue of July 17 contains a letter from Mr. R. T. Crane, President of the Crane Elevator Company of Chicago, for answering which I have to ask the courtesy of your columns.

Mr. Crane's letter, like many of the moves which have been made against the Sprague Company, will, I think, prove a mistake. It was probably written under some misapprehension, and certainly in ignorance or disregard of a number of important facts with which he should be familiar. It is interesting as containing some important admissions, notably the responsibility of the Crane Company for the legal attacks made upon the Sprague Company through the Minneapolis Court House Commission, despite the vociferous denials to the contrary in the public press at the time.

Mr. Crane's letter treats of three things: The attack of ELECTRICITY upon the hydraulic combination, the general subject of elevators, and finally a letter concerning elevator tests.

So far as the first is concerned, since the Sprague Company has nothing to do with it, present discussion would not be pertinent. If it pleases ELECTRICITY to take up as a subject for investigation the doings of the hydraulic combination that is a matter which concerns it. Attacks which we make are made directly, and not, unless we are forced to do so, through the medium of any newspaper.

That ELECTRICITY should be fortified in its assaults by a paper written by me may be a misfortune for the Crane Elevator Company, but I would remind Mr. Crane that the existence of the Minneapolis paper is directly due to attacks which his company made upon us at the time. So for the present, as far as that subject is concerned, I will leave the Crane Company and your paper to fight it out on your own lines.

Mr. Crane says that I have taken the bull by the horns. That is true, but I am not in the habit of taking hold of an obstreperous animal at the danger point unless I am pretty certain of my grip, and that in the end the bull will have to come down. It will be so in this case.

Let me examine for a moment this particular animal and see why its aquatic blood is so aroused by the subject of an electric elevator.

What is an hydraulic elevator system? Is it something unique? Is water in itself a power as distinguished from electricity? Do the various elements which go to make up such a system in themselves represent the best typical methods in power generation, transmission or utilization? Let us examine it in detail.

It consists primarily of a steam cylinder, or a multiplicity of steam cylinders, worked ordinarily under poor conditions of steam economy, that is, with a fixed cut-off in the high pressure cylinder of a compound pump, and no cut-off in any cylinder of a simple pump. This element corresponds to the cylinders of a steam engine in the electric system, which use steam expansively with a cut-off varying according to the load, and under pressure conditions which are somewhat better than exist in a pump. It is to duplicate the results of this system of variable cut-offs and steam expansion that the energies of the various pump builders have been more or less ineffectually bent for a great many years in plain acknowledgment of that defect in their simple and duplex pumps, the latter of which is common to almost every hydraulic plant of any moment in the United States.

The next element is the water cylinder, which corresponds to the dynamo in the electric system, and on account of the high friction due to packing, the efficiency of a water cylinder with its valves is not ordinarily equal to that of a dynamo, which with a motor stands to-day the typical example of an efficient energy converter.

The next element is the piping and the tanks, compression or roof, and perhaps an accumulator, into or through which the water is pumped for delivery to the controlling valves of the elevator, and the element which corresponds to this in the electric system is its simple wiring, and if a storage battery is used, then this last in conjunction with it.

Any competent engineer knows that measured by standard practice a given number of pounds of energy can be delivered to the controlling apparatus of an electric elevator for less pounds of steam, that is, water evaporated, through the medium of no less than fifty combinations of engines and dynamos, than can be delivered to the valves of any hydraulic cylinder through the standard pumps permissible in average elevator service. To be specific, the average water evaporation on a compound duplex pump, which is almost universally used, will in practice be not less than about seventy pounds per H. P. of water energy delivered to the valves, whereas the electric combination will easily give the same for less than forty pounds.

There are exceptional conditions in which a higher steam economy can be gotten in an hydraulic system, but they are few and are not typical, and under equal conditions the steam consumption in an electric system can be cut in two.

But this is not all. The fact is persistently ignored, although the attempt is made to offset it by recent experiments with a differential piston, that a standard hydraulic elevator uses the same amount of water under the same pressure for every foot of travel of a car, which volume of water and pressure are determined by the maximum load which has to be carried, although the average load on the rope, including the excess of car over counter-weight, is not over one-third of the maximum. On the other hand, the electric elevator uses, and must use, under normal conditions, current directly proportional to the load, modified in a small degree by starting and slow running.

In short, over and above the friction load of the generating system, the steam consumption in the engines the generation of electricity in the dynamo corresponds instantly and absolutely with the demand of the elevator machines. It is a system which is of necessity automatic. On the other hand, the hydraulic system is one of the most flagrant violators of the relation which should exist between demand and supply. It is a system of transmission by water, having at one end a generating plant doing full duty for every foot of travel of its piston, with a variable duty on an elevator car at the other end, and an intermediate straight line water engine with its pipes and tanks taking care of that variable duty and using the balance of its energy in heating the water which passes through its valves.

So much for Goliath—let us turn to David.

Mr. Crane waxes historical and says that in the early introduction of electricity as a power, quite a number of elevator builders immediately went to work to perfect and build electric elevators; and he states that the Sprague Company has violated pretty nearly every well-established law in the development of its apparatus.

I will have to call Mr. Crane's attention to a little history and a few facts. Almost the first, if not the first, commercially operated electric elevator in the United States, which continued to operate, was installed by the writer, now some eleven years ago. It is true it was a freight machine, and with nothing particularly characteristic of it excepting the fact that electricity was used. It was nearly five years before the elevator companies would concede in the slightest degree the utility of even this use of electricity, and almost the first move in this direction was its minor use in connection with a gas engine to operate a pump. This particular infant early gave up gasping for breath, and it is not now a serious factor in the elevator field.

Mr. Crane intentionally confuses the Sprague electric elevator with that which has been built by other companies, and while acknowledging, as did all his business associates, who accommodatingly signed affidavits against us at Minneapolis, that their own electric elevator was unfit for serious office duty, attempts to apply the same limitations to our machines.

I would remind him that there are two types of machines, one the worm gear and drum, and the other the screw, and that while this company builds both, the hydraulic companies build only the former; that as they make a limitation in the possibilities of that type, so does this company draw an absolute line of distinction between the possibilities of the two, and that on the score of limit safeties without regard to anything else whatever.

Mr. Crane complains that we have violated the best principles in elevator practice. In order that he may understand perhaps a little more fully just what the screw machine is, I will briefly describe it.

There are in such a machine three things besides safety and economy to be considered. These are the multiplying sheaves, the nut and screw, and the electric motor and regulator. With regard to the first, all that can be said for or against them is nothing more nor less than the stock arguments for the various types of the vertical and horizontal hydraulic machines, because the rope movement is practically the same.

As to the nut and screw, we may be pardoned if we have not taken into our confidence the representatives of the hydraulic interests; but the so-called "impossible" ball, nut and screw keeps on working twenty-four hours a day, with less wear and tear and depreciation, measured in dollars and cents, and less trouble, than are common to the piston packing and cylinders of its competitors.

Antiquity is not the only gauge of merit, nor is experience a part of the capital solely of the hydraulic companies, for so far as the motor is concerned, while not so old as the hydraulic elevator as a commercial machine, there have been built since 1888, on the model and type originated by me, for railway work alone, more electric motors than there have been built hydraulic elevators by the combined companies in this country during the past twenty-five years. So that as regards perfection of construction, capability of standing severe usage, and for general utility and reliability, the electric motor, notwithstanding its youth, will compare very favorably with its aged rival.

In the three years that have passed, despite all the efforts of opposing interests, this screw machine has been developed to a state of perfection in which certain characteristics are well established, to which I will call attention.

Compared with the hydraulic, it is as safe, or safer, for not only has it all the safeties which the older system has, but it has two new ones — the centrifugal, which prevents a car running away too fast under certain conditions, and an automatic car control—neither of which is practically possible to the hydraulic elevator.

The machine has any required lifting capacity and speed. It has any required refinement of control. It can be started as suddenly or gently as desired.

It occupies less space, most appreciably so in high buildings, and all the machinery is in the basement, where it belongs.'

Like parts in different machines are interchangeable.

It is far more accessible. Most of the wearing parts are in plain sight, and repairs when necessary can be made in a shorter time and with less outside extra work.

It can be run from a local plant or from the street, and its cost of operation, measured by repairs and coal consumption, is less than one-half that of the standard hydraulic elevator.

Mr. Crane, while admitting that there is a field for electric elevators when supplied from a central station, naively says that "it never occurred to him" that when departing from a central station supply a private generation of electricity could be economical on the scale required in an elevator service. Where has Mr. Crane been for the past few years? Is he not aware that this same question was long ago settled in the matter of generation of electricity for lighting under the conditions which exist in large buildings? Is he not aware that almost every large office building in the United States, every hotel, in fact every building of appreciable size, finds that, all things considered, it generates current for less than central stations at present will generally supply it, and in fact that they are so generating current? Does he not know, and if he does not, should not his engineers know, that a central station has in addition to the cost of generation the cost of distribution and meterage, that it must oftentimes pay an interest on patents, must earn a dividend on bonds and capital representing more than the actual cost of its buildings, land and equipment? Does he not realize that many of these charges do not exist in an ordinary office building, that no additional land has to be bought for its plant, that there are no patent expenses, that there are no costs for distribution, no municipal or aldermanic expenses?

But this is not all. Every engineer knows that the fewer the number of well proportioned units the more alike they are, the greater the interchangeability between themselves, and the greater the extent to which any one unit can be utilized, the better the system for power generation and conversion, no matter what its character.

The best modern practice makes a three-unit direct-connected engine and dynamo plant the best for lighting a building. There is an empyrical relation existing between the number of lights required in a building as ordinarily designed and the elevator service.

When in addition to the lighting service such a building adopts electric elevators it is not now necessary that it shall add an independent generating plant. All that is required is that its three units should be somewhat increased in size, that their mains shall all be taken to a common switchboard with 3-way switches, and every engine and dynamo thus made interchangeable on either the lighting or elevator circuit, and at times both can be run from the same engine and dynamo, so that instead of five or six units, some water and some electric, the entire generating plant is reduced to three units, each of which is interchangeable, and one of which is almost always in reserve. Does this engineering fact appeal to Mr. Crane? Possibly not, but it is a system which has already been adopted in a number of important buildings which this company is equipping with elevators.

Apparently Mr. Crane is not very familiar with the present status of electricity in its application to the transmission of power, a field in which the writer by good fortune has been somewhat active, and in order that he may, through reasoning by analogy, learn something of the probable future of the electric elevator, I will touch briefly upon some of its developments.

Why has the trolley system, born only eight years ago, driven the horse from the street? It involves great initial expense, the conversion, distribution and re-conversion of energy. It faced all the powers of conservatism, ridicule and fear. It had to combat the allied forces of the Bell telephone interests, tested by court action in over twenty States. It had the opposition of the strongest municipal and corporate influences. Every detail of the system had to be created, and yet it stands to-day unrivalled in its industrial progress.

Why is the same trolley system driving the cable to the wall, and why has its adoption marked the abandonment of a plant costing not less than $3,000,000 in the city of Philadelphia? Are there many more examples of the direct applications of force than the cable system, many closer connections between a great engine built for the highest economy and that which it moves?

Why is the steam locomotive giving way to the electric motor on suburban service? Is there any more direct example of the application of steam than is presented by a locomotive, the power of whose cylinders is transmitted directly to the drawbar through the intermediary only of a crank?

Why does the best shop practice dictate the abandonment of the slow speed, highly economical Corliss engine and the direct application of power by belts and shafting, and adopt the high speed engine and direct-connected dynamo at a central station, with the conversion, distribution and reconversion of energy by a dozen different motors at a greatly increased expense? Is it for any other reason than convenience, reliability and economy of operation?

Why has every overhead crane builder in the United States within the past four years absolutely abandoned wire rope, square shaft and hydraulic transmission for the three-motor transmission advocated by the writer only nine years ago? Is it because it is simpler, because it will cost less, or because it is more economical, more flexible, and because it answers the purposes better than the other and more direct systems?

Why have the great central stations of the country adopted electricity for the transmission of power to the hundreds of industries within the radius of their supply, and into what form of energy is the power of Niagara being converted?

In short, why is the transmission of power in almost every case where flexibility, convenience, economy, efficiency and reliability are required depending upon the electric method, not only in new work, but oftentimes to the replacing of older plants.

And so, perhaps, Mr. Crane believes, and hugs to himself the cherished thought, that the hydraulic elevator is to be the one bulwark to stand up against the assaults of this modern giant, that it presents such fixity of design, such refinement of processes, such excellence of results, such unchangeableness of methods, that its synonym is perfection.

As well might he and his confreres attempt to stem the tides.

Electricity is to the progressive man, to the modern engineer, a scientific religion. The belief in its future is in the air we breathe, the record of its accomplishments touches our daily life on every hand. Its progress does not depend upon one individual, but in its various departments more money is being spent, more energy concentrated, more brains are active than in any other industry in the world.

The hydraulic interests have depended upon their intrenched position, but now that the electric elevator is a success, there are other forces which will bring it rapidly to the front. The younger generation of engineers, men who are in the forefront of electrical development, men who are not tied down by conservatism, which is oftentimes the synonym of cowardice, believes in them. The system of generation which I have outlined appeals to them. The self-interest of dynamo and engine manufacturers is in the direction of electric elevators.

Owners of buildings, being themselves oftentimes owners of electric railways or central stations, see no reason why if electricity can be applied on one of the most difficult services in the world—that of traction—it should not be equally well applied to elevator service. The architect and builder sees the number of units in his building diminish. They see less variety and extent of piping, the bugbear of every building; less space is occupied; and the mountain of difficulties which has been raised by the self-constituted authorities on elevator practice are disappearing like the mists on a summer morning.

Mr. Crane says plaintively that the electric elevator is like other new things=that people may possibly take it, and perhaps they will pay more for it. I suppose he speaks with a keen appreciation of his own experience in new things, to wit: his recent devotion to high-pressure hydraulic elevator service, and possibly the history of the Schiller Theatre with its thrice constructed plant appeals to him with a good deal of force. So far as cost is concerned, it is not because the electric elevators have been offered at so much higher price as that the hydraulic elevator, in the attempt to save the situation, has been offered at a particularly low price, so that in effect people have been willing to pay a higher price, varying from 5 per cent. to 20 per cent., which is perhaps the worst possible commentary on the hydraulic elevator; and in the several instances in which the electric replaces the hydraulic and steam elevator, a notable example of which was in the Board of Trade, Chicago, the difference in cost is the entire cost of the elevator plant.

With regard to Mr. Crane's letter, the time is past when I can consider it seriously, but it may interest your readers to know how the letter came to be written.

When the subject of elevators was recently being considered for an important building in Buffalo where the building committee had relegated its powers of selection to a contractor who was under heavy bonds for the completion of the work within a given period of time, there was a meeting of the representatives of a number of the principal elevator companies called by the building committee to consider the possibilities of a comprehensive test between hydraulic and electric elevators. One of the hydraulic companies and ourselves had expressed a willingness to have such a test made, and the other hydraulic companies were likewise requested to become participants. These very remarkable conditions, however, were laid down, to wit: that the Building Committee was not aware what elevator the contractors considered most satisfactory in regard to price and other particulars, or what elevator would be selected by the architects, and that they would not wish to be bound in any way by the decision of a committee to accept the Sprague elevator whatever might be the result of the proposed test. It was further stated that the sum which would be paid for an elevator plant would not exceed a fixed amount.

I at once pointed out the absurdity of such conditions, and the utter uselessness, at least so far as we were concerned, of a test having no assured practical result, and called for the reading of letters addressed to the committee, which stated our position then and states it now. From these letters I make some extracts as follows:

"The Sprague Electric Elevator Company proposes the most comprehensive test of its electric machines, screw and drum, against the hydraulic and electric machines of all competitors" "under experts at a definite pay, the loser to pay for their services, none of the experts to be connected directly or indirectly with any electric or hydraulic elevator company."

"Five of the principal elevator companies are operated together as a trust, and since the hand of every one of them is raised against us, to make any test take in every company operating under like conditions."

"The object of a test of this kind, however, is not purely scientific, and if we go into a general test it will be for the purpose of demonstrating the superiority of the electric elevator as a system against all hydraulic elevators of whatever type or character."

"The test which we shall demand would be one involving every detail of manufacture, every element of construction and operation, and every emergency test that elevator experience has proved should be applied if the results of all the accidents which may and which have occurred are to be predicated. When that test is finished it would only be equitable, and it must be made a condition by the architect, the builder and your committee that if the result bears out the statements made by the writer, and the report of the committee is in favor of our machines, then the contract shall be awarded to the Sprague Company at an equitable price, recognizing in some measure the capitalized difference in the economy of operation."

"We prefer to have the very best men which can be obtained, which experts shall not come to New York under compliment to any company, whose expenses are not predetermined by any competitor, but as the best known independent experts in the departments of electricity, steam, water and mechanics, who have the necessary knowledge to make a most thorough investigation, and whose report will carry with it the weight which we wish."

"We repeat that if this test is to be made it must go to the bottom, and the examination shall be not only of existing plants, but the records of them shall be produced, and if the committee's report is in favor of this company, the contract must be awarded to us."

I further stated that the Sprague Company was through with guerrilla warfare, and the time had come in its history when tests should not be individual but collective, not partial but complete. There was, and could be, no misunderstanding of our position.

After several hours' deliberation, the building committee announced that it would take a day to consider whether it would take the responsibility of a decision as proposed.

For reasons best known to itself, it elected not to do so, and notified the Sprague Company that it did not consider it best to have the test go ahead. Although the position taken by the Sprague Company at Buffalo was somewhat succinctly stated, the Crane Company, after a year's silence and a year's successive defeats, suddenly woke up, and its vice-president, who, although never having seen a Sprague elevator, was sufficiently complacent to sign an affidavit for use against it in the injunction proceedings at Minneapolis, and Mr. Crane, who is not over happy in the selection of his subordinates, finds time to address letters to the Sprague Company proposing a limited test.

They must have known that under the circumstances little attention would be paid to these communications. That time had passed. The Crane Company's treatment of the Sprague Company in every business relation, and the result of the commercial warfare between the two companies made the expectation of an answer futile.

It should be almost unnecessary for me to point out what has been done in the past eighteen months by the representatives of the hydraulic interests to stem the advance of the Sprague Company. It was the openly avowed intention to prevent the Sprague Company supplementing the Postal Telegraph contract, no matter at what cost. There was no criticism which could be made, no objection which could be raised, no misrepresentation so weak, but that it found ready promulgation at the hands of its agents. And with results?—an advance almost unmatched in an industrial development and bidding fair to rival that of the electric railway, and no power, whether it be that of past accomplishment or future promises, either statement of fact or misrepresentation, can check its advance.

I would remind Mr. Crane that courtesy is not a one-sided business obligation. For two years the statements of the Sprague Company concerning its apparatus have had widespread circulation through architectural and other papers. Over ten months ago, before this company had achieved its present position in the elevator world, it made a direct challenge in Minneapolis against every hydraulic and pump company, and especially against the Crane and Worthington companies to which it received no reply save vicious and unbusinesslike treatment by its opponents. It followed this with letters to the Worthington Company, whose agent I believe the Crane Manufacturing Company now is, concerning statements about the relative economy of hydraulic and electric elevators made by its representatives—equally to no effect. It addressed a registered letter to an official of the

Crane Company, as well as to others, calling attention to misstatements with which he was credited, and got no reply. It published in pamphlet form these challenges and letters, months ago, and they still went unnoticed. It challenged every hydraulic company in the United States at Buffalo to the most comprehensive test ever proposed for elevators, on the sole condition that that investigation should be comprehensive, by capable experts, that every company should be party to it, and that whatever system, whether electric or hydraulic, which should be declared preferable, should be accepted by the building committee, architect and contractor, at an equitable price; and the test was declined by the committee.

And now comes Mr. Crane, solicitous for the public welfare, and says that his company "as elevator builders owe it to the purchasers of elevators to give them all the light they can," and further that his company "as elevator builders are most decidedly interested" in the subject. Quite true. As a company doing business with the public, we now take our own method of making known the facts to that same public, and that we have effectually done so is demonstrated in part by the fact that, in addition to our other work, in every single contest since the first of December, 1894, in which the decision has narrowed down between the Crane hydraulic or electric and the Sprague electric elevators, the Crane Company has been defeated. There is absolutely not one single exception; and in order that there may be no misunderstanding, I give specific instances, as follows:

Parrott Building, San Francisco, 15 elevators.

City Hall and Court House, Minneapolis, 4 to 12 elevators, against 13 lower competitive bids.

Guaranty Building, Buffalo, 4 elevators.

Currier Bank Building, Los Angeles.

Safe Deposit Building, San Francisco.

Academy of Music, San Francisco.

Board of Trade, Chicago, 4 elevators, throwing out Crane hydraulics.

Union Trust Building, Detroit, 5 elevators.

In every one the contest was between the Sprague and the Crane machines as the typical standards, and the architects, builders, owners and experts were as varied as the locations of the buildings. Of course, the ingenious hydraulic agent or principal will find a new excuse for each defeat, but whatever the excuse, however ingenious the reasons, the defeat still stares them in the face, and the fact remains that the hydraulic elevator is coming down and the electric elevator is going up.

It is now a matter of indifference to us what the hydraulic man may wish to know about electric elevators. It does not concern us whether he believes the statements which are made in behalf of electric elevators. We are not dealing with him, except when we come in competition with possible purchasers, and these purchasers have every privilege to make any investigation which the conditions of the service of any plant makes possible; and when the stake is sufficiently high, and when we can pin the various hydraulic companies of this country, with all their various systems and the multitudinous claims which each advances for his own, down to one comprehensive test, and upon the result of that test shall depend the award of a contract of sufficient size, then this company will be found entirely prepared to have such test made.

Meanwhile, knowing perfectly well what the average water consumption of the standard hydraulic plants is, this company is prepared under premium and forfeiture arrangements to guarrantee absolutely the average electrical energy per car mile of travel, which will not be one thing here and another there, except as to small differences, and if we install the engine and dynamo plant, then, with any one of fifty combinations of engines and dynamos, we will likewise guarantee the water consumption. As I say, we are absolutely unconcerned as to what the hydraulic man believes. The greater his unbelief in the possibility of electricity, and the longer his persistence in it, the better it is for us, because when dealing with the public we have ample means of demonstrating the points of difference, and with our shops running day and night, and with contracts of a character and number to warrant our continuous and rapid growth, we can rest reasonably content for the future.

Frank J. Sprague,
Vice-President Sprague Electric Elevator Co.
July 25, 1895.

The street railway systems of Philadelphia have been consolidated under one management and a similar deal is on foot at Pittsburg.

THE ELEVATOR TRUST.

[The following letter, apropos of Mr. Crane's letter in a recent issue, from a leading elevator manufacturer, will be of general interest. It was not intended for publication, and for this reason the name of the writer is withheld.—Ed.]

If two or more men have a right to unite and form a partnership we have never understood why it would not also be right for two or more firms to unite, if by so doing they could purchase or manufacture more cheaply.

Anyone who has watched the course of the business combines or trusts that have been formed almost without number during the last few years knows that they have not been content merely to combine and get such benefits as might come from such a combination of capital and forces.

A number of firms in a certain line of trade and manufacture have got together to control that line. After they have got as many firms to work together—often nearly all—they have set to work attempting to force into their combine those who have felt that their best interests lay in doing business as independent firms.

Here comes in the great wrong of the whole affair. The combines have known they could not control the business so long as there were firms they could not control, and the means they have resorted to to force these independent firms either into their combines or out of business is something an honest man can think of only with indignation.

Many of these trusts or combines are reaping their just reward. Some are practically financially bankrupt while others are bankrupt in reputation.

The Elevator Trust stands probably alone in the fact that it is a secret Trust; that while outwardly the firms in the Trust are doing business independently as before, they are organized under another name, so a business man going to a directory to select firms to give competing bids for an elevator might chance to select the names of the firms in the combine, and so there would be no competition in the bids though they apparently came from different firms.

While the patents were pooled in another name, each firm in the Trust has a right to sell and sue under these patents so an independent elevator firm might have a "fake" or other patent suit brought against it in the name of one of the firms in the combine, such a suit proving exceedingly expensive to the one sued, while the money being furnished by the Trust would make the expense light to the firm in whose name the suit was brought.

This letter (the Crane) confirms all that Electricity has said in regard to an attempt being made by the Trust to keep the electric elevator out of the market. The burden of the letter is "The man would be bold who would say that the electric elevator would take the place of the hydraulic" (quoted from memory). Now, I do know that Mr. Otis sneered at the idea that the hydraulic would take the place of the steam elevator for passenger service, yet how completely the hydraulic elevator had taken the place of the steam elevator a few years after that sneer was given is well known.

If the only argument to be used against the electric elevator is that the man would be bold who will predict a great future for it and who believes it will take the place of the hydraulic elevator as the hydraulic took the place of the steam elevator, then such an argument would have been good and valid to use against the man who had been bold enough to predict the great things that were to be in all lines of engineering progress and progress in all lines by men whose names we delight to honor.

It could have been used against the locomotive and the steamship (I believe it was used against the steamship); it could have been used against all the vast achievements of the dynamo and motor, and we should have had none of the thousand resultant blessings which the dynamo electric machine has brought, nor of the promise of the still greater things yet to come.

Now as to the proposed test. A test was proposed some months ago, I believe, by Mr. Sprague and not accepted. I have not seen Mr. Sprague in this matter, but have no doubt that he would be glad to make such a test as soon as time permits, for I know that each minute of his time is needed to direct the vast business that is growing on his hands, as the sale of his high-speed electric elevator has amounted to hundreds of thousands of dollars, as many as fifteen of the elevators going into one building, and they are going into buildings of the highest class. Anyone who has ridden on a Sprague electric elevator knows the delight of being taken rapidly to his destination in an elevator under the perfect control of the operator and one that can be started and stopped, not with the unpleasant sensation sometimes experienced in the hydraulic, but rather as a bird rises from the ground and settles down again, so perfect is the electrical control.

The Appleton (Wis.) Edison Electric Company is seriously embarrassed by the recent order of the Secretary of War directing it to cease using the water power which it has depended on for fourteen years.

LONG DISTANCE TRANSMISSION AT 10,000 VOLTS.

(The Pomona Plant.)*

BY GEORGE HERBERT WINSLOW.

The Pomona plant was installed in the summer and fall of 1892 for the San Antonio Light and Power Company of Pomona, Cal. It was increased in the following spring, and early last year the capacity of the plant was doubled by duplicating the entire equipment. At the present time, when the plant has been in regular operation for more than two years, and its complete success has established confidence in the successful outcome of many similar projects of greater magnitude, it seems fitting to present a careful description of the entire installation. The electric plant was installed under the personal direction of the writer, as electrical engineer, who presents many of his personal observations on its construction and operation.

The plant is used to transmit energy from a waterfall to substations at Pomona, 18¾ miles distant, and San Bernardino, 28¾ miles distant, from which points it is distributed for incandescent and arc lighting. It consists of a Pelton waterpower plant and a Westinghouse alternating current transmission plant in which generators supply currents to sets of raising and lowering transformers operating at 10,000 volts, and delivering current to the local circuits at 1,000 volts.

The water power for this plant is derived from the San Antonio creek, which is chiefly supplied by the melting snows and the rains on San Antonio Mountain. Side canyons, however, also furnish some water. The creek flows for several miles through a narrow valley at the upper end of the San Antonio canyon in a bed which it has washed for itself in the layer of boulders and gravel formed by the action of an immensely larger stream in past ages.

At the lower end of the valley a sharp ridge extends eastward from the side of a neighboring mountain, from which it originally split off, and blocks up the valley except at a narrow place at which bed-rock is exposed and through which the stream plunges suddenly downward at least 90 feet between precipitous walls of rock, forming the San Antonio Falls.

To utilize this fall, part of the water is diverted by a dam about 200 feet above the falls into a canal which conducts the water to a tunnel passing through the ridge. At the other end of this tunnel the water enters a large pipe leading to the power-house, which is located 412 feet below the level of the outlet of the tunnel.

A vertical projection of the pipe line, giving the sizes of the pipe, is shown in Fig. 1.

The pipe is of sheet steel, double riveted throughout, and was delivered on the ground in sections having a length of 11 feet 6 inches. These sections consist of four sheets, each 3 feet long.

The diameter of the pipe up to within 450 feet of the power house is 30", with the exception of the length which connects it to the sand-box at the top of the pipe, which length is considerably expanded so as to allow the water to flow slower on entering, and thus to reduce the entrainment of air. Near the power house a "reducer" is inserted in the pipe to reduce the diameter to 24", and this size is maintained from this point to the power house. The pipe was designed to carry 2,000 miner's inches of water (measured under a head of 6 inches), without unnecessary loss of friction. The capacity is equivalent to 50 cubic feet per second, or 1,882 H. P. at 390 feet effective head, assuming a wheel efficiency of 85 per cent.

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*A paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

This is nearly three times the power for which the present station was built, but the extra capacity of 1,000 H. P. obtained by increasing the capacity of the pipe costs so little when compared with the cost of building an entire new pipe line that it is much more profitable to lay the larger pipe in the first place, if sufficient water can ultimately be developed to utilize the added capacity.

The thickness of the pipe is increased as it nears the power house to provide for the increase in pressure in the lower parts. At the first bend it is made greater than that of the section above it on either side, because the pressure on it there is greater. After passing the second air valve, first No. 10 and then No. 8 steel is used, the latter size being continued to within a short distance of the power house. The last few lengths are of No. 6 steel.

The horizontal distance between the mouth of the tunnel and the power house is 1,940 feet, and the difference in level between the tunnel and the floor of the power house is 412 feet. The total length of the pipe is 2,370 feet.

The sections of pipe as received from the makers were coated with asphalt both inside and out, and parts of this coat were of course scraped off through rough handling. After the pipe was laid and jointed, a man went through it and painted the joints with hot asphalt to prevent rusting.

In order to protect the pipe from the great changes in temperature which occur in the mountain between midday and midnight, earth and loose rock were placed around and on top of the pipe without any tamping, and where enough earth could not be conveniently obtained brush was cut and piled on the pipe and covered with a light layer of earth and rock.

The lower end of the pipe is closed by means of a 4 inch Ludlow gate-valve, which is bolted to a cast iron flange riveted to the end of the pipe.

The stem of the valve is geared to a small hand-wheel, partly on account of its weight, but chiefly in order that the gate may not be shut too quickly, as otherwise the pipe would be subjected to severe strains, resulting from suddenly checking the velocity of the column of water.

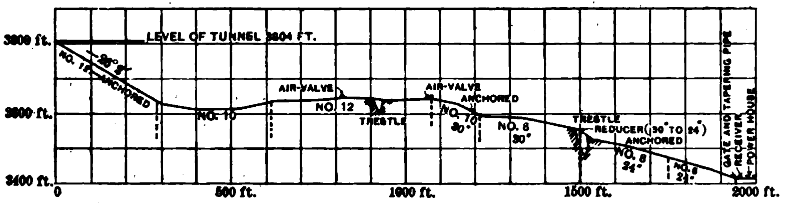


FIG. 1.—PIPE LINE, POMONA PLANT. HEAD 398 FEET.

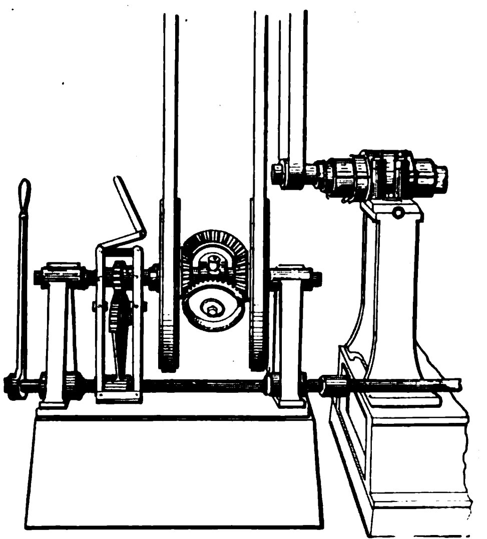


FIG. 3.—WATERWHEEL GOVERNOR.

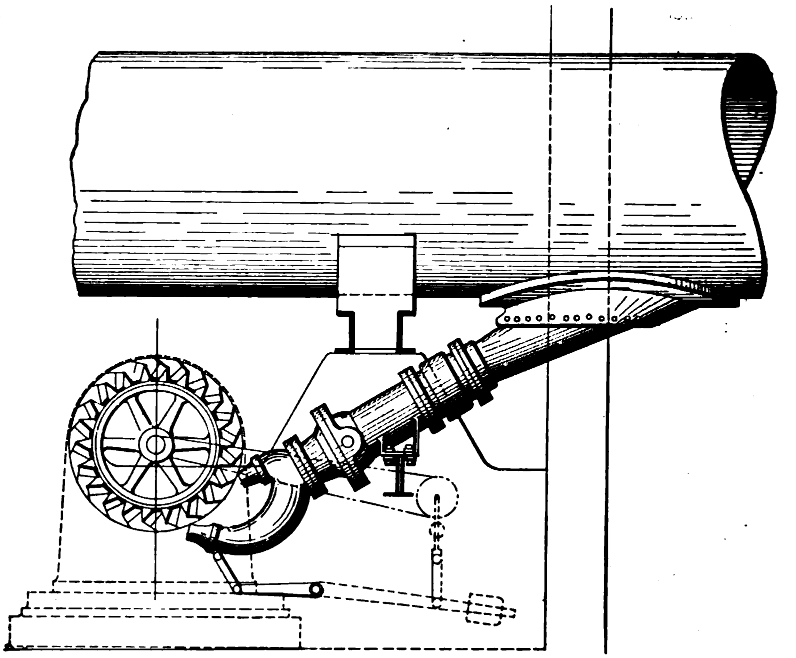


FIG. 2.—PELTON WATER-WHEEL WITH DEFLECTING NOZZLE.

For use under heavy pressures the gearing is also necessary in order to be able to move the valve at all. The head of water on this plant is so great that it is impossible to open the valve while the pipe is full and the receiver empty. It is therefore necessary to equalize the pressure by filling the receiver through a by-pass, or to partially empty the pipe by means of a relief-valve attached to the pipe close to the gate. The relief-valve is primarily designed to protect the pipe from shock by allowing the escape of a considerable quantity of water in case of an increase of pressure in the pipe; such, for example, as would occur should any obstruction partially close the opening of the gate. It has a circular valve so proportioned that a slight movement of it will afford a large opening for discharge. The valve is held in place by a weighted lever, and is set so that a very slight increase above normal pressure will cause it to open.

The gate is connected by a tapering pipe of steel to a horizontal cylindrical steel receiver 20 feet long and 42" inside diameter, from which the water is distributed to the wheel. The object of such a large receiver is to avoid the loss in head which would be occasioned by the eddies formed when drawing the water from the side of a smaller pipe. It also serves to keep air from being drawn into the discharge pipes in case it accumulates in the receiver. (Last year the receiver was lengthened to 48 feet.) An air-valve is placed at the top of the receiver.

Two tapering cast-iron pipes (a large and small one) are bolted to the lower side of the receiver at an angle of 30 degrees. These pipes conduct the water from the receiver to the under sides of two independent Pelton water wheels, which drive an alternating current generator and its exciter.

To the end of each pipe is attached a Ludlow gate-valve, the stem of which passes horizontally into the dynamo room through a bushing in the concrete wall. The larger of the two stems is geared to a hand wheel; the other is fastened directly to a smaller hand-wheel. The flow from each pipe can thus be completely controlled from the dynamo room. The pipe running to the generator wheel is provided below its valve with two nozzles cast in one piece and attached to the valve by means of a limited ball-and-socket joint, which permits them to be moved vertically to deflect the water. (See Fig. 2.)

The pipe supplying the exciter wheel has below its gate a throttle-valve, the stem of which passes through the wall into the dynamo-room, where it can be connected to a governor. The wheels are directly below the receiver and above a raceway which conducts away the water after it drops from the wheels.

The speed of a Pelton wheel is dependent for a given load and head of water upon the amount of water striking the wheel, and therefore to maintain a constant speed this amount must be changed every time the load changes, and in proportion to the latter. In the case of the generator-wheel this change is produced by deflecting the water. Constant-speed regulation may also be obtained by throttling the water, as is done in the case of the exciter-wheel. When the water is throttled there is loss in efficiency due partly to the scattering of the water as it flows from an aperture which it no longer completely fills (which causes much water to miss the buckets), and partly to the loss of head caused by friction in passing through the valve. With the deflecting nozzle there is no loss of efficiency due to this cause. There is, however, a great waste of water at light loads, since under a constant head the same quantity of water must be disposed of at all loads, and for light loads the greater part of it is wasted. To avoid this loss the use of a reservoir naturally suggests itself. It is an unfortunate fact, however, that high heads are confined to mountainous countries and that there a reservoir usually necessitates a high and consequently costly dam. The necessity of building a dam to withstand freshets so increases its cost as to make the use of a reservoir commercially impossible with high heads. Therefore the water must continue to be wasted, and the chief apparent objection to deflecting nozzles is seen to be of no importance.

A set of tips of different diameters is supplied with each nozzle, so that the size of the jet used may correspond to the maximum load and thus unnecessary waste of water be avoided. The tips for the generator-wheel range from $1\frac{1}{2}$ to $2\frac{1}{4}$ inches in diameter, while those for the exciter are from $\frac{7}{16}$ to $\frac{3}{4}$ inch. When tips are used of the proper size for the full load there is no need of throttling at the full load, and therefore no loss from this cause; and with the deflecting nozzle there is no waste of water at full load, so that for full load the two arrangements are equally good.

This is not, however, the normal condition of operation of a lighting plant, for in such a plant each dynamo is driven by a separate wheel, and the load is constantly changing, so that here the deflecting nozzle has the advantage. The deflecting nozzle is also to be preferred under high heads, to avoid the risk of straining the pipe by suddenly checking the flow of water, as would be necessary with a throttle valve if the entire load were suddenly thrown off.

Regulation by throttling is, therefore, only advisable in cases where the head is not excessive and where the quantity of water obtainable is limited, as is the case where it has to be stored in and supplied from reservoirs, or when the supply is liable to sudden stoppage. The writer recalls instances of its value in cases which occurred while he was at Bodie, Cal., in the fall of 1893. There the water was conducted 4,700 feet in an open ditch to the pipe, and was delivered by the pipe under 350 feet head to drive an electric generator for a 12-mile synchronous power transmission. In cold weather anchor-ice would form and suddenly block up the ditch at some curve, and the water-pressure would begin to fall slowly owing to the gradual emptying of the pipe, which could no longer be kept full by the diminished flow from the lower end of the ditch, which now acted as a reservoir. Having throttle valves in the nozzle, however, very little water was wasted, and the plant was thus kept running until the ditch was cleared, whereas with a deflecting nozzle the pipe would have been quickly emptied, even if the gate valves had been used as throttling valves (which is feasible if the load only varies slightly). Sometimes the head became so low that it was necessary to throw off part of the load and to run at reduced speed, to keep the motor in synchronism.

As already stated, the speed of the generator-wheel is maintained constant for different loads by deflecting the stream. This is done by raising or lowering the deflecting nozzles from the dynamo room by means of a lever fixed to a shaft which passes through the wall. The position of the nozzles is controlled automatically by means of the Pelton differential governor. The ability of this governor to keep the generator at a practically constant speed depends on the governor being driven at a constant speed. I say *practically* constant, for there must be *some* change in speed before the governor can act, and then an appreciable time is required for this action to produce its effect. The constant driving-speed in the present case is furnished by the exciter-wheel shaft. The arrangement for governing is briefly as follows: The generator is geared to stop itself by turning the water off the wheel, and the source of constant-speed is geared to speed up the generator by a contrary action. These two actions neutralize each other when the generator-speed is the same as the fixed speed, but when either preponderates the difference acts. Thus an increase in generator speed will act to stop the generator, while a decrease, by making the fixed speed predominant, acts to speed up the generator. The governor consists, in part, of two similar miter-wheels which are mounted upon pulleys and placed face to face, loosely, upon a horizontal shaft, and are driven at equal speeds in opposite directions, one by the generator shaft, and the other by the exciter shaft. The speed of the pulleys is 200 R. P. M. In Fig. 3 it will be seen that between these wheels and at right angles to the supporting shaft there is fixed to the latter a cross-bar carrying two miter-wheels, one at each end, which mesh with the two oppositely-revolving miter-wheels first mentioned. The result is that as long as the two outside wheels are revolving at the same speed the two central wheels will merely revolve upon their axes without tending to move in either direction the bar upon which they rotate. Now, if the generator speed increases, the corresponding side of each central wheel will have to travel faster forward than the other side travels backward, and the difference between these two movements will result in a movement of the central wheels in the direction of the faster wheel, and the cross-bar will consequently move the same way. The shaft to which the cross-bar is attached will, of course, turn with it, and as this shaft carries a pinion meshing in a toothed quadrant connected to the lever which controls the nozzles, the stream will be pulled away from the wheel until the generator speed falls to its normal value. This point is quickly reached with a full load, owing to the drag of the load, but for a light load the inertia of the armature and wheel prevents them from responding so readily, and the governor does not act quite so quickly. Consequently the generator is not only brought to its proper speed but is carried slightly above it, which causes the governor to reverse, and thus sets up a slight and regular *seesawing* in the speed. This seesawing will be increased if there is any lost motion in the governor and its connections. It will be increased because for a full head and light load the jets only impinge slightly on the buckets, and since the jets are round and their upper edges alone strike the buckets (which are themselves curved in the opposite direction), a slight movement of the governor produces a much greater change in the speed of the wheel under light loads than when the whole of each jet is in use. This effect of the jets is more marked when the governor is working to cut down the speed than when it is increasing the speed, because *withdrawing* the jets at a given distance causes a greater change in the quantity of water striking the buckets than would be caused by *advancing* them an equal distance. The seesawing will be further increased if the nozzles are not fully counter-balanced, as they would then tend to fall away from the wheel.

In order to avoid seesawing it is the practice in this plant to reduce the head every morning during the light load. This was at first done by opening the extra 4" relief-valve and allowing water to escape until the pressure had gone down to that corresponding to the desired head. The valve was then set tentatively until the pressure became nearly constant, when the final adjustment was made by partly closing the valve on the generator-wheel pipe. It was afterward found that the working pressure of the water at the nozzle could be sufficiently reduced by the last mentioned valve without also reducing the quantity of water in the pipe, and therefore the relief valves are no longer used for this purpose. In either case the governor throws more and more of the stream onto the wheel to compensate for the decrease in head, and the seesawing stops. Where a double deflecting nozzle is used it would seem advisable to have in the upper branch a throttle valve so connected to the deflecting levers that when running under light load the valve would be entirely closed, and the regulation be attained by deflecting the open nozzle. When the whole stream of this nozzle had come into use and more water was required, the valve would be opened. In this way the water would be used during light load under more favorable conditions than obtain with a simple deflecting nozzle, seesawing would be avoided, and in case the supply of water became less, either suddenly, as by a sharp freeze, or gradually, because of diminished rainfall, the water would be used most economically and efficiently during the time of maximum load, which is the critical time. The effect of such an arrangement of the nozzles and valves would be to increase the capacity of the plant for a given minimum water supply, the period of minimum supply being precisely that in which all possible economies are of value. It may be objected that tips of such a size should be used as would bring both streams into full use during maximum load, and that then no valves would be required, but against this is the fact that the maximum load (particularly in a lighting plant) does not reach the same value every night and that it is, therefore, always necessary to use tips large enough to meet the possible demand of any night.

In order to avoid breaking the teeth of the quadrant in case the governor should continue to act after it has moved the nozzles to either their highest or their lowest point, the pinion on the governor shaft is mounted loosely between two laterally movable toothed ratchets, which normally hold it in a fixed position. When the quadrant reaches either of its extreme positions, one of these ratchets will be disengaged by an adjustable lug on the corresponding side and end of the quadrant, and will thus allow the pinion to stop, though the shaft continues to run. Both ratchets may be instantly disengaged by hand, and the position of the nozzles be regulated by a hand lever when starting up, or in case of accident to belts or of decrease in head of water.

To start the plant the governor ratchets are first disengaged and the exciter is brought to a moderate speed; the generator is then started and its field is charged; it is then brought to about three-fourths of its full speed, and the exciter is then slowly increased until the cross-bar on the governor cease to move. At this moment the ratchets are thrown in, and the governor takes charge of the generator speed. The speed of the exciter is now slowly increased to its full value, which of course brings the generator to full speed.

The speed of the exciter-wheel is regulated by a small throttle-valve, the changes in the position of which do not have any noticeable effect on the pressure in the pipe, owing to the small size of the jet controlled. This valve is so made as to have an equal pressure on each side of its axis when partly open, and hence can be moved from one position to another with little effort, which makes it of special value for use with automatic governors. When tightly closed, however, the areas subjected to pressure are no longer equal, and the valve sticks tightly.

An effort was made to automatically govern the exciter by means of a ball governor driven by a belt from the exciter-wheel shaft and actuating the valve by means of two leather friction-cones acting alternately on a beveled disk geared to the valve, but this proved unsatisfactory and was finally discarded, chiefly on account of the difficulty of maintaining the proper adjustment, by reason of the wearing away of the cones and of their swelling from dampness. The exciter was therefore controlled directly by hand for a long time. At present the valve is worked from a distance by a simple electrical arrangement devised by Mr. Imlay, in which advantage is taken of the fact that when the exciter is at full speed the movements of the valve necessary to regulate the speed are small.

The device consists essentially of two fixed solenoids in series, energized by current from the exciter and normally acting with equal force on two iron cores supported respectively at the opposite ends of a walking beam connected by levers to the valve, their normal function being to keep the valve stationary. Either of the coils may be short-circuited at will by means of a relay controlled by two keys and likewise actuated by current from the exciter. When either coil is short-circuited it ceases to hold its core, and the core on the other end of the walking-beam is pulled down by its own coil, thereby turning the valve in a corresponding direction. In order that this movement may not be too rapid the coils and cores are immersed in oil, which causes the coils to act as dashpots to the cores; by this means the movement of the valve may be made as slight as is desired.

The relay is not really necessary, but was used to break the circuit in experiments made before the plan of short-circuiting one coil was devised, and has been retained because very convenient. A momentary closing of either key suffices to correct any change of speed, such changes being indicated by the compensating voltmeter. The current in the coils is reduced by a resistance in series with them about equal to that of one coil, and the current for the relay is shunted from the resistance at about two volts. The current normally passing through the coils and resistance is about two amperes at 100 volts (about ¼ H. P.) and when one coil is short-circuited the current in the other increases to three amperes, so that the maximum power used is ⅜ H. P.

(*To be continued.*)

BOOK REVIEWS.

ELECTRICAL BOATS AND NAVIGATION. By THOMAS COMMERFORD MARTIN and JOSEPH SACHS. 220 pp., 8vo. New York: C. C. Shelley. Price $2.50.

Mr. Martin seems to have the faculty of getting hold of a subject and publishing a book upon it while others are only just taking up its study. In this way he becomes a pioneer authority on that subject, and by his early works materially assists those who come after. Thus in the street railway motor, associated with Mr. Wetzler, he gave the world the first connected and exhaustive account of its development and application. In the present volume, ably assisted by Mr. Sachs, he has given the world the first systematic treatment of the motor as applied to the propulsion of boats, and this bids fair to occupy the same position as regards boat propulsion as his earlier work on Street Railway Motors has so long occupied in the literature of street car propulsion.

The book is handsomely printed on heavy tinted paper and abundantly illustrated. Its general scope is best indicated by the various chapter headings which are as follows: I, Electrical Boats: Historical and Introductory; Primary Battery Boats. II, Storage Battery Boats: Preliminary; Single Launches. III, Storage Launch Fleets and Passenger Boats. IV, Special Features of Storage-Launch Operation and Charging. V, Special Electrical Craft, Rowboats, Catamarans and Paddle-wheel Boats. VI, Submarine Electric Torpedo Boats. VII, Dirigible Electric "Torpedoes" for Warfare and Life Saving. VIII, Some General Considerations on Electric Launch Requirements. IX, Canal Boat Propulsion: Historical—Erie Canal. X, Conditions Entering into Canal Boat Propulsion. XI, Methods of Applying Electricity to Canal Boat Propulsion—Boats Equipped with Motors. XII, Methods of Electric Canal Boat Propulsion with Motor Exterior to Boat. XIII, Generating Plant and Distribution. XIV, Resistance of Canal Boats—Comparison of Cost Propeller vs. Hauler. XV, Propulsion: Resistance of Boats and Propellers: Paddle-wheels and Screws. XVI, Miscellaneous Uses of Electrical Power. XVII, Storage Batteries, Meters and Dynamos.

"THE ELECTRICIAN" ELECTRICAL TRADES DIRECTORY AND HANDBOOK FOR 1895, with Biographical Notes. 8vo, 907-120 pp. London: "The Electrician" Printing and Publishing Co., Ltd. Price, 7s. 6d.

This, the thirteenth edition of the Directory comes to us as an old friend in a considerably enlarged and somewhat improved form. The general plan of this work has been to divide the immense mass of material collected under three main divisions, viz., the Handbook, the Directory and the Biographical. Under the Handbook division is given much that is of use to electricians everywhere, such as reference tables, etc., etc. The Directory is divided into two parts: the first giving an alphabetical list of some 7,500 names of companies, firms and individuals directly identified with the electrical interests of Great Britain, and the second giving a similar list of names of those identified with the electrical interests of Colonial, Continental and American countries. Evidently great care has been observed in the selection of these names, and we are particularly pleased with the fullness displayed in that portion devoted to American electricians and electrical business enterprises.

The last division of the Directory—the Biographical—while of great value is the least satisfactory portion of the book. It contains sketches of the lives of 269 men who have been selected by reason of their real or supposed prominence in the electrical world. These sketches are usually exceedingly well written, and have already proved of great interest and value to users of the book, but it is in the selection of the names to be thus especially honored that the difficulty is bound to arise. We notice many sins both of omission and commission. For instance, in looking for a sketch of Helmholtz, we are surprised beyond measure to find his name unmentioned. Turning to the Directory, we also find it absent there, yet Helmholtz was one which almost beyond any other name electricians have delighted to claim as one of their number. On the other hand, there are undoubtedly some names mentioned that do not deserve to be placed in such good company as they are found in if the test of fitness is either prominence or breadth of accomplishments.

ARMATURE WINDINGS OF ELECTRIC MACHINES. By H. F. PAPSHALL and H. M. HOBART, S. B. Quarto, 368 pp., 140 full-page plates, 65 tables. New York: D. Van Nostrand Company. London: Robert W. Blackwell. Price, $7.50.

This admirable work is the outcome of the very extended practice of the authors in the practical designing of dynamo electric machines, and is unique not only in the exhaustiveness and comprehensiveness of the treatise, but in its method of treatment. As to the scope of the work, the table of contents will be the best index. It is divided into fourteen chapters, as follows: Chapter I, Single-Wound Gramme Rings; II, Double-Wound Gramme Rings; III, Two Circuit Single-Wound Multipolar Rings; IV, Two Circuit Multiple-Wound Multipolar Rings; V, Bipolar Drum Windings; VI, Multiple-Circuit Single-Wound, Multipolar Drums; VII, Multiple Circuit Multiple-Wound Multipolar Drums; IX, Interpolation of Commutator Segments; X. Two-Circuit Multiple-Wound Drum Armature; XI, Rules and Tables Continuous Current Windings; XII, Single-Phase Alternating Current Windings; XIII, Quarter-Phase Alternating Current Windings; XIV, Three-Phase Alternating Current Windings.

The method of treatment is in general as follows: The left-hand page is given to a large scale diagram of the particular method of winding, while on the page facing the diagram are given the reasons why the method is good or bad. The diagrams are so large and so excellently executed as to be easily followed, and the text is so brief, and yet pointed, as to leave no cause for confusion or ambiguity. It will thus be seen that in method of treatment a very radical departure has been made, and we think the value of the work as a work of reference, or as a catalogue of illustrated object lessons, has been greatly increased by this departure.

The publishers, too, are deserving of the highest praise for the admirable way in which they have done their part of the work. We heartily commend this book to every one having to do with dynamo designing, as most admirably supplementing the works of Thompson and others in which pure theory is more fully developed.

AMERICAN STREET RAILWAY DECISIONS. A Collection of All Reported Cases Decided in the Various Courts within the United States and Canada; chronologically arranged. Vol. 2. Edited by CHARLES A. RICHARDSON and ANDREW J. HOOK. Published by the American Street Railway Association, 1894.

This book, which comprises 483 pages of the usual legal size, is found to very fully satisfy its title and subtitle. It is the official publication of the American Street Railway Association, and as such will be regarded with entire confidence by those into whose hands it comes. The references are usually short and pithy, but in cases that have warranted fuller treatment it has been generously accorded.

American street railway law has of late years assumed an importance not warranted in the days of horse and mule traction, and with the extension of the electrical and cable systems, which have given rise to grave questions not formerly raised except by vehicles directly propelled by steam, the necessity for compilations of this kind has rapidly increased, until now they find their place in the library of every street railway company in the country. The work under review is well printed and strongly bound in sheep, and will be found very useful for reference by all those interested in the subject of street railway franchises.

The Nassau Franchise.

The General Term of the Supreme Court has handed down a unanimous decision in Brooklyn in favor of the Nassau Electric Railroad Company in its appeal from the decision of Justice Walter L. Smith, who had declared the franchise null and void on the ground that the Aldermen had not done their duty in declining an offer for the same franchise from another company which offered more. Mr. E. M. Grout, who originally brought the action, will carry the case to the Court of Appeals.

Personal.

Mr. Robert B. Corey has lately returned from a successful trip through the West, having been as far as Denver.

Mr. C. P. Mackie, late of the Electric Selector and Signal Company, has written for the *Evening Post* two very interesting articles describing the failure of a recent attempt to colonize a number of Georgia negroes in Mexico.

Col. Brian, of Washington, was seen driving down Broadway in a victoria a few nights ago, looking for the Electric Club.

Mr. J. Holt Gates, of Chicago, was in New York last week perfecting new business arrangements.

Among the out of town delegation in the metropolis last week were Mr. Chas. Huntley, of Buffalo, and Mr. S. M. Hamill, of Cleveland.

A sportsman reports from Calcutta that he uses the electric light in hunting tigers at night. He sits on a raised platform in the jungle and suspends a 5 C. P. incandescent lamp over the bait, which is placed about 30 feet away. Batteries supply current for the light. A switch on the hunter's rifle enables him to throw on the light when he is ready to shoot. The light tends to temporarily blind the tiger, and a good shot can be had before his eyes become accustomed to it.—*Electrical Engineer* (London).

General News.

What is Going on in the Electrical World.

Woodstock, N. Y.—The building of an electric road in the town of Woodstock is contemplated.

Perry, Ok.—The electric light plant was put into operation by the company for the first time on the 20th.

Des Moines, Iowa.—The city council has decided to double the capacity of the city electric light plant at a cost of $7,000.

Montevallo, Ala.—The people of this place are talking in favor of establishing an electric light plant and waterworks.

Chico, Cal.—The town trustees have granted a franchise to H. H. Clark, of San Jose, for an electric light and power plant for Chico.

Baltimore, Md.—The South Eutaw branch of the Baltimore passenger system is to be equipped with electricity and operated as a trolley line.

Springfield, Mass.—The formal opening of the new electric line to Holyoke took place last week. Cars are run on a fifteen minute schedule.

Fort Madison, Ia.—The contracts have been all let for the equipment of the street car line with electricity. The Westinghouse motor will be used.

Bainbridge, Mass.—An electric light company is about to be formed here to supply electric lights to the village if enough stock can be raised.

Adrian, Mich.—This city will probably purchase the lighting plant of J. H. Fee & Son, as the mayor has advised the city council to negotiate for it.

Southbridge, Mass.—The promoters of the Southbridge and Fiskdale Electric Street Railway have voted to increase the capital stock from $35,000 to $60,000.

Brookhaven, Miss.—The Brookhaven Manufacturing and Improvement Company have been granted a franchise to establish an electric light system in this city.

Ogdensburg, N. Y.—The Ogdensburg Street Railway Company have increased their capital stock from $75,000 to $150,000, and will convert their line into a trolley system.

Milford, Del.—An electric railway is projected to connect this town with Dover. Permission has been granted the company to lay its tracks and operate its cars.

Seattle, Wash.—The Rainier Avenue Electric Railway has been sold at sheriff's sale to Frank H. Osgood, of the Seattle National Bank. The price paid was $14,300

Quebec, Can.—The contract between Quebec City and H. J. Beemer for the construction of the electric railway has been signed. Work will be commenced at once.

Cincinnati, O.—The Martin Cable Street Railway Company have applied for permission to change the motive power on a part of their road from cable to electricity.

Sturgeon, Mo.—There is talk of building an electric line from Sturgeon to Columbia, the county seat. Several prominent citizens are interested in the matter.

Kalamazoo, Mich.—The city electric light plant was sold under foreclosure proceedings on the 17th inst. to James Munroe, acting for Leroy Cahill, who had a mortgage on the property for $30,000.

Hot Springs, Ark.—Parties having in view the building of an electric road from this city to the Ouachita River have been looking over the ground lately and have, it is reported, decided to begin the work.

Mount Holly, N. J.—The new trolley line of the Pennsylvania Railroad between Burlington and Mount Holly was formally opened to the public on the 22d inst. and scored a big success in mechanical operation and speed.

Millbury, Mass.—Representatives of the Blackstone Valley electric road have been canvassing the towns along the proposed route and have met with much encouragement. Franchises have been applied for at Grafton and Sutton.

Albany, N. Y.—The Railroad Commissioners have granted the Cohoes City Railway Company permission to use the trolley system on their road. The application of the Utica and Herkimer Street Railroad will be considered August 6.

St. Augustine, Fla.—Judge Hammond of Orlando, T. H. Packwood of Maitland, and Thomas J. Appleyard of Sanford, Fla., propose to build an electric railway here if the board of aldermen will grant them a desirable franchise.

Butte, Mont.—The first electric hoist to be placed in the mines of Butte was installed a few days ago at the Virginius, and it is more than probable that the installation will mark a new departure in the working of the mines in this vicinity.

Westfield, N. Y.—There is a possibility that an electric railroad will be built between Chautauqua and Barcelona on Lake Erie. William L. Minton has secured options on territory between the two places and something is expected to result.

Brunswick, Ga.—Col. W. A. Jeter, of Macon, has applied to the city council of Brunswick for a franchise for an electric railway in that city and neighborhood, the entire line to be about fifty miles long and to carry freight as well as passengers.

Shelburne Falls, Mass.—A committee consisting of Rufus Covell, Herbert Newell and George H. Wilkins have been appointed by the board of trade to investigate the matter of electric lighting and report as to the estimated cost of a suitable plant.

Erie, Pa.—The project of building an electric railway from Erie to North East and then continuing the line along the lake shore to Buffalo is receiving considerable attention from the newspapers in the section through which the road is to run if built.

Memphis, Tenn.—The Memphis Street Railway Company has applied to the city council for permission to purchase all the lines, equipments, franchises, etc., of the Citizens' Street Railway Company and the lines controlled and operated by that company.

Cleveland, O.—Rapid progress is being made in laying the rails of the Akron, Bedford and Cleveland Electric Railway. The work upon the line is being pushed with the view of having the cars in operation between Akron and Cleveland about the first of September.

St. Joseph, Mich.—The St. Joseph and Lake Shore street railroad has been sold at execution sale to the St. Joseph and Benton Harbor Electric Street Railway Company for $306 above the many judgments. There are three miles of the road and it will be equipped with electricity.

Rochester, N. Y.—The Glen Haven Railroad, which is to be sold under foreclosure of the first mortgage bonds about the first of September, will probably be bought in by the bondholders, in which event the road will be made standard gauge and equipped with electricity.

Knoxville, Tenn.—The Knoxville Street Railway has been sold, under foreclosure proceedings, for $162,152. The property was purchased by J. Simpson Africa and C. C. Howell as representatives of the bondholders. The road will be improved, extended and placed on a paying basis.

Niagara Falls.—It is stated that the Michigan Central Railway Company has placed an order with the General Electric Company at Schenectady for two powerful searchlights with which to illuminate the falls. Slides will be arranged so as to throw lights of various colors upon the tumbling waters.

Brooklyn, N. Y.—All the necessary preliminaries for the legal incorporation of the Kings, Queens and Suffolk Railroad Company have been completed. The company was formed to construct and operate a bicycle railroad on Long Island.—Proposals will be received for furnishing 100 miles of insulated hard-drawn copper telegraph wire for the Brooklyn Fire Department. F. W. Wurster, commissioner, can be addressed for information.

Connersville, Ind.—The city council has approved the report of a special committee advising the purchase of a municipal lighting plant. The Western Electric Company has offered to put in a new plant for $12,260. The present lighting contract expires in a few weeks.

Santa Barbara, Cal.—The stock subscriptions to the Santa Barbara Electric Railway amount to $70,000, and the company expects to begin operations at once. The officers of the road are: President, A. Hope Dueg, Santa Barbara; vice-president, S. J. Keese, Los Angeles; secretary and treasurer, N. F. Ashton; manager, W. F. Reed.

Washington, D. C.—Proposals will be received at the office of the Architect, United States Capitol, until 12 o'clock noon August 3 for electric lighting material. Schedule and other information will be furnished on application to Edward Clark, Architect U. S. Capitol. The right is reserved to reject any or all bids.

Hartford, Conn.—The Perkins Electric Switch Company of this city has increased its capital from $50,000 to $125,000. The new capital was paid in as follows: C. G. Perkins, $40,000; Roland Mather, $15,000; Edward W. Hooker, $5,000; J. M. Allen, $2,500; James Nichols, $2,500; E. C. Frisbie, $5,000; P. H. Woodward, $2,000; Talcott Brothers, Talcottville, $3,000.

New York.—The managers of the Eighth Avenue horse car line have decided to change their motive power to electricity, and will use the Westinghouse underground electric railway system, which has lately aroused much interest among street railway men. The managers of the Sixth Avenue surface road are also considering the advisability of a similar change.

Pittsburg, Pa.—A charter has been granted to the Consolidated Traction Company of Pittsburg, an organization resulting from the amalgamation of the Central, Duquesne, Pittsburg and Citizens' lines, that is, all or nearly all the street railway lines of Pittsburg. The capital stock of the new company is $15,000,000. The directors are: C. L. Magee, George W. Elkins, George I. Whitney, William Flinn and George Sheppard.

Indianapolis, Ind.—The projectors of the Indianapolis, Franklin and Greenwood electric railway are making investigations preliminary to starting the construction work on the road. The Toledo Construction Company, represented by W. S. and C. E. Coon, is prepared to begin the work as soon as it is found that the promoters of the scheme have a good franchise and the company is legally incorporated.

Sacramento, Cal.—The transmission of electrical energy from the works of the Sacramento Electric Power and Light Company at Folsom to this city, a distance of twenty-two miles, is an accomplished fact. A salute of 100 guns announced the opening The power is now effectively running street cars and will, as soon as possible, be employed in operating mills, factories, etc., as well as in furnishing light for the citizens. The engineers state that the loss in transmission is about 10 per cent.

Homestead, Pa.—The Carnegie Steel Company on Thursday last tested a new plan which Manager Schwab and Chief Electrician Kinley have evolved for reheating molten metal that has become chilled before it can be poured into the moulds, causing delay and loss The new plan largely consists in forcing into the mass an electric current, by which an intense heat is generated. The experiment was largely successful and the new method promises to become indispensable in the manufacture of steel.

Worcester, Mass.—The *Gazette* says: "A new industry has just been started in the city and is known as the Worcester Electro Marbleizing Company. This is an entirely new process for imitating marble-onyx on all kinds of metals by electroplating. The variety of color shades in light and dark that can be produced are almost unlimited. The projectors of this new enterprise are G. L. Feldman, of Newark, N. J., president; A. B. Brunnell, the well-known electrotyper of this city, treasurer, and B. F. Pierson, of New York, secretary."

Boston, Mass.—Superintendent of Lamps James Buckner has devised a pole for sustaining electric wires which is so insulated as to protect employees and other people from accidents. The pole has been subjected to a number of tests which it stood successfully, and the only question is whether the insulation (a discovery of Mr. Buckner's) is durable under the variations of weather that would assail it.—The Lowell and Suburban Street Railway Company have made application to the Railroad Commissioners for their approval of an issue of $400,000 stock by the company for the purpose of reconstruction and equipment with electricity.

Auburn, N. Y.—The Auburn Inter-Urban Railroad Company, recently organized with a capital stock of $250,000, proposes to construct an electric road from Island Park, at the foot of the lake, through to this city and thence to Skaneateles and Port Byron. The incorporators are: Edwin F. Voris, George C. Kobler, N. P. Goodhue, Wilson H. Pixley, Charles Dietz, L. S. Ebright, of Akron, O.; J. J. Smith, of Cincinnati, O.; P. M. Herron, Charles P. Mosher, George W. Elliott, Daniel L. Ramsey, George Underwood, S. E. Bell, George B. Turner and H. V. S. Lord, of this city.

Los Angeles, Cal.—The Kern River and Los Angeles Electric Power Company, lately organized, proposes to utilize the cascades of the Kern River at Bakersfield in generating electricity for transmission to Los Angeles and neighborhood. The distance is from 100 to 120 miles. The board of directors of the company is composed as follows: L. J. C. Spruance, Chicago; H. S. McKee, New York; J. W. Eddy and E. H. Gale, Aurora, Ill.; E. H. Brooks, Grand Rapids, Mich.; John Ross, O. W. Childs and W. H. Davis of Los Angeles; P. J. Beveridge of Hollywood, Cal.; E. H. James, Paso Robles, Cal., and C. J. Taylor, Kernville, Cal. The principal office of the company is in Los Angeles and the capitalization is $5,000,000.

Fresno, Cal.—The San Joaquin Electric Company has let contracts for supplying electric machinery, wire, insulators, water-wheel plant, etc., and work is being pushed in its big transmission scheme. A mile of the big ditch carrying the water from the north fork of the San Joaquin River to the great reservoir is now completed and work on the reservoir is well under way. Machinery to generate one-fourth of the power will be put in as soon as possible at a cost of about $200,000. The total power that can be generated is about 8,000 H. P. The company has decided to build a sub-station in this city, and this will be the distributing point for the mills, factories, car lines, etc., and for the vineyards within a radius of six or eight miles.

Toledo, O.—The Toledo Traction Company have closed contracts for new generators and engines and intend to make such improvements in their street railway as will make the entire system superior in every respect. A unique feature of the plant will be the consolidation of power by which the same set of engines will run generators of a current for eighty miles of single track railway, for lighting the streets and for stationary power.—Mr. Replogle has invented a wheel which furnishes its own motive power. This it does by means of an electrical generator affixed to the hub, which once the wheel is set in motion furnishes the power to keep it going. Mr. Replogle proposes to apply the wheel to a bicycle and use it as the chief feature in the characteristics of a new machine that he will put on the market in the near future.

Philadelphia, Pa.—The People's Traction, the Electric Traction and the Philadelphia Traction companies have been consolidated and a new company formed from the combination to be known as the Union Traction Company. The new corporation has deposited $3,000,000 in cash, 10 per cent of its capital stock, as required by the corporation law, and has received its charter from Harrisburg. Its capital stock is $30,000,000 and J. Lowber Welsh is to be the president. The application for the charter was signed by the following men, who are to form the first board of directors: John Lowber Welsh, Wm. H. Shelmerdine and Caleb F. Fox, of the People's Traction Company; P. A. B. Widener, Wm. L. Elkins, James McManus, Joseph B. Altemus and Thomas Dolan, of the Philadelphia Traction Company; Jeremiah J. Sullivan, Alexander M. Fox and Alfred Smith, of the Electric Traction Company.

Chicago.—At the recent meeting of the Northwestern Electrical Association a part of the president's address was devoted to a eulogium on Ex-president H. C. Thom, who died recently.—The *Times-Herald* says: "An electrical plant for the manufacture of phosphorus has been established at Grand Crossing. It is now a modest affair, but it is the result of a number of years of experimenting, and the promoters say the method of manufacture they have discovered is so cheap they will be able to control the phosphorus market. At present there are but three active phosphorus plants in the world, one in the United States and two in Europe. The Chicago company will make the fourth. The annual output of phosphorus is estimated at 50,000,000 pounds. At an average wholesale price of 50 cents per pound, the value of the product will reach $25,000,000."—The Clark street trolley ordinance has been passed over the mayor's veto.

The Clark Arc Lamp.

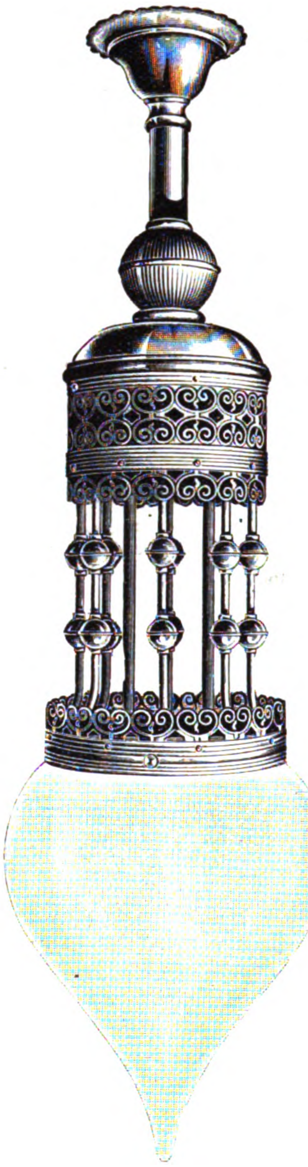
The Clark Arc Lamp is no less favorably known to the electrical fraternity than other forms of arc lighting apparatus manufactured by the Clark Electric Company, 478 and 480 Pearl street, New York.

The accompanying illustration shows a type of ornamental lamp designed for interior lighting of private parlors, banks, stores, offices, hotels, theaters, etc. This lamp can be used on arc, alternating or continuous incandescent circuits, and burned either in series or singly. The illumination is white, perfectly steady and as agreeable to the eye as daylight, and will produce, for the same cost, sixteen times as much illumination as gas or incandescent light.

Many of these lamps are used by some of the most prominent corporations, firms, institutions and individuals in New York City and elsewhere, and have given perfect satisfaction.

"Americans Abroad."

The Canadian branch of their business having been established, the Bryan-Marsh Company intend "carrying coals to New Castle" by arranging for a permanent London house for the sale of their incandescent lamps abroad. This has been the natural result of an increasing demand for their product, originating from the sale of their high efficiency Lamps that have met with such a favorable reception in Europe One good thing always sells another, and so a general demand has been created for all the types of lamp manufactured by this enterprising firm.



THE CLARK ORNAMETAL LAMP.

The business depression of the last two years having made necessary new economies in American manufacture to keep up with the gradual fall of prices, a general benefit has resulted in the shape of improved mechanical appliances that have not only lessened the cost of production, but what is far more important, have raised the standard of excellence so that buyers now feel that lamps so made approximate perfection in the present types of incandescent lamps. As this much-desired condition cannot be obtained by the old-fashioned methods in use abroad, the natural result is that the more reliable American product will obtain a strong foreign foothold, especially with shrewd buyers.

The Pittsburg Trolley Pole Company, with increased manufacturing facilities, is operating full time to keep pace with orders.

COMMERCIAL PARAGRAPHS.

There isn't much need for snow sweepers or snow plows these days, but it is a good time to think about them. The McGuire Manufacturing Company, Chicago, has issued a circular that will be of much service to those who think of buying snow plows or sweepers.

Wm. H. Hornberger, formerly of the Hornberger Electric Company, of Elkhart, Ind., is now with the "Vindex" Electric Company, Sycamore, Ill., and is about to place a new type of transformer on the market.

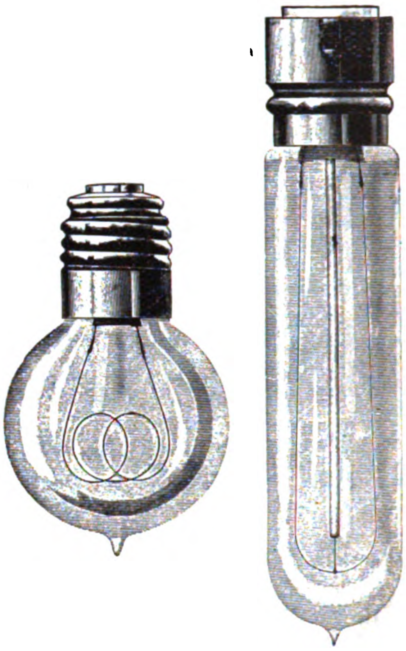
H. B. Coho & Co., the well-known electrical engineers of 208 Broadway, have become the New York agents for the Eddy Electric Manufacturing Company, Windsor, Conn.

Special Buckeye Lamps.

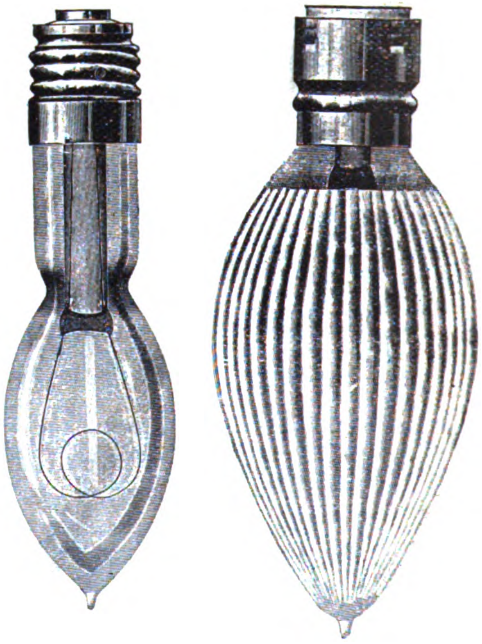
The accompanying illustrations show some of the special lamps now being made by the Buckeye Electric Company, Cleveland, O. Cut No. 1 shows the "Imperial" Decorative Lamp. This lamp is made for voltages from 48 to 130 and in 8 and 16 C. P. sizes. The globes are either plain or frosted or dipped in blue, green, ruby or amber colors.

Lamp No. 2 is especially adapted for use in breweries and distilleries and has been christened the "Bunghole" Lamp. It is made for low and high voltages, in 10 and 16 C. P. sizes, and with frosted, opal or plain globes.

A "Long Flame Candle" Lamp is shown in cut No. 3.



BUCKEYE LAMPS—NOS. 1 AND 2.



BUCKEYE LAMPS—NOS. 3 AND 4.

This is for ornamental purposes and is made for low voltages with plain, opal or frosted globes.

In cut No. 4 is shown the "Pineapple" Ornamental Lamp, made for voltages from 48 to 130, in 8 and 16 C. P. sizes, and in plain or frosted globes. All these lamps are fitted with any desired base.

INCORPORATIONS.

The Northwest Construction Company, Portland, Ore.—to build, construct and equip railroads, electric-car lines or roads, telephone and telegraph lines, and to contract for the construction of the same and for their maintenance and operation. Capital stock, $1,000,000. Incorporators: George Taylor, T. H. Curtis and F. R. Strong.

The Iron River Electric Light, Power and Telephone Company, Iron River, Wis. Capital stock, $20,000. Incorporators: Warne S. Carr, Byron Ripley and O. H. Campb ll.

The Fort Pitt Traction Company of Pittsburg, Pa. Capital stock, $500,000. Directors: Joshua Rhodes and Wm. B. Rhodes, of Allegheny; C. L. Magee and Robert S. Frazier, of Pittsburg, and Wm. C. O'Reilly, of Crafton.

The Solar Electric Company, New York, N. Y.—to make and sell electrical appliances. Capital stock, $100,000. Promoters: Hewitt Boice, Jacob R ce, King ton, N. Y.; Samuel O'Connor, Brooklyn, N. Y.

The LaBurt Electric Railway Company, New York City—to conduct, operate and maintain inventions, letters patent, etc., improvements in the mechanical arts, electrical and other science, etc. Capital stock, $3,000,000. Promoters: John LaBurt, Brooklyn, N. Y.; Louis Michaelis, Alex. M. Lowery, New York City; Irving Hull, Bridgeport, Conn. (Incorporated in W. Virginia.)

The Bullard Electric Company, Chicago, Ill.—to manufacture, buy, sell and deal in electrical apparatus, machinery, supplies and fixtures of all kinds. Capital stock, $25,000. Promoters: Charles W. Bullard, Auburt S. Bullard, Carl E. Kammeyer.

The Cape May Court House Light, Heat and Power Company, Cape May C. H., N. J.—to manufacture, generate, store and deal in electricity. Capital stock, $25,000. Promoters: Alex. R. Springer, Cape May C. H.; Howard Bucknell, Walter W. Hartel, Philadelphia.

The Yankton General Electric Company, Yankton, S. D.—to establish and operate general electric light plants. Capital stock, $50.000. Promoters: A. T. Nation, Bedford, England; Harry Eller, H. G. B. Swinhoe, Yankton.

The Kansas and Missouri Electric Railway Company, Pittsburg, Kan.—to construct and operate a line of railway in Crawford County, using either steam or electric power. Capital stock, $25,000. Directors: Sam Barrett, Robert Robyn and A. L. Chapin, of Pittsburg, Kan.; Robert Simons, of West Chester, Pa.; L M. Bedell, C. J. Simons and Harry W. Bedell, of Chetopa.

The Citizens' Electric Company, Plainfield, N. J.—to build, construct and maintain electric machinery, implements, appurtenances and plants for distributing light, heat and power. Capital stock, $50,000. Promoters: Harry G. Runkle, Elias R. Pope, James C. Pope, Plainfield, N. J.

The Electric Wire Hanging Insulator Company, Chicago, Ill.—to manufacture, sell and deal in insulators, clamps and hangers for all classes of electrical work. Capital stock, $200,000. Promoters: Edgar O. Baker, Wm. A. Robertson, Henry W. Rice.

The Iron Mountain Railway Company, San Francisco, Cal.—to build, construct and equip a railroad from the Iron Mountain mines to Spring Creek Crossing, on the California and Oregon Railroad, to be operated by steam, electricity or other motive power. Capital stock, $100,000. Promoters: Louis B. Parrott, Chas. P. Eells, M. M. O'Shaughnessy, San Francisco; Alfred Fellows, Newcastle-on-Tyne, Eng.; Chas. W. Fielding, London, Eng.

The Pocatello Power and Irrigation Company, Chicago, Ill.—to operate water power plants; generate electricity for use in producing light, power and mechanical purposes; operate telephones and furnish water for irrigation and domestic purposes. Capital stock, $150,000. Promoters: Charles W. Spalding, Daniel Swinehart, Francis W. Smith.

The Jasper County Telephone Company, Rensselaer, Ind.—to operate a telephone system in Jasper, Newton, Benton, Porter, Lake White, Pulaski, Stark, Laporte and Tippecanoe counties, Ind. Capital stock, $8,000. Incorporators: James T. Watson, C. C. Sigler, E. L. Hollings and Delos Thompson, all of Rensselaer.

The Memphis Telephone Company, Memphis, Tenn. Incorporators: J. T. Jefferson, J. C. Neely, Fred Orgill, E. G. Robinson and J. C. Neely, Jr.

The Western Electric Telephone Company, Britt, Ia.—to operate telephone exchanges in Hancock, Cerro Gordo, Kossuth and other counties. Capital stock, $100 000. Incorporators: Charles Webster, T. A. Potter and J. T. Carr.

The Detroit Harrison Telephone Company, Detroit, Mich. Capital stock, $600,000. Incorporators: Chas. P. Collins, O. W. Shipman, Chas. Flower, R. A. Brett, Wm. E. Holmes, Albert Peck, Frank D. Andrus and C. B. Hubbard.

The Sacramento, Fair Oaks and Orange Vale Railway Company, Sacramento, Cal.—to construct, own and operate a railway from Sacramento to Orange Vale, by steam, electricity, compressed air or any other motive power. Capital stock, $500,000. Promoters: L. T. Hatfield, Thos. B. Hall, Fred'k Cox, Wm. Schaw, Geo. M. Mott, Sacramento.

The Commercial Telephone Company, Alameda, Cal.—to operate telephone system. Capital stock. $100,000. Incorporators: S. P. Lunt, E. R. Smith, John W. Butler, Albert L. Stetson and J. D. Johnson.

The Atlantic City Telegraph and Telephone Company—to operate telegraph and telephone lines in all the cities and villages of New Jersey. Capital stock, $25,000. Incorporators: John J. McCloskey, Charles A. Furbush, James Brown, Peter Ballingall, Daniel McCormick, William Martin and Ulysses G. Styron of Philadelphia.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 16-23, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

543,042. Trolley-Wheel. Charles Mitchell, Yonkers, N. Y., assignor of five-eighths to Harry A. Archibald, same place. Filed Dec. 20, 1894

5 3,180. Underground-Trolley System. Noel B. Ginochio, New York, N. Y., and Henry C. Bridger, Woodbridge, N. J. Filed Dec. 27, 1894.

543,271. Trolley Stand and Pole. Lawrence C Seelye, Fort Edward, assignor of one-half to George W. Burnham, Luzerne, N. Y. Filed Jan. 2, 1895.

543,351. Electric Brake. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 28, 1895.

543,352. Safety Appliance for Electric Cars. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed April 9, 1895.

543 382. Electric Railway System. John C. Henry, Westfield, N. J. Filed May 13, 1895

543,435. Means for Arresting Motion of Electric Cars. Arthur K. Bonta, Hoboken, N. J., assignor to the Bonta Manufacturing Company, same place. Filed March 21, 1895.

542,617. Running-Gear for Electric Railways. Bion J. Arnold, Chicago, Ill, assignor to the Thomson-Houston Electric Company of Connecticut. Filed April 13, 1891.

ELECTRIC LIGHTS AND APPLIANCES.

542,625. Carbon for Electric Lamps. Henry F. Cabrau, Paris, France. Filed April 11, 1895.

542,6 2. Electric-Arc Lamp. Elihu Thomson, Swampscott, and Charles E. Harthan, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Filed June 25, 1894.

542,982. Producing Pure Electric-Light Carbon. Edward G. Acheson, Monongahela City, Pa. Filed Aug. 25, 1894.

543,016. Incandescent-Lamp Socket. Edgar H. Heath, Grand Rapids, Mich., assignor of one-half to John H. Beamer, same place. Filed March 21, 1895.

543,186. Carbon-Holder. John C. Knight, New York, N. Y. Filed Jan. 15, 1895.

43,213. Electric-Arc Lamp. Daniel Higham Boston, Mass. Filed May 2, 1895.

543,28 . Incandescent Electric Lamp. George Westinghouse, Jr., Pittsburg, Pa. Filed Aug. 29, 1892.

543 355. Electric-Arc Lamp. Henry J. Sage, Chicago, Ill. Filed Feb. 13. 1 95.

543, 99. Electric-Arc Lamp. Samuel R. Nutting, Oak Park, assignor to George W. Furbeck and Joseph Kettlestrings, Chicago, Ill. Filed Oct. 5, 1894.

543,445. Electric-Arc Lamp. William Jandus, Cleveland, Ohio. Filed Dec. 19, 1894.

DYNAMO ELECTRIC MACHINERY.

542,667. Regulation of Continuous-Current Motors. Merle J. Wightman, Scranton, Pa., assignor to the General Electric Company of New York. Filed April 2, 1895.

543,021. Dynamo-Electric Machine. Thomas Hooker, Syracuse, N. Y. Filed April 26, 1894.

543,223. Alternating Electric Motor. Joseph A. G Trudeau, Ottawa, Canada. Filed April 6, 1894.

54 ,346. Electric Transformer. John A. Mosher, Chicago, Ill. Filed May 7, 1895.

543,383. Dynamo-Electric Machine. Thomas H. Hicks, Detroit, Mich. Filed Jan. 13, 1891.

BATTERIES.

542,953. Elements of Galvanic Batteries. Franz A. von Allmonda and Nino von Allmonda, Castello Allmonda, near S grado, Austria-Hungary. Filed Oct. 20, 1894.

543,372. Secondary Battery. Emil Boettcher, Leipsic, Germany. Filed May 12, 18"0.

TELEPHONE AND TELEGRAPH APPARATUS.

542,618. Telephone Relay or Repeater. Chester H. Arnold, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed March 16, 1895.

542,619. Telephonic Repeating Circuit and Apparatus. Chester H. Arnold, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed March 16, 1895.

542,657. Telephone Relay Apparatus. Wilton L. Richards, Malden, assignor to the American Bell Telephone Company, Boston, Mass. Filed March 16, 1895.

542,658. Telephone Repeating-Circuit and Appliances. Wilton L. Richards, Malden, assignor to the American Bell Telephone Company, Boston, Mass. Filed March 16, 1895.

542,6 9. Coin-Controlled Telephone. Charles B. Hopkins and Thomas H. Elsom, Spokane, Wash. Filed March 16, 1894.

542,822. Microphone. Henri Carboncile, Brussels, Belgium. Filed Oct. 9, 1894.

542,918. Telephonic Relay or Repeating System. Chester H. Arnold, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed March 16, 1895.

543,05 . Secondary-Battery Plate. John J. Rooney, Brooklyn, N Y. Filed Nov. 19, 1894.

543,106. Village Telephone System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed July 2. 1886.

543,160. Telephone-Exchange. Wada Y. Shibata, San Francisco, Cal. Filed Oct. 11, 1894.

543,19 Art of Telephoning. Arthur E. Paige, Philadelphia, Pa. Filed Feb. 25, 1895.

543,231. Writing-Telegraph. Thomas Ewing, Jr., Yonkers, assignor to William E. Gump, Brooklyn, N. Y. Filed Jan. 9, 1894. Renewed Dec. 24, 1894.

543,241. Writing-Telegraph. William E Gump, Brooklyn, N. Y. Filed Feb. 2, 1894. Renewed June 25, 1895.

543,313. Telephone-Transmitter. Zorah E. Patrick, Chicago, Ill. Filed Jan 18 1895.

543,328. Telephone Attachment. Charles E. Bertels, Wilkes Barre, Pa, assignor of one-half to Hedley Pedlar, same place. Filed March 20, 1895.

543,425. Writing-Telegraph. James H. Robertson, Brooklyn, N. Y., assignor to William E. Gump same place. Filed Jan. 9, 1894. Renewed Dec. 24, 1894.

543,426. Writing-Telegraph. James H. Robertson, Brooklyn, N. Y., assignor to William E. Gump, same place. Filed Dec. 19, 1894.

543,427. Writing-Telegraph. James H. Robertson, Brooklyn, N. Y., assignor to William E. Gump, same place. Filed March 2 , 1895.

543,428. Writing-Telegraph. James H. Robertson, Brooklyn, N. Y., assignor to William E. Gump, same place. Filed March 2 , 895.

543,429. Writing-Telegraph. James H. Robertson, Brooklyn, N. Y., assignor to William E. Gump, same place. Filed March 21, 1895.

SIGNAL APPARATUS, ANNUNCIATORS, ETC.

542,63 . Automatic Railway-Signal. Alonzo J. Griffin, Wilkesbarre, Pa., assignor of one-fourth to George T. Griffin, same place. Filed Aug. 7, 1894.

542,664. Electric Annunciator. Henry C. Thomson, Boston, Mass., assignor to the Electric Gas Lighting Company, Portland, Me. Filed Oct. 2, 1894.

542 697. Burglar-Alarm Circuit-Closer. Albion A. Vanderpool, Newark, N. J. Filed Nov. 8, 1894.

542,761. Electric Block Signal for Railroads. Angus C. Gordon, Rochester, N. Y., assignor to the Gordon Railway Signal Company, same place. Filed May 13, 1895.

542,7 9. Electric Signal Apparatus. Thaddeus B. Keeler, Rahway, N. J, assignor to Arthur H. Johnson, same place. Filed March 11, 1895.

542,775. Fire-Alarm. Josiah R. McCoy, Marshalltown, Iowa. Filed April 8 1895.

542, 88. Fire-Alarm Device. John F. Snapp, Frichton, Ind Filed April 13, 1895.

542,883. Annunciator. John W. Olson, Chicago, Ill. Filed Nov. 21, 1894.

542,916. Electrical System for Signaling Between Trains. Alejandro Basanta y Baque, Madrid, Spain. Filed Jan. 21, 189 .

542,926 Electric Annunciator. William J. Clarke, Trenton, Canada. Filed Feb. 5, 1895.

542,928. Signaling Apparatus. Lucien S. Crandall, Par-1-h, N. Y. Filed Feb. 17, 1893.

543 000. Electrical Time-Annunciator. Edward M. Edgerton, Chicago, Ill. Filed Feb. 12, 1892.

543,104. Fire-Alarm Box. Charles A. Rolfe, Chicago, Ill. Filed May 10, 1895.

543,322. Railway-Signal. Joseph B. Stewart, Haverstraw, N. Y. Filed Aug. 24, 1894.

MISCELLANEOUS.

542 640. Electric Governor. William W. Handy, Lake Roland, Md. Filed May 1, 1895.

542,663. Electric Measuring-Instrument. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company of New York. Filed April 25, 1895.

542,67 . Insulating-Shield for Metallic Poles. William J. Braley, Fall River, Mass. Filed April 17, 1895.

542,732. Submarine Mine. William M. Huskisson, London, England. Filed Nov. 2 , 1894.

542,771. Means for Generating Electricity from Car-Wheel Axles. Morris Moskowitz, Newark, N. J., assignor to the National Electric Car Lighting Company of West Virginia. Filed Feb. 27, 1895.

542, 72. Make-and-Break Switch. Morris Moskowitz, Newark, N. J., assignor to the National Electric Car Lighting Company of West Virginia. Filed April 23, 1895.

542,773. Polarized Compound Switch. Morris Moskowitz, Newark, N. J., assignor to the National Electric Car Lighting Company of West Virginia. Filed May 2, 1895.

542 848. Electric Switch. George T. Eyanson, Philadelphia, Pa. Filed May 10, 18 5.

542 945. Electric Meter. Henry A. Rowland, Baltimore, Md., assignor of one-half to Louis Duncan, same place. Filed April 19, 1895.

542,959. Electric Gas-Lighter. Harry G. Grier, Philadelphia, Pa. Filed May 31, 1895.

542,968. Regulator for Alternating Electric Circuits. Chas. P. Steinmetz and Albert H. Armstrong, Schenectady, N. Y., assignors to the General Electric Company, same place. Filed Feb. 16, 1895.

542,979. System of Electrical Distribution. Georg W. von Siemens, Berlin Germany. Filed April 26, 1893.

542,986. Electrodepositing Device. John Bossard, Dubuque, Iowa. Filed Nov. 11, 1893.

543,003. Electromedical Apparatus. Jacob R. Etter, Crawfordsville, Ind. Filed June 19, 1893.

543, 13. Fire-Alarm Box. John T. Stack, Chicago, Ill., assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed Jan. 2, 1894.

543,065. Electrically-Controlled Voting-Machine Charles A. Stitzer, Central City, Neb. Filed Nov. 27, 1893.

543,089. Meter for Alternating Electric Currents. Ludwig Gutman, Pittsburg, Pa. Filed May 20, 1 9 .

543,116 Gas-Engine Igniting Apparatus. George W. Weltenbaugh, San Francisco, Cal. Filed Dec. 17, 1894.

543,157. Explosive Engine. Michael L. Mery, Chico, Cal. Filed Feb. 7. 1895.

543,181. Electric Switch. John W. Hearn, Brooklyn, N.Y. Filed Oct. 3, 1893.

543,198. Electric-Current Distributer. Elihu Thomson, Swampscott and Edwin W. Rice, Jr., Lynn, Mass., assignors to the Thomson-Houston Electric Company of Connecticut. Original application filed April 24, 1884. Divided, and this application filed Oct. 3, 1892.

543,249. Process of Refining Sugar by Electrolysis. Emile Javaux and Charles F. Gallois, Paris, France. Filed May 26.

543,33 Electric Registering Apparatus. Alphons Custodis, Dusseldorf, Germany. Filed March 19, 1895.

543,357. Electric Transportation System. Richard E. Sherman, Chicago, Ill. Filed March 1, 1895.

543,3 4. Testing-Circuit for Alternating-Current Systems of Distribution. Herbert C Wirt, Schenectady, N.Y., assignor to the General Electric Company of New York. Filed April 23, 1895.

543,409. Electrical Switch. Henry Steubner, Philadelphia, Pa. Filed Jan. 19, 1895.

DESIGN.

21,473. Electric-Light Shade. Harrison D. McFaddin, East Orange, N. J. Filed June 10, 1895. Term of patent 7 years.

THE TELEPHONE WORLD.

EASTERN TELEPHONE ASSOCIATION.

Plans of Organization Being Formulated by a Committee of Five.

The Eastern Association of Independent Telephone Manufacturers is yet in the formative stage, but enough has been accomplished to assure the success of the movement. An informal meeting was held in New York on the 24th inst. which was attended by the following named gentlemen:

A. H. Chadbourne, United States Telephone Construction Company, Philadelphia, Pa.

S. J. Turnbridge, Utica Fire Alarm and Telegraph Company, Utica, N. Y.

Benjamin Tice, Lockwood Telephone Company, New Brunswick, N. J.

H. S. Douglas, Century Telephone Company, Boston.

J. D. Leatherbee, National Telephone Manufacturing Company, Boston.

G. A. McDowell, Manhattan Electrical Supply Company, New York.

Palmer Bros., Mianus, Conn.

H. C. Williamson, United Electric Telephone Company, New York.

Messrs. Coy and McArthur, Franklin Telephone and Electric Company, New York.

John H. Scofield, Phœnix Interior Telephone Company, New York.

Joseph R. Strong, Tucker Electrical Construction Company, New York.

A. De Veau, De Veau & Company, New York.

At this meeting there was a free interchange of opinions as to the purposes and scope for which an association should be formed, but no definite action was taken further than the appointment of a committee consisting of five members, the duty of which shall be to formulate the plan of organization. Upon the completion of their work, a meeting is to be called for the consideration of the committee's report and the formal organization of the association.

TROLLEY VERSUS TELEPHONE.

Electric Railways Liable for Damages for Injuries from Conduction, but not from Induction.

Some new distinctions in respect to the conflict between electric railway companies and telephone companies in the use of streets, have been developed in the Tennessee case of the Cumberland Telephone and Telegraph Company against the United Electric Railway Company. This was not, like several previous cases on this controverted point, a suit for an injunction against the use by an electric railway company of currents damaging to the telephone line, but an action to recover damages caused by such interference.

The court holds that the railway company is entitled to use the streets, and that such use gives the telephone company no right to complain. Therefore no damages for injury to the telephone line from induction caused by the parallelism of wires on the street could be recovered. But for conduction, charging the ground for considerable distances outside the streets, and disturbing the use of a prior existing telephone line, the railway company must pay the damages, and these were held to be the cost of return wires for the telephone line.

Two Good Contracts.

The La Crosse Telephone Company, La Crosse, Wis., has awarded the contract for its central office exchange outfit and 500 telephones to the American Electric Telephone Company, Kokomo, Ind. This telephone and switchboard were chosen after a careful examination of twenty-four different makes.

The exchange equipment and 125 instruments for the new exchange at Monroe, La., is another contract just awarded to the American Company.

Telephone Litigation.

The Western Electric Company of Chicago has filed a bill against the Viaduct Manufacturing Company, A. G. Davis and John R. Johnson, praying for an injunction to restrain the defendants from an alleged infringement upon telephone switches and magneto call bells, and asking for an accounting.

The switch referred to is the patent of Thomas Watson, assigned by Watson to the American Bell Telephone Company, and by the latter to the Western Electric Company.

The Viaduct Company propose to contest the suit, and claim that the telephone switch manufactured by the company does not infringe the patent referred to in the bill.

An ordinance passed by the city council of Creston, Ia., has fixed the maximum telephone rentals to be charged by the Iowa Union Telephone Company at $3 per month for business houses and $1.50 for residences. The rates now in force are $5 and $3.

Mayor Bostwick can give information relative to the police telephone system which is to be installed at Jacksonville, Fla.

The Texas Telegraph and Telephone Company will establish an exchange at Houston, Tex. B. Krain can give information

C. W. Booth is secretary of the Rockport Telephone Company, organized to build an exchange at Lockport, Tex.

C. L. Downey, of Murphysboro, Ill., has asked for a telephone franchise in Pinckneyville, Ill. It is the intention to establish a local exchange and to extend the line to Duquoin, Ill.

The Martinsville Telephone Company, Martinsville, Ind., has been organized with a capital stock of $[illegible],000.

The National Telephone Construction Company of Milwaukee has asked for a franchise at Kenosha, Wis.

The National Conduit Manufacturing Company has secured the contract and is at work on the underground telephone conduit system at New Bedford, Mass.

Business men of Davenport, Ia., are organizing a telephone company with a capital of $20,000.

The Cumberland Telephone Company will extend its service to Dover, Erin and Clarksville, Tenn., when a subscription of $2,000 has been raised.

The head offices of the Order of Railway Telegraphers are to be moved from Vinton to Peoria, Ill.

W. N. Shine and M. B. Rice are promoting a new telephone exchange at Jacksonville, Fla. When the rights of way have been granted and 400 subscribers obtained, the installation of the plant will be commenced. The "M & B." system will be used.

The long drawn out contest for a telephone franchise in Sheboygan, Wis., has at last been decided by the granting of rights of way to Joseph N. End, Arthur F. Winter and William C. Johann, all local capitalists. The franchise fixes the rates at $24 for commercial and $ 8 for residence instruments. Work is to begin in the near future.

The Decatur Harrison Telephone Company, Decatur, Ill., has been sold under a mortgage of [illegible]7,900. The company began operation July 1, 1[illegible]9. There were 500 subscribers at $[illegible]6 and $24 per year.

The American Bell Telephone Company's output of instruments for the month ended July 20 shows: Gross 13,837, increase 7,40[illegible]; net 6,324, increase 5,[illegible]48; total connected July 20, [illegible]34,[illegible]81, against 573,4[illegible]7 a year ago.

The Viaduct Manufacturing Company, Baltimore, manufacturers of magneto bells, telephones, fire alarm apparatus and other specialties, are rebuilding their works at Relay, Md. The new plant will be complete in all its appointments and of a capacity largely exceeding that of the plant destroyed by fire in 189[illegible].

In connection with the Southwest Georgia Telephone Company, the Postal Telegraph Company will extend its line from Americus to Dawson, Ga.

The Southern Bell Telephone Company will erect a $25,000 building at Savannah, Ga.

The Phœnix Telephone Company of Indianapolis, Ind., has been granted franchises at Mankato, Minn., and Fort Dodge, Ia.

The Rahway Mutual Telephone Company, Rahway, N. J., will erect its plant as soon as the amended ordinance is signed by Mayor Daly.

The Hudson River Telephone Company directors on the 18th inst. declared the regular quarterly dividend of three-quarters of one per cent. It was decided to build a new line from Glens Falls to Whitehall.

The Flatbush District Telegraph Company has filed a certificate amending its articles of incorporation to permit the company to maintain lines through that part of Brooklyn formerly the town of New Utrecht, and also through Bay Ridge, West Brooklyn, New Utrecht, Blythebourne, Fort Hamilton, Bath Beach, Bensonhurst, Unionville, Sheepshead Bay, and other points in Kings County to and through Coney Island.

The Southern Bell Telephone Company's lines will be extended to Pensacola, Fla., within the next few months.

The Wisconsin Telephone Company will establish a sub-exchange in South Side, Milwaukee.

Telephone Directory

List of Independent Manufacturers Who Make and Have Telephones and Accessories For Sale.

THE 'HUNNINGS' DUST TRANSMITTER
AMERICAN ELECTRIC TELEPHONE CO.,
Kokomo, Ind.

COMPLETE TELEPHONES, PARTS, &c.,
MIANUS ELECTRIC CO.,
Mianus, Conn.

M. & B. TELEPHONES,
THE U. S. TELEPHONE CONSTRUCTION CO.,
Bullitt Building, Philadelphia, Pa.

COMPOUND MAGNETO TELEPHONES,
WESTERN TELEPHONE CONSTRUCTION CO.,
South Clinton St., Chicago, Ill.

STANDARD TELEPHONES,
PHILADELPHIA TELEPHONE CO.,
Box 707, Philadelphia, Pa.

ALUMINUM DIAPHRAGM TRANSMIT'RS,
PITTSBURG TELEPHONE CO.,
90[illegible] Penn Ave., Pittsburg, Pa.

LOUD TALKING TELEPHONES,
THE MASON TELEPHONE CO.,
Richmond, Va.

EVERYTHING FOR TELEPHONES,
DE VEAU & CO.,
32 and 34 Frankfort St., New York.

COMPLETE TELEPHONE EXCHANGES,
THE HARRISON INTER'L TELEPHONE CON. CO.,
Chicago, Ill.

THE CENTURY TRANSMITTER,
THE CENTURY TELEPHONE CO.,
[illegible]99 Devonshire St., Boston.

ARM REST MAGNETO BELL,
VIADUCT MANUF'G CO.,
Baltimore, Md.

BLAKE TRANSMITTERS,
PHŒNIX INTERIOR TELEPHONE CO.,
131 Liberty St., New York.

THE MILDE MICROPHONE,
THE STANDARD TELEPHONE & ELECTRIC CO.,
Madison, Wis.

TELEPHONES FOR THE TRADE,
W. A. GUSTAFSON,
Joliet, Ill.

AUTOMATIC SWITCHBOARDS,
STROWGER AUTOMATIC TELEPH. EXCHANGE,
[illegible]47-919 The Rookery, Chicago

ANTHONY ELECTRICAL TELEPHONES,
THE ANTHONY CO.,
5[illegible] Perin Building, Cincinnati, O.

THE SOUTHERN TELEPHONE,
THE SOUTHERN TELEPHONE CO.,
Fayetteville, N. C.

GERSON TELEPHONES,
W. D. JAMESON & CO.,
41 Broadway, New York.

LONG DISTANCE TELEPHONES,
THE UNION ELECTRIC CO.,
Cleveland, O.

TELEPHONES AND SWITCHBOARDS,
STROMBERG-CARLSON TELEPHONE MFG. CO.,
174 South Clinton St., Chicago.

IMPROVED HUNNINGS,
THE RAWSON ELECTRIC CO.,
Elyria, Ohio.

THE LOCKWOOD TELEPHONE,
JOSIAH TICE,
New Brunswick, N. J.

THE PONY NATIONAL,
NATIONAL TELEPHONE MFG. CO.,
620 (R) Atlantic Ave., Boston.

THE "KEYSTONE" TELEPHONE,
KEYSTONE TELEPHONE CO.,
Pittsburg, Pa.

$5 TO $15 TELEPHONES,
FARR TELEPHONE & CONST. SUPPLY CO.,
312 Dearborn St., Chicago, Ill.

ELECTRICITY.

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EDITORIAL NOTES.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

The Brush Double Carbon Patent.

In our last issue the endeavor to explain the scope of the Brush double carbon patent in the fewest possible words led us to be somewhat less explicit than seems desirable in view of the importance of Judge Showalter's decision. The limitations of the patent are very clearly shown in the wording of the description accompanying the specification, which is in part as follows: "The operation of my device as thus far specified is as follows: When the current is not passing through the lamp, the positive and negative carbons of each set A, A′ *are in actual contact.*".

This feature seems to be one of the essentials to the lamp which Brush covered by his patent, viz., that the positive and negative carbons in each set are normally in actual contact before the current is passed, so that the several sets of carbons form parallel paths for the current until the mechanism becomes operative. It is believed that if the several pairs of carbons are not thus normally in contact, but should be hung up so that they do not normally form parallel paths for the current until the mechanism becomes operative, they do not infringe the Brush patent.

The specification goes on: "When, now, a current is passed through the lamp the magnetic attraction of the helices E will operate to raise the lifter D. This lifter, operating upon the clamps C and C′, tilts them, and causes them to clamp and lift the carbon holders B, B′ and thus separate the carbons and produce the voltaic arc light, but it will be *especially noticed that the lifting and separation of these carbons is not simultaneous.* One pair is separated before the other. This separation breaks the circuit at that point, and the entire current is now passing through the unseparated pair of carbons A′, and now when the lifter, continuing to rise, separates these points, the voltaic arc will be established between them and the light thus produced."

This is the second feature, and one which is strongly insisted upon, viz., the *dissimultaneous* separation of the various pairs of carbons and the consequent establishment of the arc only between the last pair separated. This feature would imply, even in the absence of other specification or description, that the several pairs of carbons were normally in contact and in parallel relation to the circuit, and was considered by the Court one of the most important features of the patent. Brush himself evidently considered it such, for in the specification he says: "The lifter D, in the present instance, is so formed that when it is raised it shall *not* operate upon the clamps C, C′ simultaneously, but shall lift *first one* and *then the other.* This function of dissimultaneous action upon the carbons or their holders, whereby one set of carbons shall be separated in advance of the other, *constitutes the most important feature of my present invention.*" There is certainly no ambiguity about this, so that it is apparent that lamps not possessing this feature are not covered by the patent.

Still another feature is clearly indicated where he says: "My invention comprehends, broadly, any lamp or light regulator where more than one set of carbons are employed, wherein—say in a lamp having two sets of carbons—*one set of carbons will separate the other.*" This is an important feature, and upon its interpretation hinged partly the question whether or not two separate lamps combined in one structure and actuated by separate mechanisms were also covered by the patent. It is very clear that such an arrangement was not contemplated, for it is insisted that the several carbons are actuated *dissimultaneously* by the same mechanism.

And the last feature is, that the various pairs of carbons are successively called into arc-maintaining action only when the feeding carbon of the previously acting pair has burned so short that it cannot feed any more.

To recapitulate: the Brush patent describes a lamp containing two or more pairs of carbons, the terminals of each pair being normally in contact, so as to form multiple paths for the current; a lifting device by which the added pair of carbons (in the case of a double carbon lamp) were first separated, thus throwing the entire current through the other pair, and thus determining that the arc should form between said other pair or the last pair separated; a single lifting device actuating separate clutches for each pair of carbons, by which the latter were separated *dissimultaneously* in a predetermined order, and permanently holding the added pairs of carbons in such separated relation while the last pair separated, between whose terminals the arc was maintained, might be fed together as they burned away, and an arrangement by which, only when the arc-maintaining carbons had burned away so short as not to permit of their further feeding, could the feeding mechanism of the succeeding pair of carbons come into action.

The descriptive matter in connection with the specification makes the method of procedure so clear that it seems at first sight very strange how other Courts could have differed with Judge Showalter as to the scope of the invention. But here is illustrated again the baneful effects of so-called expert testimony, which was called in solely for the purpose of involving a very simple thing in such a cloud of mystery as to befuddle the Court, and to assign a controlling importance to features not written into either the militant or the alleged infringing patents. It is with no disrespect to our Judiciary that we say that there are few of them whose training or methods of thought are such as to enable them to discriminate in a safe manner between the essentials and the non-essentials of a purely electro-technical question. To a man without special knowledge and training there can often be no *a priori* course of reasoning by which he may arrive at the relative importance of the various features of the questions presented, and he must therefore rely upon the sworn testimony of so called electrical experts, who are in fact employed on either side *not* as experts in the popular acceptation of the term, but as associate counsel.

It is interesting to look over the previous litigation involving the same patent. As shown in our last issue, the first suit brought on this patent was that against the Ft. Wayne Jenney Company upon the Cain lamp. This case was brought before Judge Gresham sometime in 1886 or 1887 and decided by him the latter part of 1889. The only defence made was that the Brush patent itself was invalid, and could not therefore be infringed. This being practically the only point at issue, viz., the validity of the Brush patent, the decision sustaining its validity made a victory for the Brush Company without involving the question as to whether the Cain lamp did or did not infringe the Brush patent. As a matter of fact, the Cain lamp did not infringe the Brush patent, as subsequent events have clearly shown, but the defence having chosen their own battlefield were defeated on a question of their own raising, whereas had they made another issue they certainly would have won. With this precedent no court of lesser or equal jurisdiction could be found to reverse it, and preliminary injunctions were readily granted upon application of the Brush Company. A second suit was brought against a user of the Indianapolis Jenney Electric Light Company's double carbon lamp, and this, in view of Judge Gresham's previous decision, was practically admitted to be an infringement, and the decision was therefore, of course, in favor of the complainant. The next case decided was against a user of the Scribner lamp, in Toledo. This was in the Federal Circuit Court and the Western Electric Company were not a party to it. The decision therein reached did not affect the Western Electric Company's case, just decided, because the latter was in a court of another jurisdiction. A suit, however, had been previously begun in the Northern District of Illinois against the Western Electric Company, and in this Judge Gresham granted a preliminary injunction because of the finding of the Court at Toledo—the two suits being upon the same Scribner lamp, which it has now been decided is no infringement at all.

In this last case, just decided, some curious testimony was introduced by alleged experts, some of which is called to mind by an editorial in the *Electrical World* of last week. It was to the effect that a double carbon arc lamp came into use and was perpetuated merely as a fad, and that ordinary mechanical skill would have enabled one to obtain all-night service from almost any type of the so-called single carbon lamps in use prior to 1884.

While from the general character of much of our so-called electrical expert testimony we are not surprised that such a statement should be made before the court, we are surprised that it should be repeated with presumptive editorial sanction in a paper like the *World*.

The witness to whom this statement is attributed may in his capacity of associate counsel have had an object to gain by making it, but its repetition by the *Electrical World*, with the endorsement that "the point he makes seems to be one of some weight," implies an ignorance of the state of the art on the part of the editor that is surprising.

There is absolutely no truth in the statement, as every one knows who was familiar with the art at that time.

In the early history of the art the length of carbons used was practically limited to the length which they could be turned out *straight*.

While they could be molded of any length desired, it was with exceeding difficulty that they could be baked without warping or bending. This was in fact one of the greatest difficulties encountered in the early manufacture of carbons and the one which determined the length of carbons commercially manufactured. In the second place, the length was again limited by the resistance. With the crude materials and imperfect methods then at hand, the best carbons had a very high resistance per unit length, so that carbons long enough for all-night use, even if in the then state of the art they could have been commercially manufactured, would have wasted so much energy as to cause them to be discarded for this reason alone in competition with shorter carbons. In fact, carbons could be made longer even then than it was desirable to use them, as was evidenced by the frequent "pencilling" due to their large internal resistance.

The life of a short carbon could not be advantageously lengthened by increasing its diameter, for various reasons. The first of these was that with a larger mass of carbon to heat, the high efficiency was decreased, just as it would be in an incandescent lamp were the mass and radiating surface of the filament large, and the second because the distribution of the light from the large carbons was far inferior to that from small carbons. To gain efficiency, therefore, the carbons required to be small—the smaller the better. This greatly increased their resistance per unit length, and limited that length by the considerations of economy. The electroplating of the carbons with copper, as practised by Weston and others, and afterward patented by Brush, was an immense step in one direction, but with the lessened diameter of the carbons their tendency to bend and warp in baking was increased, so that the length was again limited. Even to-day, with our improved methods of manufacture, the difficulties with carbons increase very rapidly with their length, for if not perfectly straight, or if there be the slightest lateral movement of the carbon or rod, the tendency is for the carbons to slip by one another and stick. In the earlier days these difficulties were enormously magnified, and such a statement as that endorsed by the *Electrical World* could only be made either by "associate" counsel or by one lamentably ignorant of the then state of the art.

The Pomona Plant. We give in another place this week a continuation of the paper read by Mr. George Herbert Winslow at the Niagara Meeting, on "Long Distance Transmission at 10,000 Volts." This is a description of what is known as the Pomona plant, which in its final extension involves an electrical transmission of 2 ¾ miles, thus constituting it at present the longest transmission by electrical or other means in the world. A few years ago the successful transmission of energy to this distance would have excited universal wonder and admiration, but such has been the progress of electrical development that the reading of this paper at Niagara excited absolutely no comment or discussion.

The probable reason for this was twofold. In the first place, the audience was a technical one, and to the electrical engineer the mere ability to transmit current over great distances has never been questioned. To the engineer there are always two questions: first, can it be done? and second, when it is done, will it pay? The first question has been so authoritatively answered by the 100-mile transmission from Frankfort to Lauffen that it will never again be raised even if the distances involved equal those between the Atlantic and Pacific coasts. The second question is a new one with each new installation, and to that question engineers will ever give heed and discussion. Unfortunately, Mr. Winslow, though describing in full the details of construction of this particular plant, omitted all reference to data by which the financial engineering question could be judged. Without these data the paper lacked interest, for however excellent the technical design and workmanship of the project may be, it is a failure if the financial engineering end of it has failed—that is, of course, if the sole object of the project is to make money. Without intending to disparage the engineering ability displayed in the Pomona plant, there are probably twenty or forty other engineers in this country who could design and erect an equally good one from the purely technical standpoint, and it is equally probable that no two of them would follow out the same design. If the Pomona plant *pays*, then the present design has extreme interest. But, as before stated, Mr. Winslow merely states the physical engineering difficulties encountered and how they have been successfully surmounted, without indicating at all the financial engineering difficulties that were met or permitting his audience to judge whether or not they were solved. In this practical and utilitarian age mere beauty has less of attraction than adaptability, and unless the means employed are proved adequate to the ends desired, no mere attractiveness of those means will commend them to others.

Too often this is lost sight of, and references to what have proved successful in given instances have frequently been cited to prove something that they do not and cannot prove in another case. As an illustration in point: In the Frankfort-Lauffen experiment the sole object was to settle certain technical questions involved in transmissions at unusual voltages and under some hitherto untried conditions. The question of financial engineering did not enter into the project for a moment. The questions which it was intended to settle, as well as others, were all settled in a most satisfactory and gratifying manner, and the experiment was therefore a success of the most marked character. The fact that the power cost five times as much when delivered at Frankfort as it could be generated for locally by steam had nothing to do with the case, nor would it have had any bearing on the case had it cost twenty times as much; and yet we are constantly hearing this experiment cited as a marked illustration of successful transmission of power, whereas in the commercial aspect of the case it was a most marked illustration of a kind that would bankrupt any company that might be foolish enough to undertake it.

Now, in the San Bernardino transmission of 28¾ miles, assuming that the power is transmitted so as to successfully compete with locally generated steam power—what are the conditions of competition? What can locally generated power be sold for at a profit? We know that it is only a question of the cost of the local article how much we can afford to pay to bring articles from outside to compete with it. We happen to know that fuel is worth in San Bernardino about $8 per ton. Mr. Winslow does not state that, nor does he state what other supplies that go to make up the cost of power are worth at that point.

Supposing, as we do suppose, that the San Antonio Light and Power Company can sell their current for light at San Bernardino—can they sell it for power? We have understood that they do not sell it for power. If this be so, the question naturally arises, why? If it pays to transmit this power to San Bernardino, would it pay to transmit it the same distance to other localities? Evidently there are two questions involved in this, neither of which does Mr. Winslow answer. The first of these is, how much does power cost at San Bernardino? and the second is, what are the fixed charges on the transmission plant?

It is this indefiniteness or silence on these vital points that makes the paper so unsatisfactory and is probably the chief cause why the paper received neither comment nor discussion at the time of its reading. The second cause is probably the fact that few of the engineers regarded the author's method of governing his wheels as in accordance with the best engineering practice. It is our own opinion that a mere statement of the conditions would be enough to condemn Mr. Winslow's method of regulating by diversion, but as if this was not enough his further defence would convince the most skeptical.

The paper is a very readable one however, contains a great deal of information that may be of interest to the student, and is a well written description of a very important engineering enterprise, *as far as it goes.* From the engineering standpoint, however, it is like the play of Hamlet with the character of Hamlet left out. It is a description of an engineering work with the chief data which should make such a description of value entirely eliminated.

* * *

Storage Battery News. Storage batteries are to be tried again on the Fourth Avenue car line in this city. This time the chloride type will be experimented with. There is no reason why they should not be successful if the company is willing to pay the price for maintenance. It is worth noting that a few weeks before the announcement of this experiment was made, M. Jules Sarcia, the engineer of the "Societe Anonyme pour le Travail Electrique des Metaux," which has had charge of the much talked of storage battery traction experiment in Paris, reported in the "Bulletin de la Societe Internationale Electriciens" (see ELECTRICITY, Vol. IX, No. 2,) that he had been compelled to discontinue the use of positive plates of the Laurent-Cely (chloride) type and return to the "primitive form which Faure gave them." His reasons for discarding the former are given as follows:

> After the formation, their active material is composed of peroxide of lead as crystalline as the original spongy lead, and, in consequence, of great mechanical solidity; but by the normal succession of charges and discharges the crystalline peroxide of lead becomes powdery and in consequence falls to the bottom of the jar.
>
> This fall of peroxide is fatal, and every manufacturer of accumulators who tells you of positive plates with an indefinite life deceives himself or deceives you. The average life of the first plates of tramway batteries was about 8,000 car-miles. After this travel all their peroxide of lead was fallen and their perforated support unfit for service.

Other storage battery news of the week comes from the Chicago *Inter-Ocean*, whose Washington correspondent tells of the plan of one of the trunk lines leading out of Chicago to replace steam by electric locomotives on its mail and passenger trains. There is to be a great generating station at the coal mines in the interior of Illinois, from whence lines will run to various charging stations along the line of the railroad. Here chloride plates will be charged. Huge cranes will take out the used plates, substituting therefor the newly charged ones at the various charging stations, and presto!—the entire electric traction problem is solved.

We do not believe the editor of the *Inter-Ocean* would have printed such stuff if he had given any thought to this subject. We give him warning that his Washington correspondent has been imposed upon—probably by the wicked agents of a storage battery company whose chief business appears to be the sale of stock--$13,000,000 of it. The storage battery has its uses, and the chloride type of cell is no doubt as good as any; but anyone who talks of applying it for traction purposes on trunk lines is either a fool or a knave, probably the latter. The idea has been tried in this country almost continuously for over ten years on ordinary street car work, and has proved a failure in every case. It will never be successful, even for travel at the rate of six miles an hour and on a perfectly level and straight track, until some one makes a new *discovery.* It is not *invention* which is needed. Entirely new methods must be discovered before any storage battery traction scheme is worth the attention of any investor.

Under the Searchlight.

Views and Opinions on Timely Topics.

The Substitution of Electricity for Steam in Railway Practice.

Commenting on Dr. Louis Duncan's inaugural address at the Niagara meeting of the A. I. E. E., the *Evening Post* said in a recent issue:

> As to passengers, Dr Duncan takes the report of the New York Central Company for 1892, and finds that the total number of through passengers carried was but 234,650, while the number of local passengers was 21,978,979. "It will be seen," he says, "that the through traffic is but a small percentage of the total number of passengers, and that the question of preserving this local traffic is of great importance Now, the greater part of this local traffic will in the next few years be taken by the electric roads paralleling the steam roads, unless some effort is made to control the electric roads or to give an equally good service between adjacent towns" This far-reaching conclusion appears to depend upon the large local travel of the New York Central as revealed by the statistics just given. Before reaching that judgment Dr. Duncan ought to have investigated the subject a little further.
>
> The New York Central Company in making up its reports counts as "through" passengers only those traveling between New York City and Buffalo on its main line, or between New York and Chatham on the Harlem division. This division between "through" and "local" is made under rulings by the New York State Board of Railroad Commissioners, and is doubtless accurate enough for the very small use to which the statistics, as thus defined, could be put; but upon such a subject as that of electrical competition, they are worse than worthless, they are very misleading. The very large passenger travel to and from New England and the West via Albany is counted as local under this system; so, too, is all traffic which moves in through cars or trains to and from places off the main line, such as between Montreal, or the Adirondacks, or the Thousand Islands, or Saratoga and New York or any other city. Nor is this all. There is a large amount of passenger traffic which indeed starts from or is destined to some city or village on the New York Central, and is therefore "local," but because the passengers are going to or from Chicago or some prominent city at the West they take trains which run through, or connect with other trains which do so. In either case, for the purposes of electric competition, they are "through" travelers for the reason that no local trolley line could secure their passage money. Then there are also to be reckoned the passengers who take the New York Central trains after reaching that line from some connecting local road in New York State; to hold such travel, a competing electric road would require that its lines be extended practically as far as the present steam branches reach.
>
> It is impossible to say how large would be the number of travelers—strictly local—which a parallel line of electric road might hope to take away from the New York Central, but manifestly the number is very much smaller than Dr. Duncan supposes; yet that strong trolley competition could hurt the steam company, if established, there is no doubt; of that we may judge from the effects of trolley lines upon the Pennsylvania Railroad near Philadelphia, and upon the New Haven Railroad in New England. But that the New York Central would prove the easy prey supposed by the author of the address is an error into which the gentleman has been led by quoting statistics compiled for a different purpose and on a different basis from that required for a proper judgment as to the probabilities of success for trolley competition.

Which all goes to show that while Dr. Duncan could doubtless give Mr. Thomas L. Greene, the statistical expert of the *Post*, much valuable instruction in the science of electrics, Mr. Greene is equally competent to give Dr. Duncan valuable instruction in the art of statistics and how *not* to handle them. As the *Sun* once said, in discussing the question of statistics, "there are times when two and two make not four, but five and a quarter."

* * *

Points from the Inside.

(From Town Topics.)

The point comes directly from the inside that General Electric will sell considerably above 50 this year. When the movement gets well under way, the stock will cross 45 in double-quick order.

Similar points taken directly from the inside of the General Electric Company (from J. P. Morgan, C. H. Coster, C. A. Coffin, etc.,) have already cost investors in General Electric and its sub-enterprises about $25,000,000.

* * *

EVIDENCE has been laid before us that the solicitors who are canvassing this city in behalf of the "Steam and Street Railway Purchasing Agent's Directory" are worthy of no confidence whatever. Of the publication itself, if such there be, we know nothing. But the methods of the agents referred to are dishonest and fraudulent, and they should not be received in any man's office. There is, moreover, one law of business to which there is no exception: no concern should pay any money in advance for an advertisement except to a well-known publisher, and even then it should never be paid through agents. We would like to hear more from our constituents as to their experience with the solicitors for the "Steam and Street Railway Purchasing Agent's Directory," whose main office is said to be in the "Evening Post" Building, Chicago.

* * *

A. T.-H. BOND DEAL.

R. Gardner Chase of Boston and Charles E. Legg of Chelsea have brought an action against the Thomson-Houston Electric Company to recover $44,500 worth of bonds which they claim the defendant obtained from them through misrepresentations.

The plaintiffs purchased 150 first mortgage 6 per cent. bonds of the Bangor Electric Light and Power Company, at the par value of $500 each.

On June 1, 1891, the B. E. L. & P. Co., together with other companies, conveyed to a Maine corporation, called the Public Works Company, all its properties, subject to first mortgages.

July 15, 1891, the Public Works Company issued $1,000,000 of 5 per cent. bonds for the purpose of refunding the bonds of the B. E. L. & P. Co. and the bonds of the other companies which it had acquired.

Oct. 12, 1891, while the plaintiffs still held $44,500 of the B. E. L. & P. Co.'s bonds, they allege in their bill that the defendant falsely and fraudulently represented to them that a large majority of the holders of the first mortgage bonds of the several companies had assented to the plan of reorganization, and that defendant wished possession of plaintiffs' bonds for the purpose of exchanging them for Public Works Company's bonds. Relying on these representations, plaintiffs delivered the $44,500 of bonds for exchange.

The plaintiffs allege that they have lately learned that defendant never delivered the bonds to the Public Works Company, but fraudulently keeps the same.

We suppose these $44,500 of bonds go to make up the item of $64,500 bonds of the Bangor Electric Light and Power Company, claimed as an asset by the General Electric Company in their last report.

* * *

Mr. H. M. Byllesby must have had visions of great wealth when he saw the first car go over the St. Paul and White Bear Railroad. Col. Sellers's figuring his profits on eyewater—so many people, so many eyes, so many *sore* eyes, so many bottles of eyewater sold, millions in it!—must have occurred to him as he contemplated the possibilities of 102 trolley systems, 102 lake resorts with 204 bears, and from $200,000 to $1,000,000 bonds on each system, which Mr. Coffin could sell in Boston at 60. For did not Mr. Coffin say in 1892 to all his agents, that he could take an unlimited number of bonds at 60?

* * *

It is about settled, we think, that the General Electric Company will soon begin a movement to consolidate all their works at one point. The place is very likely to be at Depew.

* * *

According to the Chicago *Chronicle*, "Assistant Chief Manager Bailey of the General Electric Company admits" that his company is seriously considering the equipment of a new trunk line from Chicago to Buffalo on which trains will be run through at the rate of 150 miles an hour. "It is no longer a theory," says Assistant Chief Manager Theodore Buncombe Bailey, "that such a road can be built and operated with safety," and of course he knows, for did he not build an electric railroad in his native town of Ottawa, Ill. (pop. 9,985)?

* * *

A St Louis inventor has patented a device for raising drowned bodies from the beds of rivers and lakes. The apparatus utilizes from four to eight sticks of dynamite in a machine box connected by fine wire to the electric battery on the shore, from which is communicated the spark that fires the heavy charge resting on the river bed.—*New York World.*

Dr. Adams's air line project would be a good subject for this St. Louis inventor to experiment upon.

* * *

Justifiable.

(From the Electrical Engineer, London).

At the North London Police Court the other day, Joseph Triggs, aged 45, compositor, of Walsingham-road, who was found drunk in Stoke Newington-road, excused himself on the ground that in the office where he had been at work all night the electric light had broken down; the gas was put on, which made the air so oppressive. He was discharged.

* * *

Truths from Our Exchanges.

(From Railway Review.)

Electricity is looked upon as a welcome blessing in every home.

(From New York Herald.)

Electricity is life.

* * *

You Bet!

(From New York Times.)

Electricity is just now in high repute.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER IV.

The St. Paul and White Bear Railroad Company.

Introductory.

Probably no enterprise which engaged the attention of the General Electric financiers, either in the West or in the East, furnishes better evidence in support of the charge of Electricity, that the whole financiering scheme of Mr. Coffin was a gross swindle, than the one which we treat this week—the St. Paul and White Bear Railroad Company.

When Mr. H. M. Byllesby went to St. Paul as the official head of the Thomson-Houston (G. E.) Company, his predecessor, Mr. E. R. Gilman, was supposed to have applied the Coffinesque system of raising bonds to the limit of his capacity in this direction—which the records show were not small. Mr. Byllesby was, therefore, sent out to discover new worlds to conquer—new schemes for the manufacture of worthless bonds which could be sold in the East. Mr. Byllesby in his industry found one place which had escaped Mr. Gilman's attention, although it was under his very nose.

There was a steam dummy line running from the northern outskirts of the city of St. Paul to a little manufacturing settlement one-third of the way between the terminus of the St. Paul street railway system and White Bear Lake. This steam road was owned by Messrs. Stone & Morton, of St. Paul, the latter a son of ex Gov. Oliver P. Morton, of Indiana. The road had never been profitable, because most of the manufacturing plants established at its northern terminus had been unprofitable and transitory. Mr. Ralph Beach, now of the General Electric railway department, had, among others, met with misfortune in his efforts to establish a wheel factory there. There was no resident population worth mentioning, the workmen preferring to live nearer the city of St. Paul proper. This dummy line had been built almost in a night, with "shingle" roadbed, and was equipped with a half-dozen cars and three locomotives of the kind usually adopted for such service. Having been a losing venture, it was, of course, just what the General Electric financiers desired to begin operations with, though its franchise did not permit of connection with the cars of the St. Paul street car system, there being an interval of two blocks over which passengers must walk. Such small matters, however, as connections with *towns* or with other roads carrying people, were not considered worthy of consideration by these unrivalled financiers. The dummy line had a track 3.5 miles long.

THE SCHEME.

The scheme for utilizing this steam road in the manufacture of bonds and stocks, as it unfolded itself to Mr. Byllesby and was endorsed by Mr. Coffin, was to organize and capitalize a new company to be known as the St. Paul and White Bear Railroad Company, paying for the dummy line with a portion of the bond issue, and selling the rest in Boston. The track was to be extended to the south shore of White Bear Lake, eight miles further, or 11.5 miles from St. Paul.

This was done, $300,000 of bonds planned to be issued and $200,000 of stock, $75,000 of the former going to Messrs. Stone and Morton to pay for the property of the dummy line.

NEW RESORTS WERE NOT NEEDED.

The State of Minnesota has within its boundary no less than 7,000 lakes. By far the larger number of these would, no doubt, be better described as ponds rather than as lakes. It is a fact, however, that scarcely any city, town or village in the State is without its lake, and many of the cities, towns and villages have quite a number of lakes adjacent to or within their boundaries.

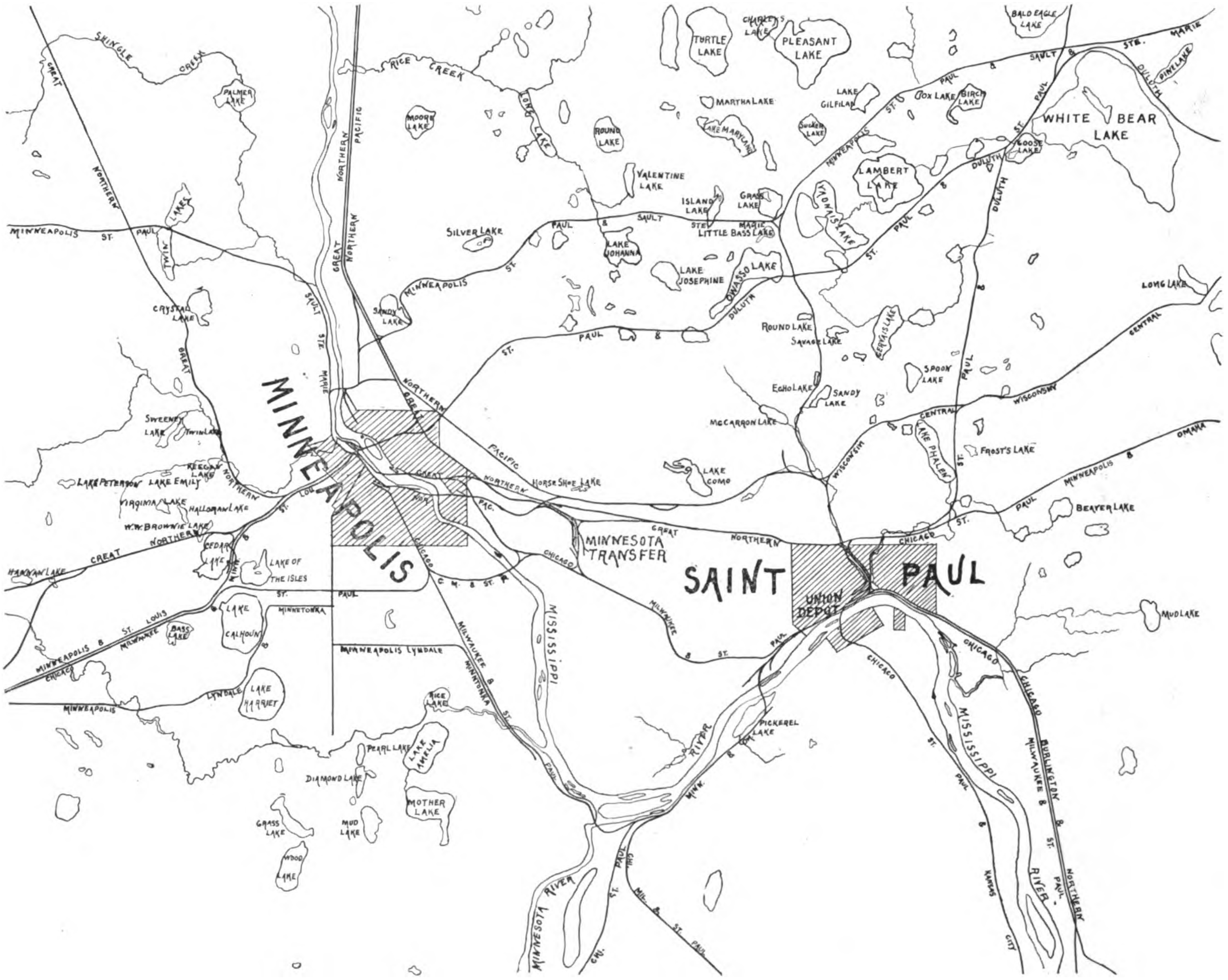
The city of St. Paul itself has, as shown by the accompanying map, no less than 102 of these lakes or ponds within a radius of 12 miles from the center of the city, not to mention the thirty or forty within a like radius around Minneapolis.

Most of them were surrounded by virgin forests, as was the southern shore of White Bear Lake. But the grand opportunities presented were of course not lost upon Messrs. Byllesby and Coffin. Mr. Byllesby's letters are, no doubt, still on file in the General Electric offices, in which he dilated upon the possibilities for applying the Thomson-Houston financing scheme to a proposed route to each of these 102 lakes. Why not? Could not each and every one of them be bonded for double enough to cover equipment and construction? And could not Mr. Coffin sell the bonds in Boston, if they could be taken at 60? Two of these lakes must certainly have been in mind for the next efforts after the White Bear scheme had been carried out. They are Goose Lake and Sucker Lake, and we only wonder that the latter was not chosen first in preference to White Bear.

Seriously or honestly considered, there was no apparent reason for building any electric line to White Bear Lake. There was nothing whatever at the terminus of the road except a wilderness. The scheme was, however, as outlined to the purchasers of the bonds, to establish there a summer resort. If there was any need or chance of success for any further resorts of this nature around St. Paul and Minneapolis, the fact was not apparent to local capitalists.

The city of Minneapolis has no less than ten lakes or ponds within its boundaries, and a large number adjacent to it. At least three of these lakes within the boundaries of the city were made most attractive pleasure resorts, the boundaries being surrounded by excellent roads, lighted by electricity and with beautiful driveways from various parts of the city and from the adjoining city of St. Paul. On the shores of each of these lakes, were splendid pavilions and numerous places for refreshments, also places where boats and fishing tackle could be hired. Public carriages for those desirous of riding through the charming scenery of the lakes; ponies for children, and all the usual means of ministering to the pleasure or comfort of visitors. Excellent music was always to be heard during the summer months. These lakes were easily accessible from any part of the city of Minneapolis, or its sister city, St. Paul, by means of an extensive network of electric railways. These lakes were the favorite resorts of the citizens of both cities, and during the summer months large numbers of the people of both cities visited them daily and nightly.

In addition to these resorts there were quite a



MAP SHOWING THE POSSIBILITIES FOR LAKE RESORTS, TROLLEY LINES AND BONDING OPERATIONS AROUND ST. PAUL.

number of others within a few miles of the boundaries of both cities. The largest of these is Lake Minnetonka, a beautiful sheet of water about twelve miles long and about five wide, situated about ten miles west of Minneapolis and eighteen miles west of St. Paul. Lake Minnetonka is a favorite summer resort for the well-to-do citizens of both cities, and on its shores are numerous handsome private summer residences and a number of very large and fine hotels. The shore of Lake Minnetonka must measure close to sixty miles. The lake is beautifully situated and was easily accessible first by steam railroad, second by steam dummy road, and third by electric line.

[COPY.]

FINANCIAL STATEMENT.

ST. PAUL AND WHITE BEAR RAILROAD COMPANY.

NOVEMBER 1, 1892.

Assets.		
Railroad plant complete	$388,827.29	
Pleasure grounds, casino, etc., at White Bear	21,997.36	
		$410,824.65
Furniture and fixtures	$1,241.9	
Accounts receivable	1, 86.43	
Cash	40 . 8	
Material on hand	4, 70.11	
Insurance premiums paid in advance	300.00	
		6,60 .08
Total assets		$417,429.73
Liabilities.		
Capital stock, issued	$200,000.00	
Bonds	200,000.00	
Bills payable	2,800.00	
Accounts payable	9,759. 9	
		$412,559.89
Gross earnings:		
July 1, 1892, to October 31, 1892	$27,12 .97	
Operat'g expenses and fixed charges	22,2 6.13	
Surplus		4,8 9.84
Total liabilities		$4 7,42 .73

[COPY.]

ST. PAUL AND WHITE BEAR RAILROAD COMPANY.

TRIAL BALANCE, NOVEMBER 1 18 2.

		Credits.	
Construction	$338,627 40	Capital stock	$200,000.00
Terminal properties	13,19 .86	Bonds	200,000.00
Franchise	50,000.00	Bills payable	2,800.00
Furniture and fixtures	241.96	Trainmen's deposit	225 00
Building	199.89	Pay-rolls	7 3.07
Fire insurance	101.71	Vouchers	5,749.67
Indemnity insurance	695.11	Income	21,959.87
Freight earnings	768.14	Passenger fares	14.88
Trainmen's uniforms	12.00	Ticket sales	2,149.72
Cash	40 .58	Repair department	1. 0
Operat'g expenses	17,214.77	Bank account	657.68
Terminal operating expenses	3,744. 4	Northwest General Electric Co	2 9.50
Warehouse stock	4,07 .11	James Thomas	6 3
St. Paul City Railway Company	10.00	Nolan Brothers	1 6 0.00
Wildwood Park Co.	5,08 .17	Richard Norton	00
Standard Life and Accident Ins. Co.	29.75	Weed & Lawrence	231.71
Ramaceoitte & Gilbert	67 7	Pioneer Press Co.	20 .53
I. G. Earhuff	6. 0		
J. R. Morris	1 .00		
Tim Reardon	3, 00.00		
W. S. Morton	3 .00		
I. F. Pilling	8. 7		
North St. Paul Table Company	1.00		
Dale & Co.	148.75		
A. McDonald	1.50		
	$139,685.86		$139,685.86

Lake Minnetonka and the other lakes referred to were west of St. Paul, and to reach them it was necessary to pass through Minneapolis.

North and northeast of St. Paul, and but a short distance from the city, there are a large number of lakes and ponds, and it was one of the largest of this group that was selected for the swindling operations of the St. Paul and White Bear Railway Company. This lake was already easily and cheaply accessible from that city by the St. Paul and Duluth Railroad.

White Bear Lake is about three miles long, and is two miles wide at its widest part. On the north shore of this lake was the little village of White Bear with a population of 1,300, and in the village were three or four small hotels and boarding houses, together with a dancing pavilion and music hall, both houses owned or run by a man of the name of Ramonetti, who kept a bakery and confectionery store in St. Paul and only kept his White Bear resort open for a period of about three months during the year. The St. Paul and Duluth Railroad had two stopping places on the west shore of the lake, the first being Ramonetti's Pavilion and the second White Bear Beach Depot.

On the south shore there was no settlement, and it was the intention of the promoters of the

St. Paul and White Bear Railroad Company to found a settlement at a point just two miles by water from the village of White Bear. The first step in this direction was to build a railroad and issue stock to the extent of $200,000 and $300,000 of bonds!

It has been said that every well-to-do citizen of Minnesota has a lake of his own, but however this may be, we think we have made it clear that there was no long-felt want for a new summer resort at White Bear Lake or an electric line to carry the people.

LOCAL OPINION OF THE PROJECT.

In considering the prospects of success for this venture it is proper to recall the state of public opinion in the two cities of St. Paul and Minneapolis at that time in regard to the encouragement of new enterprises promising any benefit to the community. Subsidies were raised a most in a day for any sound addition to the business of either city. Land was donated freely, and every effort was made to attract new concerns to locate there. For the simple erection of a large office building the New York Life Insurance Company was guaranteed $1,000,000 of new insurance. Yet no local enthusiasm was aroused for the St. Paul and White Bear Railroad project. True, we have not forgotten that 40 acres of land were donated at Wildwood Park, as the new resort was called, but this came largely from Stone and Morton, who stated when they went out to look things up preparatory to building the road, that they "had land somewhere in that locality, but never knew just where." Subsequently, it may be remarked, most of this land was divided up among the promoters, and the bondholders have no benefit from it whatever its value.

No local capitalists could be found to take any interest whatever in a project which had no hope of success, except, as stated, Stone and Morton, who had a dead horse to dispose of in their dummy line.

The officers for the first year were as follows: President and general manager, W. S. Morton; vice-president, L. K. Stone; secretary and treasurer, W. Ruan; superintendent, S. B. Livermore.

Later some changes were made. At the date of our last report the officers were: President and general manager, H. M. Byllesby; secretary, W. P. Johnson; treasurer, W. Ruan; purchasing agent, S. B. Livermore.

THE RESULT.

But the road was built and bonded, or rather, bonded and built. No large hotels were provided for permanent visitors, but a few harmless amusement schemes were introduced, such as a dancing pavilion, a few swings and two tame bears which Mr. Byllesby sent from St. Paul. The line itself was built through the fields nearly all its length. The novelty of the ride for the first few months attracted quite a number of passengers, and the company apparently made money, as shown by the accompanying official statement for the period covering the first four months' operations.

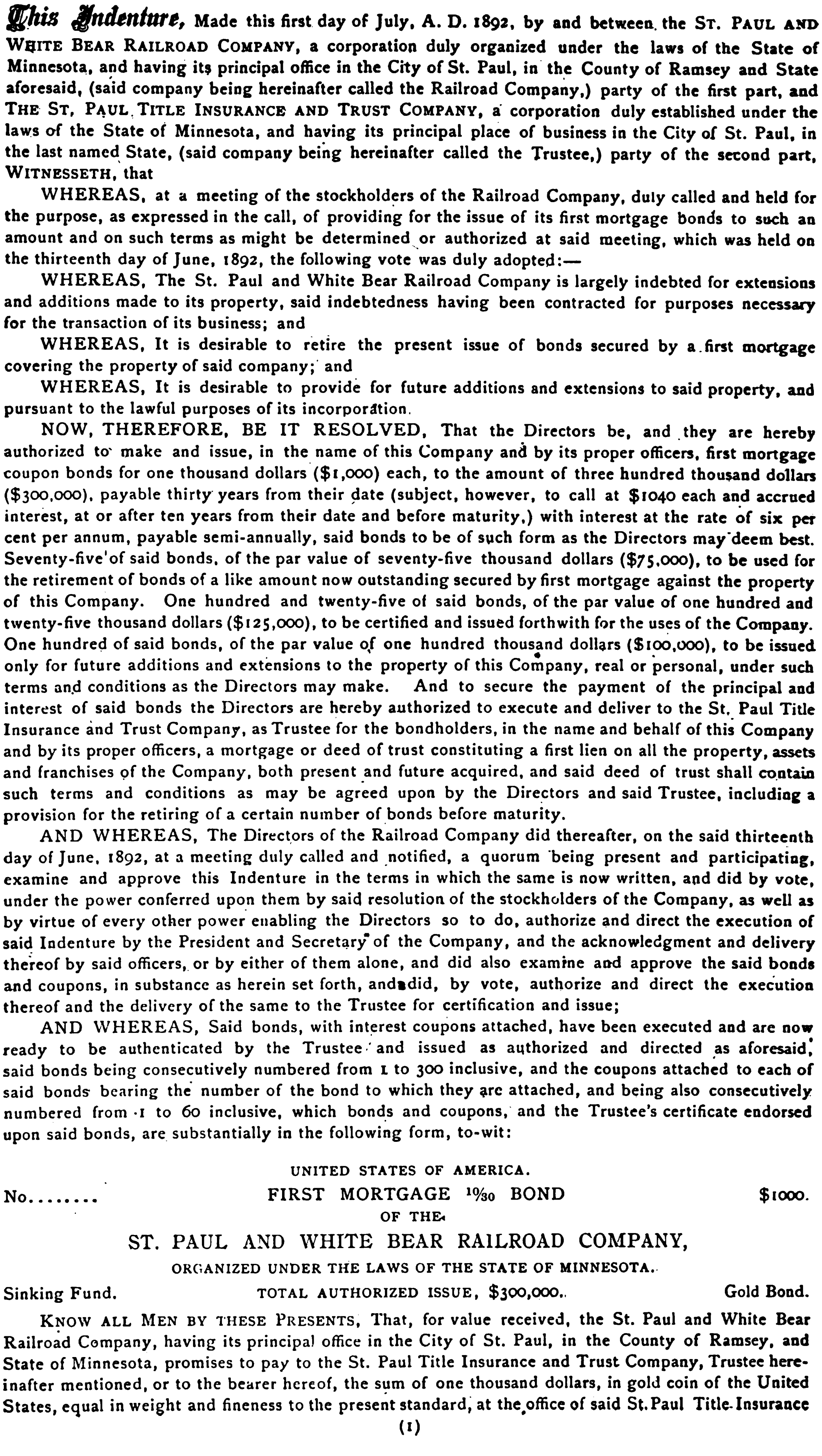
No such showing was made in any later statement. After October the receipts fell to almost nothing, and the loss from operation was from $1,200 to $2,000 per month until the following summer. If it is argued that the road might have ceased operations during the winter and still made money during the summer months, no further answer is necessary than to compute the fixed charges for one year and compare them with the summer's profits:

Gross earnings, July 1 to October 1.	$27,125.97
Operating expenses and fixed charges, 4 months.	22,256.13
Profits (4 months)	$4,869.84
Fixed charges (interest on bonds) one year	18,000.00
Fixed charges (interest on bonds) 9 months	$13,000.00
Deduct profits (4 months)	4,869.84
Shortage for year	$8,631.16

Of course the inevitable came to pass, and Mr. F. A. G. Moe has been appointed receiver of the property. Those who know the situation thoroughly in St. Paul say that the only possible way for securing any return to creditors or bondholders is to tear up the tracks, sell the equipment, and close up the business. There is not and never has been any reason for the existence of the road except to find something which could be *bonded*, and give Mr. Coffin more bonds to take at 60 and sell to his New England friends at 80. We find that of these St. Paul and White Bear bonds $125,000 went to the United Electric Securities Company of Boston

We do not see that any official records of this company are specially needed for educational purposes. The record of the entire transaction is so plain, the end has come so soon, prolonged argument would be superfluous. We present a copy of the first page of the bond agreement merely to show the uniformity of these docu-

BOND AGREEMENT—FAC-SIMILE OF FIRST PAGE.



This Indenture, Made this first day of July, A. D. 1892, by and between the St. Paul and White Bear Railroad Company, a corporation duly organized under the laws of the State of Minnesota, and having its principal office in the City of St. Paul, in the County of Ramsey and State aforesaid, (said company being hereinafter called the Railroad Company,) party of the first part, and The St. Paul Title Insurance and Trust Company, a corporation duly established under the laws of the State of Minnesota, and having its principal place of business in the City of St. Paul, in the last named State, (said company being hereinafter called the Trustee,) party of the second part, Witnesseth, that

WHEREAS, at a meeting of the stockholders of the Railroad Company, duly called and held for the purpose, as expressed in the call, of providing for the issue of its first mortgage bonds to such an amount and on such terms as might be determined or authorized at said meeting, which was held on the thirteenth day of June, 1892, the following vote was duly adopted:—

WHEREAS, The St. Paul and White Bear Railroad Company is largely indebted for extensions and additions made to its property, said indebtedness having been contracted for purposes necessary for the transaction of its business; and

WHEREAS, It is desirable to retire the present issue of bonds secured by a first mortgage covering the property of said company; and

WHEREAS, It is desirable to provide for future additions and extensions to said property, and pursuant to the lawful purposes of its incorporation.

NOW, THEREFORE, BE IT RESOLVED, That the Directors be, and they are hereby authorized to make and issue, in the name of this Company and by its proper officers, first mortgage coupon bonds for one thousand dollars ($1,000) each, to the amount of three hundred thousand dollars ($300,000), payable thirty years from their date (subject, however, to call at $1040 each and accrued interest, at or after ten years from their date and before maturity,) with interest at the rate of six per cent per annum, payable semi-annually, said bonds to be of such form as the Directors may deem best. Seventy-five of said bonds, of the par value of seventy-five thousand dollars ($75,000), to be used for the retirement of bonds of a like amount now outstanding secured by first mortgage against the property of this Company. One hundred and twenty-five of said bonds, of the par value of one hundred and twenty-five thousand dollars ($125,000), to be certified and issued forthwith for the uses of the Company. One hundred of said bonds, of the par value of one hundred thousand dollars ($100,000), to be issued only for future additions and extensions to the property of this Company, real or personal, under such terms and conditions as the Directors may make. And to secure the payment of the principal and interest of said bonds the Directors are hereby authorized to execute and deliver to the St. Paul Title Insurance and Trust Company, as Trustee for the bondholders, in the name and behalf of this Company and by its proper officers, a mortgage or deed of trust constituting a first lien on all the property, assets and franchises of the Company, both present and future acquired, and said deed of trust shall contain such terms and conditions as may be agreed upon by the Directors and said Trustee, including a provision for the retiring of a certain number of bonds before maturity.

AND WHEREAS, The Directors of the Railroad Company did thereafter, on the said thirteenth day of June, 1892, at a meeting duly called and notified, a quorum being present and participating, examine and approve this Indenture in the terms in which the same is now written, and did by vote, under the power conferred upon them by said resolution of the stockholders of the Company, as well as by virtue of every other power enabling the Directors so to do, authorize and direct the execution of said Indenture by the President and Secretary of the Company, and the acknowledgment and delivery thereof by said officers, or by either of them alone, and did also examine and approve the said bonds and coupons, in substance as herein set forth, and did, by vote, authorize and direct the execution thereof and the delivery of the same to the Trustee for certification and issue;

AND WHEREAS, Said bonds, with interest coupons attached, have been executed and are now ready to be authenticated by the Trustee and issued as authorized and directed as aforesaid, said bonds being consecutively numbered from 1 to 300 inclusive, and the coupons attached to each of said bonds bearing the number of the bond to which they are attached, and being also consecutively numbered from 1 to 60 inclusive, which bonds and coupons, and the Trustee's certificate endorsed upon said bonds, are substantially in the following form, to-wit:

UNITED STATES OF AMERICA.

No........ FIRST MORTGAGE $^{10}/_{30}$ BOND $1000.

OF THE

ST. PAUL AND WHITE BEAR RAILROAD COMPANY,

ORGANIZED UNDER THE LAWS OF THE STATE OF MINNESOTA.

Sinking Fund. TOTAL AUTHORIZED ISSUE, $300,000. Gold Bond.

Know all Men by these Presents, That, for value received, the St. Paul and White Bear Railroad Company, having its principal office in the City of St. Paul, in the County of Ramsey, and State of Minnesota, promises to pay to the St. Paul Title Insurance and Trust Company, Trustee hereinafter mentioned, or to the bearer hereof, the sum of one thousand dollars, in gold coin of the United States, equal in weight and fineness to the present standard, at the office of said St. Paul Title Insurance

(1)

ments in all the schemes. There was the stereotyped inducement held out that the bonds were redeemable at $1,040. Mr. Coffin never failed to give his victims a *chance* to make money—on paper.

In the trial balance, a copy of which is also presented, we find the franchise valued at $50,000. This item carries its own moral. The only franchise of any value was the one they could not get—that is, giving them the right to connect with the North Seventh Street line in St. Paul. The steam dummy franchise and the right to continue through the green fields into the wilderness had no value. "Terminal properties, $13,497.36," is also excessive by about $12,000. The only terminal owned was at "Wildwood Park" on White Bear Lake. The power house was about midway on the line, and is included in "Construction, $338,627.40." This latter figure is at the rate of about $30,000 per mile, or nearly double what the entire system should have cost. At the prices then prevailing, $16 000 per mile would have been a generous allowance for the entire system.

It will be noted, moreover, that although $200,000 of bonds had been issued, and the proceeds applied somewhere, after only four months' operations the road was over $12,500 in debt.

CONCLUSION.

We shall be pleased to record the ultimate disposition of this property by the courts, and to report the terms of settlement between the United Electric Securities Company, which bought $125,000 of the bonds (and has been unable to sell them), and the General Electric Company of New York. We shall also be at pains to report the result of the movement now on foot among the swindled preferred stockholders of the Northwest General Electric Company to recover their money from the General Electric Company. Before we have concluded this series of articles, we will, we think, give these preferred stockholders much valuable information for use in their suit.

Of course in this White Bear enterprise it would be useless to apply the same method of analysis which can fairly be applied to most railway systems. It was purely a suburban system, with a large population two miles away from one terminal and two bears and a keeper at the other. The only problem in forecasting the result was whether or not the large population of St. Paul, or any appreciable part of it, could be induced to forego well-established, comfortable resorts, of which there were already large numbers suited to all tastes, pay their fare on the cars of the St. Paul City Railway to the end of the line, walk two blocks. and pay another fare for an eleven-mile ride through the fields to a shabby resort in the woods, where the chief attraction was Mr. Byllesby's two bears.

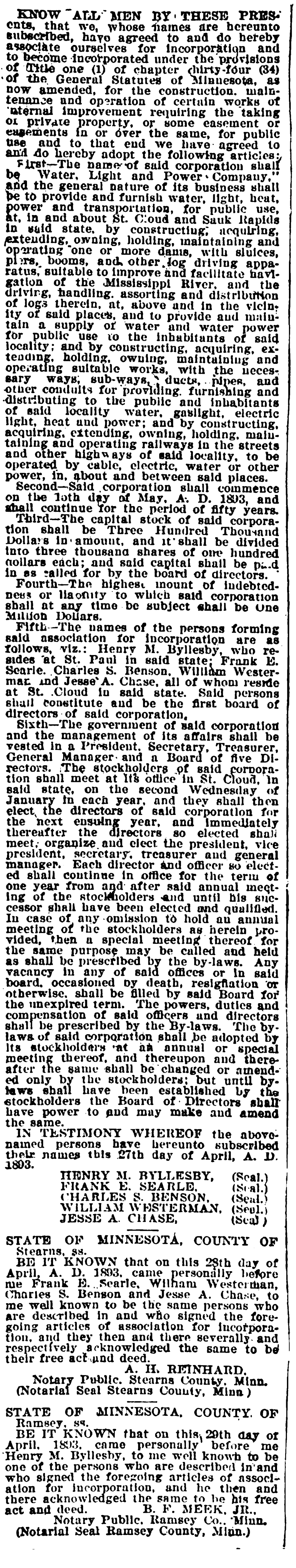
But the General Electric financiers cared little for results of actual operation. They wanted to sell bonds and get quick action on their money. They got it, and with over 50 per cent. of all the companies which they financed in the hands of receivers, it looks as though their victims were also getting plenty of action.

THE ST. CLOUD SCHEME.—II.

In our last issue, in discussing the affairs of the St. Cloud City Street Car Company, we said :

> The trade at St. Cloud City . . . differed in some respects from that at Winona. The town had only 7,686 people. The railway company only was bought, as the scheme did not hold out long enough to permit of buying the lighting company and making another of Mr. Coffin's grand consolidations. There was thus only one capitalization.

When we said that the scheme did not hold out long enough to permit of making another of Mr. Coffin's grand consolidations, we were fortified, as we always are, with documentary proof. This proof we present herewith in the fac-simile copy of an advertisement which appeared in the St. Paul *Pioneer Press* of May, 1893. This was a notice of incorporation of the "Water, Light and Power Company," to provide light, heat, power, etc., for public use in and about St. Cloud and Sauk Rapids.



KNOW ALL MEN BY THESE PRESENTS, that we, whose names are hereunto subscribed, have agreed to and do hereby associate ourselves for incorporation and to become incorporated under the provisions of Title one (1) of chapter thirty-four (34) of the General Statutes of Minnesota, as now amended, for the construction. maintenance and operation of certain works of internal improvement requiring the taking of private property, or some easement or easements in or over the same, for public use and to that end we have agreed to and do hereby adopt the following articles:

First—The name of said corporation shall be Water, Light and Power Company," and the general nature of its business shall be to provide and furnish water, light, heat, power and transportation, for public use, at, in and about St. Cloud and Sauk Rapids in said state, by constructing, acquiring, extending, owning, holding, maintaining and operating one or more dams, with sluices, piers, booms, and other log driving apparatus, suitable to improve and facilitate navigation of the Mississippi River, and the driving, handling. assorting and distribution of logs therein, at, above and in the vicinity of said places, and to provide and maintain a supply of water and water power for public use to the inhabitants of said locality; and by constructing, acquiring, extending, holding, owning, maintaining and operating suitable works, with the necessary ways, sub-ways, ducts, pipes, and other conduits for providing. furnishing and distributing to the public and inhabitants of said locality water, gaslight, electric light, heat and power; and by constructing, acquiring, extending, owning, holding, maintaining and operating railways in the streets and other highways of said locality, to be operated by cable, electric, water or other power, in, about and between said places.

Second—Said corporation shall commence on the 10th day of May, A. D. 1893, and shall continue for the period of fifty years.

Third—The capital stock of said corporation shall be Three Hundred Thousand Dollars in amount, and it shall be divided into three thousand shares of one hundred dollars each; and said capital shall be paid in as called for by the board of directors.

Fourth—The highest amount of indebtedness or liability to which said corporation shall at any time be subject shall be One Million Dollars.

Fifth—The names of the persons forming said association for incorporation are as follows, viz.: Henry M. Byllesby, who resides at St. Paul in said state; Frank E. Searle. Charles S. Benson, William Westerman and Jesse A. Chase, all of whom reside at St. Cloud in said state. Said persons shall constitute and be the first board of directors of said corporation.

Sixth—The government of said corporation and the management of its affairs shall be vested in a President. Secretary, Treasurer, General Manager and a Board of five Directors. The stockholders of said corporation shall meet at its office in St. Cloud, in said state, on the second Wednesday of January in each year, and they shall then elect the directors of said corporation for the next ensuing year, and immediately thereafter the directors so elected shall meet, organize and elect the president, vice president, secretary, treasurer and general manager. Each director and officer so elected shall continue in office for the term of one year from and after said annual meeting of the stockholders and until his successor shall have been elected and qualified. In case of any omission to hold an annual meeting of the stockholders as herein provided, then a special meeting thereof for the same purpose may be called and held as shall be prescribed by the by-laws. Any vacancy in any of said offices or in said board, occasioned by death, resignation or otherwise, shall be filled by said Board for the unexpired term. The powers, duties and compensation of said officers and directors shall be prescribed by the By-laws. The by-laws of said corporation shall be adopted by its stockholders at an annual or special meeting thereof, and thereupon and thereafter the same shall be changed or amended only by the stockholders; but until by-laws shall have been established by the stockholders the Board of Directors shall have power to and may make and amend the same.

IN TESTIMONY WHEREOF the above-named persons have hereunto subscribed their names this 27th day of April, A. D. 1893.

HENRY M. BYLLESBY, (Seal.)
FRANK E. SEARLE, (Seal.)
CHARLES S. BENSON, (Seal.)
WILLIAM WESTERMAN, (Seal.)
JESSE A. CHASE, (Seal.)

STATE OF MINNESOTA, COUNTY OF Stearns, ss.

BE IT KNOWN that on this 28th day of April, A. D. 1893, came personally before me Frank E. Searle, William Westerman, Charles S. Benson and Jesse A. Chase, to me well known to be the same persons who are described in and who signed the foregoing articles of association for incorporation, and they then and there severally and respectively acknowledged the same to be their free act and deed.

A. H. REINHARD,
Notary Public. Stearns County. Minn.
(Notarial Seal Stearns County, Minn.)

STATE OF MINNESOTA, COUNTY OF Ramsey, ss.

BE IT KNOWN that on this 29th day of April, 1893, came personally before me Henry M. Byllesby, to me well known to be one of the persons who are described in and who signed the foregoing articles of association for incorporation, and he then and there acknowledged the same to be his free act and deed.

B. F. MEEK, JR.,
Notary Public. Ramsey Co., Minn.
(Notarial Seal Ramsey County, Minn.)

This company was to be capitalized at $300,000, and $1,000,000 of bonds were to be issued. On the former scheme $100,000 of stock and $125,000 of bonds had been issued.

This was a grand idea of Mr. Byllesby's, but it came too late. The General Electric Company was already on the verge of bankruptcy, and its very name had become so obnoxious that it was not deemed safe to prefix the words General Electric to the St. Cloud Water, Light and Power Company. Moreover, Mr. Coffin had already been found out by his former associates in Boston. The United Electric Securities Company had shut down absolutely on taking any more of Mr. Coffin's bonds, and there was no market for them elsewhere.

Thus the glorious career of the St. Cloud and Sauk Rapids Water, Light and Power Company ended with its incorporation. The giant baby died a-bornin', the $1,300,000 of securities never found their way to the strong boxes of New England investors, and Mr. Coffin is probably a few thousands poorer than he would have been if the scheme could only have been carried out and nursed along for a year or two.

Of the gentlemen signing the accompanying document, Mr. F. E. Searle was at that time cashier of the German American Bank of St. Cloud.

LONG DISTANCE TRANSMISSION AT 10,000 VOLTS*—II.

(The Pomona Plant.)

BY GEORGE HERBERT WINSLOW.

The power house is 66 ft. long by 30 ft. wide. and has walls 12½ ft. high. The walls, which are of concrete, were all built by tamping concrete in a space between temporary wooden walls forming a mold, a few feet of wall being built at a time, and the planks then loosened and raised to the height of the next section, the walls being thus made at the least expense for timber. The best English Portland cement was used. The walls were consolidated and cement saved by the use of well-washed fragments of rock imbedded in the concrete. In order to obtain the greatest available fall the power house was placed as far as possible below the level of the fall. This necessitated blasting into the side of the hill so far that the entire wall next the hill was below the level of the adjoining rock.

The station was built to accommodate four 120 K. W. 7,200 alternation, 12-pole, single-phase Westinghouse alternators with their full complements of raising-transformers and switchboard apparatus, and two exciters. The first installation consisted of one generator with one 90 ampere 125 volt "I" exciter, capable of exciting the four alternators, and of 240 K. W. capacity of oil transformers in 40 units of 6 K. W., 21 of these being located at the power house.

Several different methods of connecting the raising and lowering transformers were given careful consideration, the test of actual use favoring a series connection for both primary and secondary coils of both sets of transformers, a plan which had proved to be thoroughly reliable in its practical operation at the Westinghouse plant at Portland, Ore. It was however decided, in order to be able to change the initial pressure on the line in case of accident to any of the transformers, to connect the primary coils of the raising transformers in multiple to the dynamo, put the line coils all in series with the line and with a similar set of coils in the lowering transformers, and connect the other coils of the latter in multiple to the distributing circuits.

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*A paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

The next question was what size of transformers should be used. Many small transformers meant less cost per unit for repairs, greater facility of handling, and greater flexibility in case it were desired to change the voltage on the line. Their use, however, also meant greater first cost, more complication, and somewhat lower efficiency, but these points were outweighed by the former, and a transformer unit of 6 K. W. was chosen. Each transformer is contained in a cast-iron box provided with vertical outside ribs, which serve to stiffen it and also to cool the oil with which the box is filled and which entirely covers the transformer. The box is covered by a cast-iron lid, which has conducting and radiating ribs both outside and in, the inner ones dipping into the oil at its hottest part and helping to cool it. The oil when heated rises through open spaces around the coils and spreads out in all directions, guided by the ribs on the lids, and sinks slowly down between the core and the sides of the box, thus having ample opportunity to become cooled. Each box is provided with a pet-cock, at the bottom, by which to draw off the bottom layer of oil should it become too thick by evaporation. It also has an oil gauge to show whether the tops of the coils are completely covered without having to raise the lid. The boxes are supported upon a substantial timber frame, upon the top of which two iron bands serve incidentally to protect the wood, but chiefly to metallically connect the boxes to each other and to the earth, in order to dissipate the static charge received by the boxes, which is very unpleasant. The core of the transformer is connected to the box by a copper strip fastened around a block of wood upon which the core rests in the box. To provide against the danger which would result from accidental connection between the primary and secondary coils, an insulated sheet of copper is placed between the latter and close to the dynamo-coil, and is connected to the core by a tongue which is stuck between the plates.

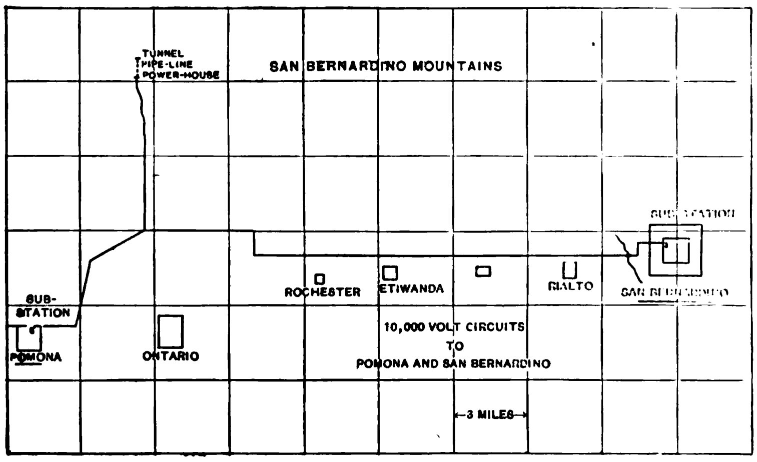


FIG. 4.—ROUTE OF LINES.

The line-coil, of No. 7 B. & S. gauge wire, is inside the dynamo-coil, and is kept everywhere at a distance of one-half inch from the latter, the ground plate and the core by walnut blocks boiled in paraffin, between which ample openings are left for circulation of the oil. The ratio of transformation is 1,000 to 450, so that in a bank of 20 transformers the dynamo pressure required for 10,000 volts on open circuit is 1,110 volts, and on full load about 3 per cent. more than this, or 1,140 volts. The space between the 1,000-volt coil and the core is one-eighth of an inch. The terminals of the line-coils are brought up through the oil in mica fiber tubes passing through heavy glass bushings held in paraffined wooden blocks which are attached to the sides of the boxes. The 1,000-volt terminals are similarly supported, but without glass bushings. The transformers are all connected in multiple to the dynamo-circuit, which is supported directly above them on a light pine framework which also supports the fuse blocks. The latter are single-pole, and the fuse passes through a hole in a marble block, the object of so confining the arc being to blow it out by its own force. Only one fuse is used on each transformer. The secondary or line coils are all connected in series by U-shaped insulated wire connections which may be readily detached when making periodical tests for insulation of terminals, and which are entirely independent of the framework supporting the dynamo circuit. Accidental contact with the exposed connectors is prevented by the framework above mentioned, and there is an inflexible rule that the high tension side of the transformers shall not be touched under any circumstances whatever while the dynamo is running.

Clark's insulation is used on all wires connected to the transformers and to the dynamo, and the terminal wires of the full bank, which must often be disconnected for testing, are further insulated by heavy glass tubes at points where they might come in contact with other wires. All other transformer wires are supported upon double petticoat glass insulators and all dynamo wires upon porcelain knobs.

The switchboard is of narrow redwood boards, tongued, grooved and beaded, nailed on a framework of yellow pine, the latter supported on porcelain insulators to keep it dry. The switchboard outfit for one generator and one exciter consists of two 120 ampere fuse blocks, an A. C. field rheostat with a 25 ampere D. P. field switch with fuses, an exciter rheostat, one 150 ampere ammeter and a 200 ampere D. P. jawswitch. From this switch the current passes to two 4-dynamo marble switch-panels which are connected in multiple to the dynamo, and are each provided with two pairs of contact plugs. By means of these panels and of two 200 ampere dynamo changing switches below them, any feeder can be operated from any dynamo which is connected to the switch-panels. Between each panel and its switch is a pair of 65 ampere Wurts shunt-wire fuse-blocks, each provided with an extra fuse and shunt which can be connected by inserting a plug should it be desired to double the fuses during the run on account of overload or of weakness in the fuse. The remaining instruments on each feeder are a voltmeter, a No. 1 switchboard converter and a 150 ampere type "E" compensator. When both feeders were run from one alternator, one voltmeter was connected to the generator and the other to the feeder, and in this way the amount of compensation could be watched.

The oil-transformers were tested before shipment with 20,000 volts between the line-coil and the core and were then taken out of the oil and boxed. In order to expel any moisture which might have been absorbed by the insulation of the coils or have condensed on the cores during their long journey, the transformers were connected in two banks of ten each, the line-coils of each set being connected in series to the generator, which was run at a reduced speed, and the secondary coils each short circuited on itself. The coils were thus gradually heated to a point somewhat above the boiling point of water, which at that elevation was about 201 degs. F. They were kept at this temperature for a short time and then paraffin oil of a special grade ("Diamond") was poured slowly into the boxes at the edges so that the coils would begin to absorb oil at their lower ends, and thus drive upward the air and volatile gases occluded by the insulation. The transformers were then again brought to their former temperature, which caused expansion and partial expulsion of the air remaining in the insulation. Some of the air would, however, collect under the insulation at the top of the coils, and had to be freed by mechanical agitation, produced by stirring the folds of insulation, or by pounding on the boxes. The heat caused volatilization of some of the lighter elements of the oil, these coming to the surface as bubbles, just as the air did at first, and the agitation was kept up at intervals until bubbles from this cause also were entirely eliminated.

The twenty transformers were then connected as they would be when in regular use, and the two terminals of the line-coils, which were to give 10,000 volts, were connected in series with one hundred 100-volt lamps, which were then brought to full candle power, showing that the transformers were all in good condition. A similar test was then made at Pomona at the end of the 14-mile transmission line running to that place; after which the transformers there were prepared for work in the same way as at the power-house, except that the grouping and initial voltage were changed.

There are two transmission lines, one 13¾ miles long, which supplies Pomona, and another, 28¾ miles long, which supplies San Bernardino. Each line consists of two No. 7 B. & S. gauge hard-drawn copper wires. The joints in the wire are made with McIntire connectors. To further improve the joint the ends of the wires were bent back side by side and soldered together. After the Pomona line was completed and the first ten miles of the San Bernardino line was put up, the supply of connectors ran out, and the regular telegraph joint was substituted. The conductivity was assured by soldering as before.

The wires are supported upon large double-petticoat flint-glass insulators designed for this plant. These insulators are of perfectly clear flint-glass, which gives a better surface-insulation than is attainable with any other kind of glass.

It was at first proposed to use oil-insulators. The reason they were not used was because the glass companies which had undertaken to furnish them found on trial that they could not make them without considerable experimenting, which would have delayed the installation of the plant. This was no doubt fortunate, as the country through which the line passes is subjected to hot, dry winds which not only blow dust onto the insulators, but also inside them, and during the day the sun beats on the insulators until they become so hot that they nearly blister one's hands. If oil were used under these conditions it would soon evaporate and thicken, and become filled with dust. It would therefore seem undesirable to have used oil insulators in this case, or to use them in any other until an increased voltage makes them necessary and the transmission of greater amounts of energy over the circuits justifies the additional expense necessary to keep the insulators in good condition.

The two circuits are carried on the same pole line for 7½ miles. (See Fig. 4.) The inside pair of pins was used for the circuit to Pomona and the outside pair for that to San Bernardino, until after the acceptance of the plant, but in anticipation of the installation of another generator the Pomona circuit was changed to the right-hand pair of pins, and the San Bernardino circuit to the left hand pair, to avoid the fluctuation in lights which would result from inductive interference between two independent circuits.

(To be continued.)

TO PERFECT ELECTRIC LOCOMOTIVES.

The successful use of electricity as a motive power on steam roads has led the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Company to effect one of the most important combinations yet made in electrical railway affairs. Conferences have been going on between the two companies for the past two or three months which have resulted in an agreement by which they will hereafter work together in the development of apparatus for the operation of railroads by electricity. It is expected that the union of talent and manufacturing facilities of these two companies will result in the early introduction of improved forms of electric motors for standard railroads.

The news of a working arrangement between the Westinghouse Electric and Manufacturing Company and the Baldwin Locomotive Works is confirmed as we go to press.

It looks like a good trade for both the interested parties, and ought to be of some benefit to the public at large. Notwithstanding the boasts which have been made, we have, so far, no satisfactory elèctric locomotive for either heavy traction work or for rapid transit on trunk lines. The combined talent of the two companies above mentioned working in harmony will, no doubt, hasten the solution of the problem—and it is a serious problem.

American Electro-Therapeutic Association.

The above-named Association will hold its fifth annual meeting at "The College of Physicians and Surgeons of Ontario," in Toronto, Can., on Tuesday, Wednesday and Thursday, September 3d, 4th and 5th, 1895.

General News.

What is Going on in the Electrical World.

St. Ignace, Mich.—St. Ignace will establish an incandescent electric light plant.

Unointown, Ala.—A stock company is being organized here to put in an electric light plant.

Avoca, Pa.—An election is to be held to vote on the question of lighting the town with electricity.

Columbia, Mo.—Col. E. C. Moore has secured a franchise for an electric street railway in Columbia

Red Bank, N. J.—The Gillette Electric Bell Factory has been sold at sheriff's sale to O. E. Davies for $3,875.

Shelburne Falls, Vt.—The residents of this place are agitating the question of building a new electric lighting system.

Rutherford, N. J.—W. H. McKay & Co. have made application to the council for permission to build an electric railway through Rutherford.

Charleston, W. Va.—It is reported that a New York syndicate is planning to utilize power from the Kanawha Falls for electric light and power.

Bardstown, Ky.—The corporation desires bids for installing an electric light plant until August 10. Address Record Printing Company for particulars.

Lancaster, Pa.—The Columbia, Mt. Joy and Ironville Electric Railroad Company will proceed at once to construct their line between Columbia and Mt. Joy.

Spokane, Wash.—The board of commissioners of Spokane County has about decided that the county will put in the plant for lighting the court house by electricity.

Knoxville, Tenn.—It is reported that the East Tennessee Telephone Company is contemplating the erection of an electric lighting plant to furnish arc and incandescent lights for this city.

Norfolk, Va.—It is reported that the Norfolk, Albemarle and Atlantic Company is contemplating the changing of its line to standard gauge, to be operated by electricity.

Toledo, O.—Bids will be received until August 19 for the installation of an electric lighting system in the Lucas County court house. Charles H. Jones is county auditor and can be addressed.

Herkimer, N. Y.—The new Herkimer, Mohawk, Ilion and Frankfort Railway (trolley), was opened for traffic last week. The first cars over the line were greeted with enthusiasm at all points.

Long Island City, N. Y.—A new syndicate has been organized, to be known as the Long Island City Heights Association, to build a street railway up Thompson avenue to the Hunter's Point ferries.

Springfield, Mass.—At the annual meeting of the United Electric Light Company, held on the 26th ult., the directors were authorized to build a new power house at Indian Orchard at a cost of about $150,000.

Scoharie, N. Y.—The promoters of the proposed electric railroad from Albany to Scoharie have appointed a committee to visit the various towns along the line for the purpose of getting subscriptions to the stock.

Montpelier, O.—We are advised by Mr. H. H. Humphrey, electrical engineer, Detroit, that proposals will be received until August 15, by D. Stauffer, mayor of Montpelier, for an electric light and steam plant.

Greenbush, N. Y.—The Albany, Greenbush and Bath Railway Company, a recent organization, has asked the trustees of Greenbush for a street franchise. The board of trustees will give a hearing to the company on August 15.

Niagara Falls.—A test of the second of the big dynamos has been made, with the same result as that of the first—a great success in the fullest sense of the term. The distribution of power to local consumers will begin, it is said, in about two weeks.

Canton, O.—The company to build the electric road to Cleveland has been quietly organized with the following incorporators: Wm. Hoover, New Berlin; Lew Smith, Greentown; Milo White, Springfield; W. H Nees, Uniontown. The road will connect with the Cuyahoga Falls route at Akron.

Tehuacana, Tex.—Charles R. Pengilly, of Mexia, Limestone County, Tex., has received many encouraging assurances of aid in his scheme for an electric road between this place and Mexia. The distance is six miles, and the cost of putting the plant and road in operation is estimated at $25,000.

New Albany, Ind.—The Highland electric railway plant at New Albany has been sold at commissioner's sale, and purchased for $20,000 by the trustee representing the bondholders. The judgment against the road is for $55,000, besides which there are $15,000 of second mortgage bonds.

Sacramento, Cal.—Arrangements are being made here for an "Electric Carnival" on the 9th of September—Admission Day. The Power Company has agreed to furnish electricity free of cost, but the citizens will have to supply the wires and lamps. It is estimated that $20,000 will be needed for the electrical display.

Tiffin, O.—After several attempts on set days to sell the Tiffin Street Railway and the Tiffin Electric Railway and appurtenances at auction, the sheriff succeeded in disposing of them on the 29th ult. The Tiffin Electric Railway was purchased by Samuel B. Sneath for $20,000 and the Tiffin Street Railway by Joseph Loudenslager, Jr., for $4,010.

Fayetteville, N. Y.—The Suburban Railroad Company of Syracuse have been granted a franchise to run their road through this town. Manlius has already acted favorably on a similar application, and the citizens of both villages are jubilant over the prospect of rapid transit to Syracuse.

Haverhill, Mass.—It seems probable now that the electric road between Haverhill and Danvers will be built. One of the best known and most solid street railway syndicates operating in New England are willing to put in the necessary funds to take almost all of the capital stock, and two or three Haverhill parties will take blocks of stock of a greater or less size.

Painesville, O.—The Lake County commissioners have revoked their former resolution granting a franchise over the county highway from Painesville to the Cuyahoga County line to the Cleveland and Painesville Electric Street Railway Company, and decided to give the franchise to the Cleveland, Painesville and Eastern Street Railroad Company, providing terms can be agreed upon.

Jacksonville, Fla.—It is stated that an electric railroad from Jacksonville to St. Augustine will be in operation by January 1, 1896. The road will be constructed by the Jacksonville and Tampa Bay Improved Railway Company. The company has secured the passage of an ordinance by the city council of St. Augustine giving it the right to construct and operate a street railroad through the streets of that city.

Athol, Mass.—The Athol and Orange electric road has passed into the hands of new owners, namely, W. D. Luey, George D. Bates, W. D. Smith and H. M. Slate, of Athol; John W. Wheeler and W. M. King, of Orange, and Mr. Ferguson, one of the original owners. The new company has organized as follows: President, Mr. Ferguson; clerk and treasurer, W D. Luey, of Athol; directors, the seven owners.

Stoneham, Mass.—It seems certain now that the new Mystic Valley electric railway, from Stoneham to Arlington, will be built. The capital stock is to be raised to $65,000. The board of directors will probably consist of Hon. Onslow Gilmore, of Stoneham, William Bassett, of Arlington, Edward F. Johnson, of Woburn, Arthur E. Whitney, George S. Littlefield, Edwin K. Blakie and Abram Coffin, of Winchester.

Batavia, N. Y.—The project of building the Beecher single-rail railway which was to run from Oak Orchard to Batavia has been abandoned. A few hundred yards of the line was constructed and operated successfully. Financial aid was slow to materialize and its inventor became discouraged and quit the field.—C. W. Archer, J. Amstice, and Frank Westcott of this city have applied for a franchise to light the streets of the city.

Pittsburg, Pa.—The West Side Belt Line Railroad Company have received their charter from Harrisburg and are having the route surveyed. The road is to connect the Saw Mill Run Railroad with Monongahela City. It will be 20 miles long, shortening the distance between Pittsburg and Monongahela City by 12 miles. The main purpose is to tap the rich undeveloped coal fields in the second range of hills back from the Monongahela River. John S. Scully is the principal stockholder.

Milwaukee, Wis.—The *Sentinel* states that as a result of a conference between Henry C. Payne and a committee representing the people of South Milwaukee, Cudahy and the town of Lake, the Milwaukee Street Railway Company will build the line to Cudahy and South Milwaukee. Congressman McGann, of Chicago, and his associates have been endeavoring to get a franchise for a road to those places.

Stevens Point, Wis.—The Stevens Point Lighting Company, Gas Company, Water Company and Electric Railroad Company, and the Clark Water Power Company have consolidated, and the motive power of all the interested concerns will be derived from the Owen Clark dam on the Wisconsin River in this city. The capital stock is said to be about $200,000, and articles of incorporation under a new name will be filed at Madison soon.

Brainerd, Minn.—C. N. Parker, owner of the Brainerd street railway and president of the board of trade, has associated with himself E. C. Gibson, of Chicago, in a scheme to consolidate the Brainerd electric railway, the water power, telephone system and the electric lighting plant into one company, to be known as the Brainerd Public Works Company. The city owns the electric light plant, and the council has Mr. Parker's offer to purchase it under advisement.

"In the Adirondack Mountains."

Persons contemplating a visit to the Adirondack Mountains should by all means possess themselves of a copy of the delightful little book, just issued by the New York Central, bearing the above title. It will not take long to read, for it contains only [illegible]4 pages, but every page bristles with information of just the practical kind one wants at such a time. You can take this book and in half an hour secure a good idea of the Adirondack region—its grand divisions, characteristic of each, the location of the principal resorts and how to reach them.

Not the least valuable feature is a fine new relief map, printed in four colors, showing the correct location of all the principal mountains, lakes and streams; also all stage lines, wagon roads and carries, and on the back a complete list of hotels, cottages and camps—location, dates of opening and closing, rates, etc.

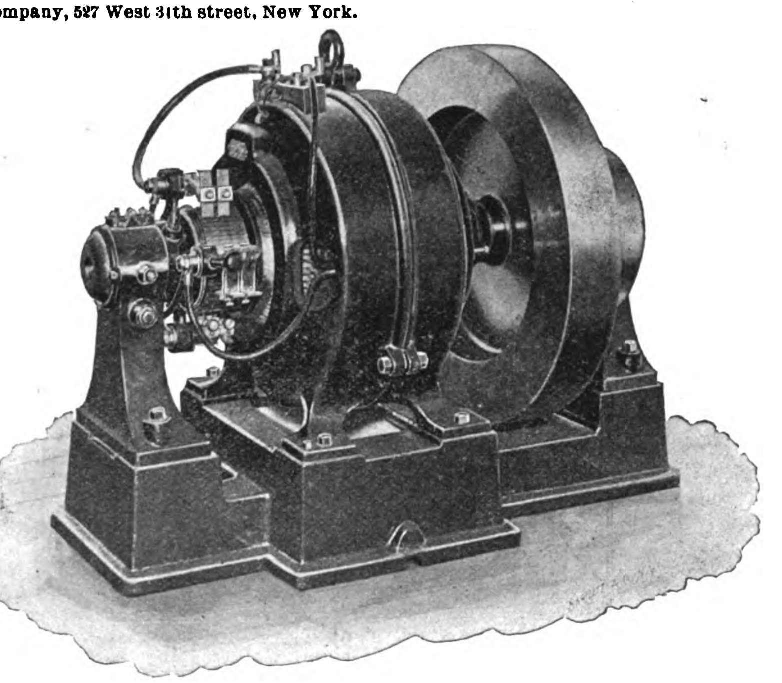
There is, probably, no other book published on the Adirondacks containing in such compact and readable shape so much useful information.

A copy will be sent free, postpaid, to any address in the world, on receipt of two 2-cent stamps, by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

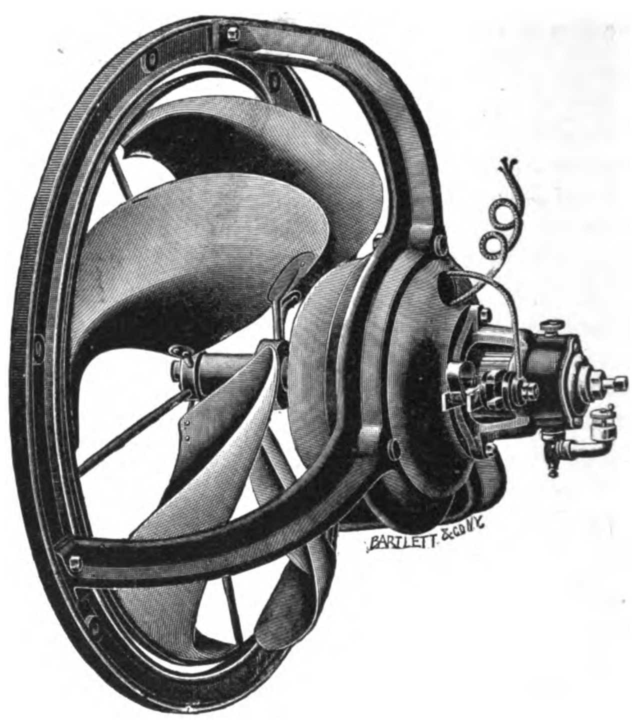
The Little Giant Phenomenal Feed-Water Heater and Purifier is a steam plant accessory recently put on the market by Braucher Bros., Danville, Ill., the inventors and patentees of the device. The heater operates on the same principle as the artificial ice machine, extracting the heat from the fuel by forcing the water to evaporate in contact with the boiler plates. It is fully described in a pamphlet just issued.

New Lundell Apparatus.

In the accompanying illustrations are shown two new forms of the well-known Lundell apparatus recently placed on the market by the Interior Conduit and Insulation Company, 527 West 31th street, New York.



Cut No. 1—Lundell Generator for Gas Engine Service.



Cut No. 2—Lundell Exhaust Fan Outfit.

In Cut No. 1 is shown the Lundell Generator for Gas Engine Service. Notwithstanding great improvements have recently been made in gas engines, absolute uniformity of speed has not yet been attained in engines above 5 H. P. Failure to overcome this defect has alone prevented a more extended use of gas engines for electric purposes.

In the new Lundell generator the slight inherent irregularities of the gas engine are compensated by a fly-wheel of heavy rim weight, thereby maintaining uniform incandescence of lamps in such a plant.

This generator is a modification of the isolated type, and is provided with heavy shaft, self-aligning and self-oiling bearings. The efficiency is from [illegible]6 per cent. for small machines to 95 per cent. for the largest. They are made in sizes ranging from 4.5 to 8.5 kilowatts.

Cut No. 2 shows a type of Exhaust Fan which possesses marked improvements over many forms now in use. The bearings supporting the fan shaft are but two in number and are placed in the motor frame itself. The practice heretofore has been to place a bearing in front of the fan, in the fan ring, as well as back of the fan. Doing away with the front bearing insures perfect alignment and noiseless running of the shaft.

These fan outfits are made in sizes from one-fourth to fifteen horse-power and with horizontal shafts, unless otherwise ordered, and are invariably made so that the direction of the flow of air is from the motor toward the fan. In all horizontal shaft fans lubrication is effected by oil. In vertical shaft fans lubrication is effected in an oil receptacle enclosing a step at the bottom of the shaft, and a graphite or other self-lubricating bearing at the upper end of the shaft.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Atlanta Ga.—Architects Bruce & Moran are preparing plans for a ten story fire-proof office building for Wm. Ostell; all modern improvements will be introduced.

Atlantic City, N. J.—It is reported that a syndicate has been organized for the purpose of building a five story brick hotel building to cost about $1,[illegible]00,000; every modern improvement will be introduced, including electric elevators, a roof garden, etc. Wm. ingerly and Edward H. Flood are among those interested.

Baltimore, Md.—Architect Charles E. Cassell is preparing plans for a ten story apartment house at Mt. Vernon Place, Cathedral st.; the structure will be provided with every modern improvement....The Mt. Royal station, which is to be built by the Baltimore and Ohio Railroad Co., on Bolton lot, is to be lighted throughout with electricity.

Boston, Mass.—An eight story apartment house is to be erected on Massachusetts ave. for Washington B. Thomas; the plans call for all modern improvements.... The erection of a mammoth hotel building in this city is projected; the structure is to be eleven stories in height and will cost $3,500,000.

Brooklyn, N. Y.—The city hall is to be repaired and improved at an estimated cost of $100,000....Architects Cady, Berg & See have prepared plans for four residences to be erected on Pierrepont street for Dr. Graham Tusk. The structures are to be equipped with an electric lighting system.

Columbia, Pa.—Samuel Daron has purchased a site cor. 7th st. and Alley H, and will erect 4 brick dwellings with all modern improvements.

Chicago.—A sixteen story addition is to be built to the Great Northern Hotel which will contain a theater; the structure will be equipped with the most modern improvements.

Cincinnati, O.—A new club house is to be erected by the directors of the Lincoln Club; Architect Reckart has prepared plans.

Cleveland, O.—Plans have been prepared by Major C. F. Crames for a seven story building to be erected on Huron street for the Knights of Pythias. The structure will be equipped with all modern improvements, including passenger elevators, etc.

Dallas, Tex.—The erection of a $150,000 temple is contemplated. W. W. Manning and A. V. Lane will give information.

Detroit, Mich.—W. J. Chittenden has secured a long lease of the Russell House, and will make a number of improvements, including an independent electric lighting plant.

East Orange, N. J.—Plans for a town hall will be submitted to the township committee on August 5; steam heat and electric lighting are features.

Fall River Mass.—The Young Men's Irish American Society will erect a building on Anawan street.; all modern improvements will be introduced.

Hartford, Conn.—It is reported that a new opera house is to be erected here at an estimated cost of $125,000.

Jacksonville, Fla.—An addition is to be built to the Windsor Hotel by Washington Van Hamm. Among other improvements electric lighting will be introduced.

Knoxville, Tenn.—A syndicate including Joseph H. McLear, W. M. Hood, Major Swetson and the East Tennessee National Bank, will erect an opera house opposite the Palace Hotel; estimated cost $100,000.

New Haven, Conn.—Plans have been prepared by Architect W. H. Allen for a five story theater and office building to be erected on Church st. for Manager Poli.

New Orleans, La.—Architects Shepley, Routan & Coolidge, of St. Louis, have prepared plans for the Pickwick Club House, to be erected in this city; the building will be provided with every modern improvement.

New York City. Wm. Broadbelt, 403 West 148th st., will erect a seven story and basement brick store and lofts at 241 and 243 West 23d st.... James L. Libby & Son, 69 Liberty st., have leased the property at 5-9 Union Square and 20 East 15th st., and will commence the erection of an eight story fire-proof building....It is reported that an eight story office building is to be erected at Pearl st. and Burling Slip by the New York Metal Exchange..... P. M. Stewart, 562 West End ave., will build 2 four story and basement dwellings on south side of 76th st., west of West End ave....John D. Crimmins has purchased ground bounded by 143d and 144th sts., Lenox and 7th aves., on which model apartment houses will be built....Eugene Schieffelin will build a private residence on north side of 76th st., east of 5th ave.; Architects Parrish & Schroeder Madison ave....Wm. H. Bingham will build 2 five story apartment houses, north side of 119th st., west of Park ave.; Architects Neville & Bagge, 215 West 12[illegible]th st.... John McLaughlin, 346 East 81st st., will build 2 five story brick flats, south side of 9[illegible]th st., west of 1st ave.; Architect John Hauser, 1441 3d ave....Architects Clinton & Russell, 32 Nassau st., have completed plans for 5 American basement houses, to be erected on [illegible]5th st., west of 5th ave.; lighted by gas and electricity....Charles H. Bailey, 102 East 108d st., will erect a five story flat, north side of 111th st., west of [illegible]th ave....Architect George F. Pelham has prepared plans for a row of five story stone apartment houses to be erected at 1 6th st. and 7th ave. for Giblin & Taylor....Plans have been prepared for a new sixteen story office building at 5 to 11 Broadway; estimated cost $1,800,000....A seven story brick store and loft building is to be erected for Thomas B. Keogh at 40 Great Jones st.; Architect E. G. Dollner....Plans have been prepared for a new club house for the New York Athletic Club at 59th st. and 6th ave.; the structure will be 9 stories in height and the cost is estimated at $150 000.... Joseph L. Buttenweiser, 26 Pine st., will erect a seven story flat and store building at 39 Great Jones st....B. M. Stiger, 323 State st., will build a four story brick dwelling at 319 West 74th st. to cost $[illegible]8,000....Norman J. Murray, 101 Willow st., Brooklyn, will build a four story brick dwelling, north side of 74th street, east of Riverside Drive....Asa Hull, 209 West End ave., will build a four story brick dwelling, Riverside Drive, north of 75th st.... John T. and James Farley of the Nevada apartment house will build 2 four story brick dwellings on south side of 72d st., east of Columbus ave; Architects Thom & Wilson, 1[illegible]67 Broadway....W. C. Adams, 74th st. and West End ave., will erect a five story brick dwelling, north side of 74th st., east of Riverside Drive; Architect P. H. Gilbert, 18 Broadway....Florence L. De Baum will erect a three story brick dwelling at 28 West 45th st; Architect W. H. Miller....A four story brick and stone stable is to be erected for P. H. McManus, at a cost of $60,000, after plans prepared by H. H. Carter; elevators, steam heating, electric lighting, etc., will be introduced.

Owensboro, Ky.—A new Y. M. C. A. building is to be erected here at a cost of $30,000. Specifications call for latest improvements.

Paoli, Ind.—The Paoli Mineral Springs Co. propose to erect a new hotel here, and will put in an electric plant to supply the hotel and town.

Philadelphia, Pa.—A ten story addition is to be built to the Aldene, at a cost of $225,000.

Scranton, Pa.—Work will soon be commenced on the erection of the new building for the Traders' National Bank.

Sedalia, Mo.—A four story brick and stone hotel building is to be erected by B. G. Cassidy and other local capitalists; estimated cost, $200,000; all modern improvements will be introduced.

St. Louis, Mo.—An addition is to be built to the Turner Hall of the South St. Louis Gymnastic Society; among the improvements will be electric lighting.

Tacoma, Wash.—Plans have been prepared for a four story business building for C. A. Darmer; elevators, electric lighting and other improvements will be introduced.

Westfield, N. J.—Plans are being prepared for the erection of a three story building for the Young Men's Christian Association on Elm st.; to be equipped with every modern improvement, including electric lighting, a gymnasium, etc.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

AUGUST, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.40 P. M.	2	4.00 A. M.
2	......	..	....
3	12.40 A. M.	3	4.00 “
4	1.40 “	4	4.00 “
5	No light.	5	No light.
6	“	6	“
7	“	7	“
8	7.30 P. M.	8	9.30 P. M.
9	7.30 “	9	9.50 “
10	7.30 “	10	10.10 “
11	7.30 “	11	10.30 “
12	7.30 “	12	11.00 “
13	7.30 “	13	11.30 “
14	7.30 “	15	12.20 A. M.
15	7.30 “	16	1.00 “
16	7.30 “	17	1.10 “
17	7.30 “	18	2.10 “
18	7.30 “	19	3.30 “
19	7.20 “	20	4.30 “
20	7.20 “	21	4.30 “
21	.20 “	22	4.30 “
22	7. 0 “	23	4.30 “
23	7.00 “	24	4.30 “
24	7.00 “	25	4.30 “
25	8.00 “	26	4.30 “
26	9.00 “	27	4.30 “
27	9.40 “	28	4.30 “
28	10.40 “	29	4.30 “
29	11.00 “	30	4.30 “
30	11.30 “	31	4.30 “
31	......	..	....

INCORPORATIONS.

The Kootenai Mining and Milling Company, Spokane, Wash.—to do a mining and milling business, and deal in mineral products and electric light plants. Capital stock, $1,000,000. Promoters: L. Frank H. Gordon, Spokane, Wash.; B. E. Barinda, Wm. H. Gawkey, Detroit, Mich.; John D. Farrell, Albert E. Humphreys.

The Freeman Street Improvement Company of Orange Valley, N. J.—to improve Freeman street, Orange, and build an electric railway in that street and up the side of Orange Mountain. Capital stock, $100,000. Incorporators: Victor N. Savale, Christian H. Heckel, J. Henry Fiedler and John J. Barry, and the officers are: President, John Davis; vice-president, Franz Berg; secretary and treasurer, Robert D. Collins.

The Amber Investment Company, Tacoma, Wash.—to construct, lease and operate electric street railways and develop water and electric power, etc. Capital stock, $5,000. Incorporators: Arthur G. Prichard, Fenley Bryan, Frank G. Taylor, F. J. Miller and Robert C. Applegate.

The Wellesley and Boston Street Railway Company, Newton, Mass.—to build and operate a street railway from West Newton to Wellesley. Capital stock, $40,000. Directors, Horace B. Parker, Austin P. Mitchell, James L. Richards, J. W. French, Newtonville; George W Morse, W. F. Hammett, Newton; Frederick Johnson, Auburndale.

The Fall River Street Railway Company, Fall River, Mass. Capital stock, $50.0 0. Directors: Wendell E. Turner, Arnold B. Sanford, David Beattie, J. E. Osborn, W. F. Shove, Herbert Field, M. T. Hudner, all of Fall River.

The Albany, Greenbush and Bath Railway, Albany, N. Y.—to build and operate an electric railway in Albany and Greenbush, for passengers, express and freight. Capital stock, $150,000. Directors: Edward J. Duggan, William E. Drislane, Edward J. McCaffrey, Patrick J McArdle, Meyer S. Levy, Michael F. Cantwell, Albany; John F. Munger, East Albany; John F. Reilly, Greenbush; and Charles A. Bailey, Bath-on-the-Hudson.

The Jenkintown and Fox Chase Electric Railway Company, Philadelphia—to build and operate a street railway. Capital stock, $20,000. Incorporators: Howard Fleck, Samuel L. Schively, James Satterthwaite, Thomas B. Harper, Howard Noble, of Jenkintown, and William P. Longstreth, Fox Chase.

The Whiteside Harrison Telephone Company, Morrison, Ill. Capital stock, $6,000. Incorporators: Aaron D. Hill, Simon S. Crider and John D. Hill.

The South Bend Telephone Company, South Bend, Ind. Capital stock, $50,000. Directors: C. B. Van Pelt, Louis Nickel, Jr., W. H. Longley, E. G. Waldron, W. L. Kizer and F. W. Martin.

The National Electric Plumbing Supply Company, Cleveland, Ohio—to manufacture and deal in all kinds of plumbing and sanitary goods light and electrical machinery. Capital stock, $25,000. Promoters: T. O'Mara, Wm. H. Cleveland, Wm. J. Gleason, Geo. W. Papsworth, M. J. Kelly.

The Samuels Dynamite Accumulator Company (incorporated in West Va.), New York, N. Y.—to manufacture and sell electrical storage batteries in the United States and Canada. Capital stock, $5,000,000. Promoters: Wm. Seward Webb, Shelburne, Vt.; John Jacob Astor, Henry L. Sprague, Henry B. Ely, Charles H. Burnet, New York City.

The La Harpe Electric Light and Power Company, La Harpe, Ill.—to purchase, erect, maintain and operate an electric light and power plant in the city of La Harpe and vicinity. Capital stock, $15,000. Promoters: Joseph R. Crabill, George Coulson, W. O. Butler.

The Montpelier Telephone Company, Montpelier, Vt. Capital stock, $20,000. Promoters: J. Hayes, John Burns and W. N. Pay, all of Montpelier.

The Dan River Power and Electric Company, Danville Va. Capital stock, $7[illegible]0,000. President, Thomas B. Fitzgerald; vice-president, William P. Bethel; secretary and treasurer, R. A. James; directors: Frank X. Burton, John H. Schoolfield, James E. Schoolfield and R. Addison Schoolfield.

The Hillsboro Electric Street Railway Company, Hillsboro, Hill County, Texas—to build and operate an electric railway. The officers are J. H. Graham, of Boston, president; H. W. Carter, Hillsboro, vice-president; J. T. Voss, Atlanta, Ga., superintendent; R. J. Ware, Hillsboro, secretary and treasurer. The officers, with S. E. Carter and S. F. Sullenberger, constitute the directors.

The Watertown Telephone Exchange Company—to maintain lines through Watertown and the towns and villages in Jefferson County, N. Y. Capital stock, $50,000. Directors: A. L. McCrea, Jr., and J. R. McIntyre, of Gouverneur, and John C. Streeter, Samuel Felt. George C. McMullin, James L. Newton and Francis A. Sherman, of Watertown, N. Y.

The Little Falls and Richfield Springs Railway, and the Richfield Springs and Schuyler Lake Railway companies, the former to build an electric road 18 miles long, and the latter one a mile long, have been incorporated at Albany. The Little Falls and Richfield Springs Railway has a capital of $200,000, and the Richfield Springs and Schuyler Lake Railway a capital of $2[illegible],000. The boards of directors of the two companies are identical, comprising Caleb L. B. Tylee, Frank H. Viele, George E. Tylee, Edwin J. Carpenter, John L. Miller and Thomas J. Mack, of Corning; Theodore C. Bates and William H. Tylee, of Worcester, Mass., and H. Arthur Sillsbee, of New Bedford, Mass.

The Dunmore Electric Street Railway Company, Dunmore, Pa.—to build and operate an electric street railway in Dunmore. Capital stock, $7[illegible],000. Promoters: P. J. Horan, T. E. Boland, Dunmore; I. H. Burns, Scranton, Pa.

The Sycamore Light and Power Company, Sycamore, Ill.—to produce and dispose of light, heat and power for public and private use, and manufacture all appliances for such purposes. Capital stock, $30,000. Promoters: Frank C. Patten, Carrie C. Patten, Thomas L. Halloran.

The Wilkinsburg and Rankin Street Railway Company, Pittsburg, Pa.—to build and operate an electric street railway. Capital stock, $24,000. Promoters: Albert L. Schultz, John W. Taylor, Pittsburg; S. L. Tone, Rochester, Pa.

The Munhall Street Railway Company, Pittsburg, Pa.—to build an electric street railway. Capital stock $3,000. Promoters: Albert L. Schultz, John W. Taylor, Pittsburg; S. L. Tone, Rochester, Pa.

The Rankin Street Railway Company, Pittsburg, Pa.—to build an electric street railway. Capital stock $3,000. Promoters: A. L. Schultz, Sam P. Whit n, S. L. Tone, John W. Taylor.

The Citizens' Telephone and Electric Company, Hoboken, N. J.—to construct, operate and maintain telephone and electric service lines in the county of Hudson, and for the transmission of light, heat and power. Capital stock, $50,000. Promoters: Wm. H. Elles, John Ryan, John J. Cuddiley, Hoboken, N. J.; Morris Frankford, New York City.

The La Porte City Electric Light and Water Company, La Porte City, Iowa—to build, maintain and control systems of electric light and waterworks. Capital stock $15,000. Promoters: W. D. Wagoner, E. Duke Naven, A. Van Valkenburg, J. C. Graham, A. L. Waker, La Porte City.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 30, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

543,529. Electric Trolley. George W. Hooper, Rochester, N. Y., assignor to James S. Baker, same place. Filed Sept. 11, 1894.

543,544. Electric-Car Brake. George B. Damon, Lowell, Mass., assignor of one-half to Gardner W. Pearson, same place. Filed April 9, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

543,502. Electric-Arc Lamp. Samuel E. Nutting, Chicago, Ill., assignor to George W. Furbeck and Joseph Kettlestrings, same place. Filed April 5, 1894.

543,6 6. Internal Illuminator and Probe. Willard E. Dow, Braintree, Mass. Filed Feb. 16, 1895.

543,729. Electric-Arc Lamp. Charles F. Hartmann, Lynn, Mass., assignor, by mesne assignments, to the General Electric Company, Schenectady, N. Y. Filed Nov. 21, 1894.

DYNAMO ELECTRIC MACHINERY.

543,52[illegible]. Starting or Stopping Device for Electric Motors. Jonathan P. B. Fiske, Alliance, Ohio. Filed Nov. 14, 1894.

543,524. Device for Automatically Operating Brakes and Rheostats. Jonathan P. B. Fiske, Alliance, Ohio. Filed Dec. 6, 1894.

543,525. Electric Motor and Brake Mechanism Therefor. Jonathan P. B. Fiske, Alliance, Ohio. Filed Feb. 9, 1895.

543,557. Overhead Traveling Crane. Thomas R. Morgan, Sr., Alliance, Ohio, assignor of three-fourths to Thomas R. Morgan, Jr., John R Morgan and William H. Morgan, same place. Filed Sept. 10, 1894.

543,670. Four-Motor Reversing-Switch. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed May 15, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

543,490. Contrivance for Disinfecting Telephone Apparatus. Rudolph Lamarche, Hamburg, Germany. Filed July 21, 1894.

543,559. Signaling Apparatus for Telephone Exchange Circuits. Joseph J. O'Connell, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed May 14, 1895.

543,626. Transmitting and Receiving Attachment for Telephones. Hosea W. Bibbey, Boston, Mass. Filed Oct. 9, 1894.

543,708. Telephone-Exchange. Wada Y. Shibata, San Francisco, Cal. Filed Nov. 24, 1 93.

543,798. Telephone. Norval L. Burchell, Washington, D. C. Filed Oct. 29, 1894.

BATTERIES.

543,480. Secondary Voltaic Battery. Ludwig Epstein, London, England. Filed Jan. 5, 1895.

SIGNALS AND SIGNALING APPARATUS.

543,591. Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed Nov. 17, 1892.

543,592. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed Oct. 5, 1893.

543,594. Electrical Railway Signaling System. Thomas B Dixon, Henderson, Ky. Filed July 10, 1894.

543,595. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed Aug. 20, 1894.

4 ,596. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed Aug. 20, 1894.

543,721. Signaling on Railways and Means Therefor. Edwin Blakey, Bradford, assignor to the Automatic Electric Railway Signal Company, Limited, Liverpool, England. Filed June 11, 8 4.

543,7 5. Railway Signaling. Jens G. Schreuder, Edgewood Park, assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed March 28, 1894.

543,793. Switch and Signal Mechanism. John V. Young, Boston, Mass., assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed Aug. 29, 18 4.

MISCELLANEOUS.

543, 9[illegible]. Electrical Controlling System for Elevators. Cyprien O. Mailloux, New York, N. Y. Filed May 28, 1895.

543,564. Reactive Coil. Edgar E. Stark, New York, N. Y., assignor to Sigmund Bergman, same place. Filed Feb. 21, 1894.

543,613. Manhole for Underground Conduits. James F. Cummings, Detroit, Mich., assignor to the Cummings & Engelmen Conduit Company, same place. Filed Nov. 6, 18 4.

543,625. Machine for Boring Joists for Electric-Light Wiring, John G. Henderson and Robert H. Henderson, Chicago, Ill. Filed Oct. 3, 1894.

543,653. Electric-Brake Shoe. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 10, 1895.

543,65 . Electric Soldering-Iron. Frank B. Rae, Detroit, Mich., assignor to Charles L. Coffin, same place. Filed Sept. 18, 1894.

543,655. Watchman's Time-Recorder. George F Ransom, Milwaukee, Wis., assignor of one-half to Harold G. Underwood, same place. Filed Sept. 4 1894.

543, 86. Thread-Guide for Electrical Stop-Motions Robert C. Holt, Troy, N. Y. Filed Oct. 29, 1894.

543,705. Railway-Switch. Isaac N. Saddler, Perrysburg, Ohio. Filed April 22, 18 .

543,707. Electric Clock-Winding Mechanism. William S. Scales, Everett, assignor to the Columbian Clock Company, Boston, Mass. Filed Nov. 12, 894.

543,800. Electric Heating-Rug. Jesse R. Davis, Parkersburg, W. Va., assignor of one-third to Charles A. Wade, same place. Filed July 11, 1894.

543,821. Electrode osition of Alloy. Henry J. Altman, New York, N. Y., assignor of one-half to Max Il Fischer, same place. Filed April 12, 1894.

THE TELEPHONE WORLD.

"The Telephone Systems of the Continent of Europe."

The above is the title of a book the appearance of which at the present stage of telephone development in the United States is very timely. The author, A. R. Bennett, member Institution of Electrical Engineers, has long been identified with the telephone interests of the United Kingdom and is at present general manager and chief engineer of the New Telephone Company, London. He has long been interested in the problem of cheap telephone service in England, it having been his belief for years past that the English were paying too much for an inferior service. As general manager of the Mutual Telephone Company of Manchester, he demonstrated the possibility of giving a service superior and at least 75 per cent. cheaper than that supplied by the National Telephone Company. The Mutual Company built up a profitable business and was so successful that it was credited with having solved the problem of cheaper telephone service, but in an evil hour the directors sold out to a company which proposed to extend the fight all over England. Within a short time this company was absorbed by the National Company, and once more Manchester and other cities were in the grasp of monopoly.

To provide himself with authentic information that will enable him to continue his warfare against high rates and poor service in England, Mr. Bennett made a visit of personal inspection to the Continental countries. The book is the result of his observations It is certain that a perusal of it will convince the most doubting that the people of the United States as well as of England have been paying dividends on watered stock of monopolistic corporations rather than for a satisfactory telephone service.

The telephone systems of the Continental countries are not controlled by the corporations, but by the Governments, which aim to give the best services at the lowest rates. Mr. Bennett makes no direct argument for Government control of telephones but suggests the possibility of municipal management, which in England is not uncommon in enterprises of a public and quasi-public character. Fortunately, perhaps, neither national nor municipal control is needed to correct the abuses of telephone monopoly in the United States. The competition of the rapidly increasing independent telephone service is solving that problem to the eminent satisfaction of the telephone-using public.

Austria, Bavaria, Belgium, Bulgaria, Denmark, Finland, France, Germany, Portugal, Roumania, Russia, Spain, Sweden, Switzerland and Wurtemburg were visited by the author. He devotes considerable attention to the history and present development of the telephone service in each country, as well as to the character of service, rates, details of construction, statistics, etc., and deduces from the data gathered the observation that there are countries where the telephone is used for the benefit of the public rather than as a means of levying tribute for the support of monopolies.

The telephone tariffs of these countries are the lowest in the world. The inclusive rates, covering the supply and maintenance of wires, instruments and accessories, are £2 10s., £2 15s. 7d. and £3 6s. 8d. in Norway ; £1 15s. 7d. and £8 6s 8d. in Denmark ; £2 9s. 7d. and £2 .7s. 10d. in Holland ; £3 4s. in Finland ; £2 16s. and £3 12s. in Italy ; while rates of four pounds and five pounds are frequent elsewhere. In refutation of the assertion that low rates mean bad workmanship, the author directs special attention to the installation at Zutphen, Netherlands, a town of 17,000 inhabitants, where an inclusive rate of £1 17s. 10d. prevails. The installation is fitted with metallic circuits of bronze wire, heavier than is used in England, with the best makes of instruments, and an expensive switchboard. The line construction is of the best. An all-night service is maintained and the company pays 4.2 per cent. on the capital invested. To dispose of the assertion that low rates are applicable only to small towns, the author reproduces the report of the Christiana Telephone Company for 1893. This company, operating in the capital city of Norway, has nearly 5 000 subscribers, and has regularly paid dividends of from 5 to 5½ per cent. since 1885, besides keeping its system up to date, providing ample reserve funds, and liberally contributing to the benevolent fund of its employees, all on an inclusive rate of £4 8s. 11d. In the town of Frondhjem, Norway, the exchange is managed by the city council. The exchange is well built and provided with the Ericsson instrument, the most expensive in the market. This plant earns a profit of 4 per cent. on an inclusive rate of £2 10s. for business, and £1 5s. for private connections.

Numerous other instances of low rates are cited, all verified by statistics. Touching the question of rates, Mr. Bennett reaches the conclusion that telephony can be conducted as cheaply in England as on the Continent, and that a company having control of the English business could easily earn good dividends at half the present rates provided it did not have a watered capitalization. It is quite possible that the same would hold good in the United States.

The book is a mine of information on the subject and will prove a valuable aid to those interested in the cheapening and improvement of the telephone service.

Not Ready to Report.

The committee having in charge the details of the plan of organization of the Eastern Telephone Protective Association has not yet been able to complete its labor, owing to the absence from the city of Mr. H. T. Johnson, of the Manhattan Electrical Supply Company, who has been called away by the death of his father. Mr. Johnson is one of the moving spirits in the formation of the association, and together with Mr. A.F. Stanley, of De Veau & Co., is entitled to the credit of having originated the idea.

Telephones Supplant Messenger Boxes.

An innovation in district messenger service has been introduced at Des Moines, Ia., by C. K. Mead, of the American District Telegraph Messenger Company of that city. The messenger call boxes have been removed and telephones substituted for them, and instead of calling up by box, the telephone is now used to talk with. In addition to this branch of the service, also, a telephone has been placed in all the factories and like institutions, employing watchmen. The object is to have the watchmen report to the messenger service every hour during the night, it being so arranged that if an hour is missed without a report an officer can be dispatched at once to the establishment in which the watchman should be on hand, to discover whether he is asleep or is unable from sickness or injury to report.

Capt. A J. West, one of the promoters of the new telephone company at Atlanta, Ga , says his company will do nothing further until the overhead versus underground issue is settled between the city council and the company.

The common council of Niles, Mich., has rescinded its action allowing the Bell Telephone Company to place its poles and wires in the streets and ordered the company to take off all those which are now erected.

The Pennsylvania Telephone Company has brought suit against the Reading and Southwestern Electric Railway Company at Reading, Pa., for damages to instruments cuased by crossing of trolley with telephone wires.

The Jacksonville Telephone Company, Jacksonville, Fla., wishes estimates for telephone equipment for 400 or more subscribers to an exchange. Address the company, or W. N. Shine, Tallahassee, Fla.

The Interior Telephone Company of New York will install a working exhibit at the Atlanta Exposition.

The telephone rates in New Haven, Waterbury, Hartford and Bridgeport, Conn., have been reduced by the Southern New England Telephone Company to $10 and $4 per month for single and $6 and $3 for party wire.

The Latrobe Telephone Exchange Company has been organized at Latrobe, Pa., with a capital of $5,000. Joseph E. Barnett, of Latrobe, is president.

Mayor Clapp proposes that the conduits soon to be laid in Memphis, Tenn., be installed by the city instead of the electric companies.

The Iowa Union Telephone Company has cut its rates in Sioux City, Ia., to $1 and $2 per month. The Home Telephone Company, which has established an independent exchange of 600 subscribers, charges $2.50 and $3.

The capital stock of the Lafayette Telephone Company, Lafayette, Ind., has been increased by $45,000, making a total capital of $75,000.

The Citizens' Telephone Company has completed a large exchange at Columbus, Ind., using the Harrison system, and has reduced the rates of the Central Union Telephone Company from $36 to $12.

The Automatic Telephone Company has practically abandoned its negotiations for a franchise in Rochester, N. Y. The Standard Telephone Company, through Frederick Cook, has petitioned for a franchise in that city.

The Supreme Court of Connecticut has handed down a decision in the case of Mrs. Caroline L. Bradley of East Haven against the Southern New England Telephone Company, finding no error in the trial in the court below, which awarded $800 to Mrs. Bradley for the cutting down of two trees on her property by employees of the company.

The underground telephone system at San Antonio, Tex., has been completed.

The board of trade of Carbondale, Pa., is organizing among its members a company to accept the telephone franchise recently granted by the council of that place.

The Delaware County Telephone Company is the name of a local telephone company being organized to operate at Lansdowne, Pa., and vicinity, with connections to Philadelphia. The rates will be $ .50 and $1.50 per month. After fifty signatures are obtained to the subscription papers work will be commenced.

The contest for a telephone franchise in Detroit, Mich., which has been bitterly waged by the Brown Loud Speaking Telephone Company and the Detroit Harrison Telephone Company, has been decided by Mayor Pingree, who has vetoed the Brown Company ordinance and approved the ordinance of the Harrison Company. The rates are fixed at $25 and $40. The Harrison Company has not accepted this condition.

Grafton, W. Va., is just now in the throes of a telephone war between the Bell people and the Standard Company. The Bell people have cut the rate for business houses from $70 to $.0, and for private houses telephone may be had for $17. The Standard people charge $23 and $ 0 respectively, but promise to meet any cut the Bell people may make.

ELECTRICITY will soon publish some information in regard to the early microphone patents taken out in France by Dr. Emil Berliner which cannot fail to be of more than passing interest.

The Northwestern Electric Telephone Company is seeking a franchise at Racine, Wis.

The Gonzales Telephone Company has been organized at Gonzales, Tex., by L. P. David, A. J. Moore and others, to build a long distance system.

A company is being formed to build a telephone line between Sulligent and Vernon, Ala.

The Northwestern Telephone Company has commenced to build a telephone line from Wanconia, Ia., to Cresco, via Jackson Junction, Protervine, Decorah and Burr Oak.

An agreement has been entered into by the West Shore Telephone Company of New York State and the Standard Telephone Company, under which the plant of the former company will become the property of one of the branches of the latter and the lines of the West Shore will be completed and put in operation throughout the entire territory covered by that organization. The Standard Company assumes the indebtedness of the West Shore Company and agrees to give to each shareholder the same amount as his holding in that company of the capital stock of the Citizens' Standard Telephone Company, a new organization, capitalized at $150,000 and covering the counties of Ulster, Orange and Greene. Each stockholder is to become a subscriber to the service of the new company at $1.50 a month, the service to include all of Ulster County without extra tolls and with half the present rates for business outside the county.

The Wisconsin Telephone Company is building a new metallic circuit between Washburn, Ashland and Bayfield, Wis., a distance of thirty miles,

The Elizabeth Mutual Telephone Company, Elizabeth, N. J., has filed articles of incorporation. The stockholders are one hundred well-known citizens, including many of the leading business men, manufacturers and professional men of Elizabeth. The capital is $30,000, of which $10,000 has been subscribed. It is the intention of the company to begin at once the building of its telephone exchange.

The city council of Eureka, Ill., has granted a twenty-year franchise to the Postal Telegraph Company.

A telephone war is on in Frankfort Ind. Two months ago the Frankfort Telephone Company, composed of home capital, organized and announced that it would construct a plant and give the public service at $1.50 per month for private residences and $2.50 for offices, or, where a business man subscribed for two telephones, the rates would be $1.25 and $2.25. The Central Union Telephone, on the organization of the home company, reduced its rates to $3 and $2, with the threat that if the new company's plant was built the rate would go still lower. The home company went ahead perfecting its service until it now has 1 0 subscribers to the Central's 75. Last week the Central Union Company notified its subscribers that they would hereafter be charged but $1 and $2, with the chance of getting the service still cheaper should the Frankfort Company meet the new rate. Immediately the Frankfort Company announced a $1 and $2 rate, with the assurance that it proposes to protect itself against any reduction made by the Central Union.

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EDITORIAL NOTES.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

The Braking of Trolley Cars.

Our esteemed contemporary, the *American Machinist*, comes out with a lengthy editorial on the inefficiency of the braking devices employed on trolley cars, and incidentally slurs the electrical journals for not having given, so far as it knows, any attention to this important question. It says:

"The multitude of electrical publications is now so great, so much talent is employed upon them, and so much enterprise is displayed by them, that between them all we should at least be able to get at all the important facts connected with the matters which they professedly handle. As it is their mission to disseminate knowledge, to promote investigation, to chronicle the results of investigation and experiment, and in a manner anticipate for the uninitiated the progress and development of the modern wonder, we had hoped before this to have seen something of the topic indicated by the title above. We have been waiting very patiently, and looking very longingly for some solution of the perplexing problem of how to operate the brake upon the electric car so that an electrically propelled car shall be as safe as any other so far as the stopping of it is concerned. *We have not seen that problem considered, or even enunciated by any electrical journal.* Why not? It is not to be supposed that any electrical journal is ignorant of the fact that an electrically driven car upon a street railway, a trolley car, either an overhead trolley or an underground trolley, and especially, and for an additional reason, a car operated by a storage battery, cannot either of them, with safety to itself, be stopped as quickly as any other car of the same capacity and running at the same speed."

The italics are ours. A blind man might truthfully say that he never saw the sun rise, but that certainly would not be the fault of the sun, nor is it the fault of the electrical journals that our contemporary never saw the problem of brakes considered or enunciated in the electrical journals. The subject has been a very much discussed one both by the electrical journals and by the American Institute of Electrical Engineers, and if the editor of the *American Machinist* will drop in on us, we will be pleased to turn to many pages of our paper that have been devoted to this very question. Our contemporary, however, is laboring under a very much more serious error than the one referred to above, and it is the more surprising in the *American Machinist*, because it indicates a misconception of mechanical facts with which it should certainly be conversant.

It says:

"Any mechanic must see at once that the brake, in view of the emergency that it is supposed to provide for, is a slow-acting affair, and if he will investigate the propelling mechanism of the car, he will easily see that it is, and why it is, purposely made so. The armature of an electric motor, as everybody knows, is quite a heavy part of it, and, running at a high velocity, it is, of course, a powerful fly-wheel, and when it is noticed that the armature, or the shaft which carries it, is geared to the axle without the possibility of slip the whole situation is exposed. If the axle is stopped suddenly something is going to be smashed, so the slow-acting brake is a safety device for the motor."

This is only partly the truth. The mechanical brake is a slowly-acting affair, and purposely so, but not for the reason assigned. The large angular movement of the brake handle is provided simply and solely for the purpose of mechanical advantage and not for the protection of the gearing as supposed. To produce the most effective braking, several requirements must be fulfilled. In the first place the propelling force must be cut off first, and then the retarding effort must be applied. It must be remembered, too, that suddenness of application of the brake is not always or usually a requisite to a good brake. Were this so, the blocking of the wheels would be the most efficient emergency stop. All experience has shown that this is not true, and that a car may be brought more rapidly to rest under other than skidding conditions. In fact if the wheels once begin to slide, the motorman will best throw off his brake entirely for a moment until the wheels have again attained normal rolling friction, and then apply it rather than to continue the former conditions. Were suddenness of application the sole desideratum, the electric car would have facilities not found to the same extent in other vehicles, for by simply reversing the motors the wheels would be revolved in the opposite direction. The objection to this method of procedure would not be the one raised by our contemporary, viz., that it would strip the gears, though there might be some danger of that, but it would doubtless burn out the armature, and even if it did not do this it would fail to bring the car to rest as rapidly as might be done by a proper application of the brake. In series electric traction the danger to the armature above referred to does not exist, and electric braking can be resorted to with impunity, but to be effective it must not be applied so strongly as to produce skidding.

The chief difficulty with electric cars is their greater weight. No other mechanically propelled vehicle has *as good* braking facilities as has the electric car if they are properly manipulated, but the motorman on the usual trolley car has too many things to attend to. He has both hands continually occupied, and in the case of an emergency, unless he be of better stuff than the ordinary run of men, he will take the necessary steps to check his car in the wrong sequence, or omit one of the steps altogether, both of which are equally bad.

Electric cars, too, run at higher speed than other street vehicles, and although by the present means of braking a car can be brought to rest from a speed of ten miles an hour within a distance of ten feet if the braking mechanism be guided by proper intelligence, it is exceedingly doubtful if the number of accidents would be much lessened by any improved mechanism which would render stoppage possible within half the distance unless there were a higher intelligence behind it than that usually found on our street cars. Many of the accidents—we think it safe to say, most of them—that are attributed to faulty brakes are not due to that cause at all. In populous residential cities such as Brooklyn, where the streets are largely used as playgrounds by the children, no brake could be devised that would avert many of the accidents that are reported. A slower speed of the cars would alone prevent them, or a more perfect fender is required. The public are demanding rapid transit and with this demand it has come to stay. It seems a sad commentary on humanity to say that to the public as a body a few lives more or less are considered of no importance provided only that the convenience of the public is not interfered with. Hence rapid transit has come to stay simply because the public demands it. We would all hail with satisfaction any improvement in braking devices that will lessen the slaughter which results from this public demand, even though the improvement were ever so slight, but there is much greater room for improvement in fenders than there is in brakes, and still more room for improvement in the personnel of those who handle the cars than in either of the other two factors. We do not blame the motormen—they are as a rule an intelligent and painstaking class of men who aim to do as nearly right as they can. The fault lies in a system which will permit even bright and conscientious men to handle apparatus which they do not thoroughly understand. Some of the more progressive street railway companies endeavor to train their men to a thorough understanding of their apparatus before they put them in responsible positions. We know of some who have bought books which they have placed in the hands of their employees so that they might learn more intelligently the management of their motors, and who supplement this with instruction in the repair shop. This is all very well and commendable, but we know of no case where the men are regularly put through an emergency brake-drill which would enable them to manage their cars to better advantage when instantaneous and cool-headed action is demanded.

Our paid fire departments go through a regular drill every day in the year for the purpose of increasing their efficiency at fires. Why should not our motormen go through similar drills, if by that means life could be saved? We believe that we are coming to this, for it will pay. The motorman's position is often more trying than that of the steam locomotive engineer. Give him therefore a training that shall fit him to occupy it with credit to himself, with increased efficiency of the apparatus in hand, and greater safety to the public.

* * *

The Need of Telephone Organization.

The institution of the suit of the American Bell Telephone Company against the National Telephone Manufacturing Company, for alleged infringement of the Berliner patent of 1891, emphasizes in the most positive manner the urgent necessity for unity of purpose and action among the independent telephone manufacturers. The somewhat protracted delay in instituting suit on this patent has given rise to a feeling of security, more fancied than real, and the delusive hope that the Bell Company would do nothing has already been too long indulged. It is now evident that the Bell Company proposes to attempt to maintain its asserted rights under this alleged valid patent. Should it be able to do so, the consequences cannot be otherwise than disastrous to the independent telephone business. In fact, it will mean the almost complete demoralization of it.

With the possibilities of such a condition confronting them, it would seem to be almost gratuitous to presume that the independent telephone manufacturers need be urged to unite against a common enemy and one that threatens their very existence. The Bell Company is magnificently equipped in point of talent and capital to contest, in the courts and elsewhere, all its vested or predicated rights. There is not a single independent telephone company in existence that is able, of itself, to successfully combat this gigantic New England corporation, but by the organization of the scores of companies now in the field it is possible to create a combination of capital, talent and information that will be abundantly able to contest the validity of the Berliner patent in any and every court.

The future development of the independent telephone business may be said to hinge upon the outcome of the Bell Company's suit to determine the validity of the Berliner patent. If a decision favorable to the Bell Company is had in the New England judicial district, an injunction will immediately be obtained against every other manufacturer in that district. With the prestige of one decision in its favor, the Bell Company can go into other judicial districts, and, in all probability, secure favorable decisions there. And thus throughout the United States, until every independent telephone manufacturer is enjoined, just as was done in the incandescent lamp patent cases.

To avert the evil consequences of such adverse decisions, there seems to be but one thing to be done. The validity of the Berliner patent must be successfully attacked. A single one of the comparatively weak independent telephone companies cannot do this. All working in harmony can.

There are two organizations of independent telephone manufacturers now in the field, but the membership of both does not yet comprise all those engaged in the business. That the Bell Company, in the inauguration of its legal proceedings, should select a company that has declined to become identified with either organization, is significant, and should convey to all outside a hint of what is wisest and safest to be done. Had all the companies been completely unified by organization, it is not at all improbable that action on the part of the Bell Company would have been even longer delayed.

The formation of the Telephone Protective Association was suggested by the decision of the United States Circuit Court of Appeals in Boston in the suit brought by the Government for the cancellation of the Berliner patent of 1891 on the constant contact telephone transmitter. The instigators of the movement concluded that as the Bell Company not only has great resources in money at its command, but has the influence of its numerous licensees, whose stock in many cases is held by dangerously-near relatives of a great many Federal judges, the Berliner patent, while not a valid patent by any means, was one that might prove dangerous if not properly looked after. So they got together on a certain day in Chicago and formed the nucleus of the Association, and then, after the opinion of the Court was handed down, met at Pittsburg and completed the organization, which now has on its rolls most of the leading manufacturers of telephones and appliances therefor.

The object of the Association is solely defensive. It does not propose in any way to regulate the price of telephones or telephone service, but it simply stands ready to take up the gauntlet when it is thrown down by the Bell people. It proposes to meet the Bell people whenever they may offer battle, to employ the best legal talent to be had, and offset influence by proving facts.

Its attorneys and counsel will not be employed on account of their political "pull." They will be employed to win and will be aided by the members of the Association, all of whom are practical telephone men, men who know the art of telephony from its inception and who cannot be bought.

The Association is necessarily strong financially of course, but in information vastly stronger. It is ready at any time to defend, and has all the material necessary for answering a bill in equity already in the hands of its attorney. It wants a chance to defend, but wants the Government to keep its hands off. The Government has not the machinery for fighting a patent suit. In the Berliner suit it made a miserable failure. It did everything it ought not to have done, and left undone all that it ought to have done.

The Bell side of the case was splendidly managed. The Government side was mismanaged in every way. Now it remains for the Telephone Protective Association to see that the country shall not be further burdened by a monopoly which it had every reason to believe had expired.

The Association will not encourage piracy of any kind. Most of the members own patents, and those who do own them expect them to be respected as well by the members of the Association as by the general public, as they in turn propose to respect valid patents. They can expect no aid whatever from the Association in their private enterprises. They may rival each other and underbid as much as they please; they may give away their instruments if they choose. The Association has nothing to do with these matters. It has only one enemy to fight, and that is the American Bell Company, and its shield is against only one weapon, the Berliner 1891 patent, as it believes that this patent was fraudulently granted and is invalid.

The Eastern Protective Telephone Association is not yet fully organized, but its objects are essentially the same as those of the Western Association. It proposes to present a united front whenever the Bell Company invites issue on the Berliner patent, and is prepared to guarantee immunity to all its customers. Just why there should be two Associations is not apparent. It certainly would add much to the strength of the cause if the minor differences which now separate the Associations could be reconciled and the organizations resolved into one. But if each should insist in preserving the autonomy of its organization, there is no valid reason why they should not pool issues on the Berliner patent.

Under the Searchlight.

Views and Opinions on Timely Topics.

ANY person desiring to acquire the plant and business of a thriving electric light company in an Indiana city, with a profitable city contract for a term of years, and capable of earning, under present conditions, from $10,000 to $12,000 net per annum, can obtain further information from ELECTRICITY.

* * *

Wisdom of the "Electrical World."

(From Electricity, London.)

Some papers, and occasionally even electrical papers we are sorry to say, are a little slow in getting news even in go-ahead America. Our worthy contemporary, the *Electrical World*, for instance, seems to be singularly ill-provided with information about this country, or even with common books of reference. How else could the following paragraph have been evolved and passed?—

> "THE SNAEFELL MOUNTAIN RAILWAY.
>
> "Work on the electric railway to the summit of Snaefell Mountain, Wales, is progressing rapidly, and the road is expected to be ready for July. The overhead system will be used, and when this line is completed there will be a complete stretch from Douglas to Laxey, and thence to Snaefell, about ten miles in all."

That Wales is only ten miles distant from the Isle of Man will be news to most of us, and a cultured minority, who have read Mr. Hall Caine's novels, will be startled to hear that Snaefell is in Wales. The editor of the *Electrical World* should remember what happened to the man who read Oliver Wendell Holmes's joke, and forbear to trifle too much with our powers of endurance.

Brother Johnston is pretty familiar with the geography of Ireland, and we suggest that the next time he goes abroad he take pains to learn something about the rest of the kingdom of Her Gracious Majesty.

* * *

"BIRDS OF A FEATHER."

Two of Mr. Coffin's Friends.

A few days ago receivers were appointed for the Trenton Rubber Company and the Central Jersey Traction Company, in both of which companies Mr. Frank A. Magowan was a leading spirit. His affairs are said to be badly tangled, and considerable of his paper is reported to have already gone to protest.

Mr. Magowan is the gentleman with whose assistance Mr. C. A. Coffin sandbagged the electric light company into a consolidation with a paper company which Coffin, Magowan and Mr. X. Y. Z. Maguire had arranged for the purpose.

A recent dispatch from Tacoma says:

> The estate of the late defaulting general land agent of the Northern Pacific Railroad, Paul Schulze, who was accused of involving the Armours, of Chicago, to their loss, in Tacoma street railways, has been sued by Paul F. Mohr, a New York capitalist, for wines which he alleges Schulze purloined and drank while Mohr was absent from the Union Club of this city. Mohr laid in a choice stock of old wines while Schulze was cutting wide swaths a few years ago, and going away to Eastern cities he gave Schulze the key to his wine cellar here. Schulze was to take only a sample now and then, but he visited the cellar and made off with everything.

Mr. Schulze was the man with whose assistance Mr. Coffin and Mr. Byllesby carried through the Tacoma street railroad swindle.

ELECTRICAL FAKIRS AND THE DAILY PRESS.

A Sample Case.

The following appeared in a recent issue of the Boston *Transcript:*

> To write the history of electricity without using the name of Van Choate would be like playing "Hamlet" and leaving out the melancholy Dane. . . But none except educated electricians know how crude and impracticable are the electrical appliances now in use. and what a vast amount of energy is wasted in the transmission of this mysterious force. Mr. Van. Choate's inventions show a saving of over 60 per cent. in the transmission of energy from one point to another. This one fact alone makes his system worthy of careful investigation by conservative investors. If this and the other claims of the company can be sustained, and we have every reason to believe that they can, it is only a question of time when the other electric companies will have to get off the face of the earth.

Of course this was a paid notice, and of course it was designed to assist Mr. Pennock's chief rival in swindling the public.

One of our constituents, who evidently considered, as we did at one time, that the *Transcript* was honestly conducted, and had been imposed upon, called the attention of the editor to the matter in the following letter:

> Editor Boston "Transcript":
>
> Dear Sir: I notice on page 10 of your issue of to-day a brief article, "The Advance in Electricity." As I know nothing about the remarkably prolific character of the gentleman's inventions, I pass at once to the middle of the article to criticize the statement, "None except educated electricians, etc." This and the following sentence are misleading in the extreme. The first is absolutely wrong, modern electrical apparatus standing well at the head of modern engineering practice in point of efficiency. Certainly, machines which work with a commercial efficiency of 94 per cent. to 97 per cent. can hardly be called inefficient, while no man who ever entered a modern power-house with a fair average amount of brains in his possession would come out of it with the word "impracticable" on his lips. As to the second sentence of the two, I will criticize it by a paraphrase on the following two lines, thus: This one fact alone makes his system unworthy of careful investigation by intelligent investors. I am far from desiring in any way to underrate Mr. Van Choate's work, but if he is a wise man he will regret as much as any one else the making of such dubious claims as this, which tend to make an electrician feel *a priori* toward it as one does toward "the Pennock system" and the many disreputable electro-medical frauds, which frequently make one blush for the paper in whose columns their advertisements appear.
>
> It is the appearance of erroneous paragraphs such as this, which lead the non-technical public astray and maintain the popular illusion concerning the amazing possibilities of electricity, that all electricians desire to see give place to an intelligent appreciation of this newest branch of science and engineering. I am sir, very sincerely yours, ELECTRICIAN.
>
> Boston, June 27, 1895.

To this the following reply was received:

> Dear Sir: I am much obliged to you for your criticism of the paragraph on the Van Choate electric system, but as that was not the kind of paragraph in which we expect to state things with scientific accuracy, it belonging to the class of items aiming only to secure publicity, I do not think it is well to add a gratuitous amount of that commodity. I should prefer to make the statement that you give us concerning the efficiency of electrical machines in some form independent entirely of that item. Very truly yours, EDITOR "TRANSCRIPT."
>
> Boston June 29, 1895.

The sense of moral responsibility in the office of the Boston *Transcript* is not what it was twenty years ago, and it is little wonder that the influence of the paper is only a reminiscence

We give space to this matter to convince the public that daily paper statements in regard to electrical subjects or electrical companies are totally unreliable.

Those who hold that only fools invest in the Pennock and Van Choate schemes are mistaken. A large number of otherwise intelligent people have been led to invest by just such notices as this in the *Transcript*, appearing with editorial sanction, not marked as an advertisement, but paid for at so much per line.

Convention of Edison Illuminating Companies.

THE PROGRAMME.

Lively Discussions Expected.

(Special Dispatch to ELECTRICITY.)

DETROIT, Mich., Aug. 13.

The Sixteenth Convention of the Association of Edison Illuminating Companies begins here to-day.

The first thing on the programme is "Addresses on the Relation of the General Electric Company to Edison Licensee Companies."

A meeting of the Executive Committee, composed of Messrs. Beggs, Marks, Gilbert and Weeks, was held yesterday, at which Mr. Coffin and S. D. Greene were present. Mr. Coffin left for the East last night, leaving Mr. Greene in charge of the defence. There will be a lively discussion of the complex situation which has puzzled licensees and parent company alike.

Among other General Electric representatives are Sunny, Lovejoy, Emmet and Paige.

A sign of the times is noted in the preparations for a full discussion of the two-phase system, which even Edison licensees are being forced to adopt.

The sessions close on Wednesday.

Illuminated Trolley Excursions.

Six open cars, elaborately trimmed with bunting and brilliantly decorated with red, white and blue incandescent lamps, were used to inaugurate the illuminated trolley car excursion on the Brooklyn Heights railroad in Brooklyn on Wednesday night. The cars ran over the various lines of the city and met at City Hall at 8 o'clock, proceeding thence, in processional order, to Ulmer Park, at Bensonhurst. Over three hundred passengers were guests of the company, among whom were ex-Governor Flower, ex-Lieutenant Governor Sheehan, representatives of the press and others.

The Electric Elevator.

Messrs. J. Hammond & Co., who for ten years were the representatives of the Otis Company on the Pacific Coast, and who have probably installed more elevators than all other concerns combined in that section, are among the latest converts to the superiorities of the electric elevator, and have become the agents of the Sprague-Pratt Company on the Pacific Coast.

Eugene Phillips's Clambake.

The 17th annual clambake of the American Electrical Works will be given at Haute River on Saturday August 17 next. This occasion also marks the 25th anniversary of the founding of the business.

Personal.

Mr. Max Berg, late with the Wallace Electric Company, has taken the Chicago agency of the Mansfield Brass Company.

Dr. Arthur Browne, of Boston, who was for a long time with the Edison General Electric Company, is again doing special work for the General Electric Company in the South.

Mr. H. L. Luffkin of the Crocker-Wheeler Electric Company, has recently returned from a six weeks' trip through the West.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER V.

The Tacoma Railway and Motor Company.—II.

INTRODUCTORY.

Although ELECTRICITY is in almost daily receipt of letters commending us for the present series of articles, paying us high compliments for the style of treatment of the subject and for the clear proof presented by the publication of original documents and official records which cannot be disputed, yet we suppose there are some members of the fraternity who doubt the propriety or fairness of calling attention to the bad spots in the electric railway business. If there are any such among our constituents, we desire to address a few remarks to them for their edification and instruction.

The railway companies so far treated by us can scarcely be considered as rotten spots in an otherwise sound and healthy business. They are rather only a part of the mass of rottenness which is the result of the Coffinesque method of financiering—a method which has found many imitators—the results of which are just the same by whomsoever applied. The object of the series is two-fold. First, to show conclusively that the plan of financing which has been in vogue since 1888 is radically wrong, that every system to which it has been applied must end in bankruptcy and reorganization or be wiped out altogether; and second, that the one man responsible for the entire plan is Charles Albert Coffin. Every other man connected with the scheme of bonding street railway plants for from two to ten times their value, selling the bonds to Eastern investors, has been either a tool or an imitator of Mr. Coffin.

ELECTRICITY will never agree to the theory that the publication of actual facts in regard to the electric railway business is a crime, or even ill-advised. The situation is the result of crime; it is almost wholly bad, and radical improvement in it can only be brought about by a dissemination of facts, by pointing out the causes, and showing just why scarcely a month passes without one or more of the systems confessing bankruptcy.

The one prime cause to which all others are subsidiary is over-capitalization.

We all know the unsavory record which the steam railway business has made for itself. The financial management of American steam railways has become a stench in the nostrils of the investing public in every civilized part of the world. With few exceptions, there has apparently been no other object on the part of the promoters than the sale of securities, which have been piled up until a startling percentage of the entire railway mileage of America is in the hands of the courts for the benefit of deluded security-holders.

According to the reports of the Inter-State Commerce Commission, there were in June, 1893, 1,890 steam railroads in the United States, of which 156 were then in the hands of receivers. There were in the latter number several of the larger systems, so that the mileage of receivership systems, 38,869.96, was nearly one-third of the total mileage of the country. To-day the proportion is much larger. The total capital (investments confessed to be in jeopardy) of the receivership properties was $2,500,000,000.

The Commissioners say in their report:

"An investigation into the history of the 156 roads in the hands of receivers shows them to have been burdened with an indebtedness which was with difficulty carried through even prosperous times."

We do not think any argument is needed, however, to prove the over-capitalization of American steam roads. But how many of our readers have ever taken pains to make any comparisons between the steam and electric railway industries?

According to the *Street Railway Journal's* statistics, which are the best obtainable and approximately correct, the street railways of the country make the following showing:

CAPITALIZATION OF STREET RAILWAYS.

Total number roads		196
Mileage:		
Horse	1,914	
Electric	10,363	
Cable	682	
Miscellaneous	679	
		13,588
Capital stock	$748,014,206	
Funded debt	552,125,505	
Total capitalization		$1,300,139,711
Average capitalization per mile of track		$95,600

As against this the showing of the steam roads is altogether in favor of the latter. The report referred to (1893) gives the following figures:

CAPITALIZATION OF STEAM RAILWAYS.

Common stock	$3,962,009,602
Preferred stock	686,285,816
Total stock	$4,648,295,418
Funded debt	5,225,689,821
Total capitalization	$9,873,985,239
Average capitalization per mile of track	$59,729

The electric railway business is only seven years old. The steam railway business has enough age to have been thoroughly tested, and the results of over-capitalization (a conservative term for robbery) are painfully in evidence. Yet the capitalization is but little over half as much per mile as that of the street railways.

Every man who knows anything at all about the two kinds of roads knows that the *actual cost* per mile of electric roads is not over half the actual cost of steam roads. How, then, can success be hoped for in our electric systems unless a revolution in methods is created? If any one shall argue that this plan of over-capitalization, while resorted to in the beginning, is now obsolete, we have but to point to the present plan of reorganization in Philadelphia, with the millions added to an already unsafe capitalization.

THE TACOMA OPERATION.

A few weeks ago when the Messrs. Armour, of Chicago, brought suit against the financiers who engineered the Tacoma street railway bonding scheme, ELECTRICITY (June 12) presented a review of the condition of the Tacoma Railway and Motor Company and of the companies which it succeeded. There was considerable interest in that specific case of Thomson-Houston financiering at the time, and it seemed best to anticipate our general plan a little by giving the public the information which was not easily to be had except through these columns. Although that

[COPY.]

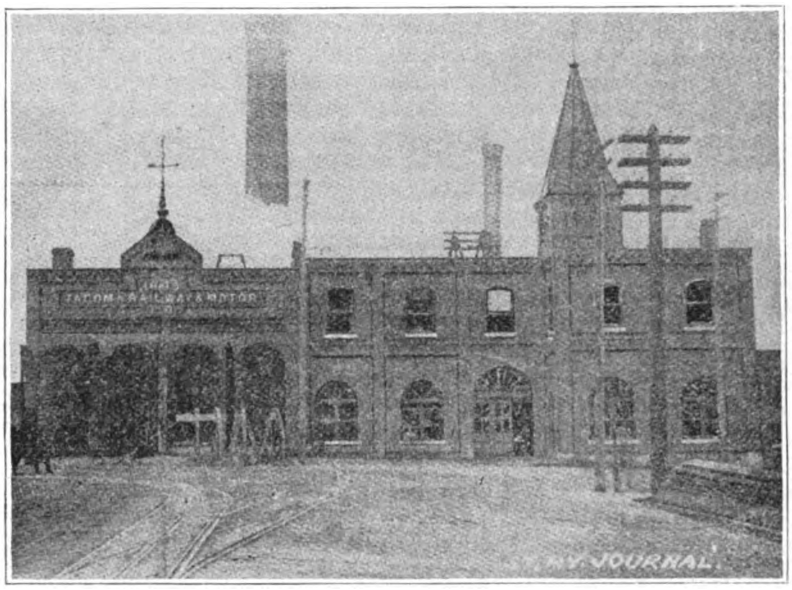
TACOMA RAILWAY AND MOTOR COMPANY.

STATEMENT OF EXPENDITURES, OCTOBER, 1892.

OPERATING EXPENSES.	For Oct., 1891.	For Oct., 1892.	From July 1, 1892, to Sept. 30, 1892.	Total 4 months, 1892.
General expenses:				
Salaries—General officers and clerks	$679.65	$457.66	$1,456.98	$1,914.64
Miscellaneous expense	131.12	36.84	144.83	181.67
Stationery, printing and advertising	130.40	155.20	888.15	1,043.35
Legal expense	......	......	......	......
Insurance	180.00	329.12	815.45	1,144.57
Injuries to persons and property	14.00	1.85	84.40	86.25
Rents	127.50	......	275.00	275.00
Taxes	184.10	392.98	1,113.24	1,506.22
Secret service	......	11.20	45.75	56.95
Total	$1,446.77	$1,384.85	$4,823.80	$6,208.65
Transportation expense:				
Car service	$5,470.40	$6,270.65	$18,439.78	$24,710.38
Car house expense	215.80	315.05	729.50	1,044.55
Total	$5,686.20	$6,585.70	$19,169.28	$25,754.98
Motive power expense:				
Power service	$675.85	$705.30	$2,649.54	$3,354.84
Power expense	1.88	180.57	406.58	587.15
Oil and waste	168.81	56.78	208.97	265.75
Fuel	1,180.53	1,131.35	3,443.75	4,575.10
Total	$2,027.07	$2,074.00	$6,708.84	$8,782.84
Total expense	$9,160.04	$9,994.55	$30,751.87	$40,746.42
Maintenance of rolling stock:				
Repair service	$1,813.35	$760.30	$2,696.76	$3,457.06
Repairs and renewals of cars	698.95	193.35	582.07	775.42
Armatures and fields	541.30	68.21	757.96	826.17
Gears and pinions	160.50	79.18	5,654.45	644.63
Other repairs	.60	......	10.65	10.65
Grips	......	35.41	60.83	96.24
Machine shop, tools and machinery	......	......	31.73	31.73
Total	$3,214.70	$1,136.45	$4,705.45	$5,841.90
Maintenance of power plant:				
Repairs and renewals, engines and boilers	$53.28	$99.18	$351.61	$450.74
" " " dynamos	16.07	77.73	29.27	107.00
" " " cable and cable machinery	......	426.88	1,183.83	1,610.71
Total	$69.35	$603.74	$1,564.71	$2,168.45
Maintenance of way and buildings:				
Repairs to roadbed and track	$606.51	$515.84	$1,386.40	$1,902.24
Rails	......	......	......	......
Ties	......	......	......	......
Paving	......	......	......	......
Repairs and renewals of buildings	......	51.70	43.06	94.76
Total	$666.51	$567.54	$1,429.46	$1,997.00
Maintenance of overhead system and ground connections	$79.80	$131.91	$372.64	$504.55
Horse feed, etc	......	......	29.75	29.75
Total	$79.80	$131.91	$402.39	$534.30
Total maintenance	$4,030.36	$2,439.64	$8,102.01	$10,541.65
Total operating expenses	$13,190.40	$12,434.19	$38,853.88	$51,288.07

article was quite long, it did not do full justice to the case. We will now, therefore, consider some features which were necessarily neglected before.

We have already shown in the article referred to, by the official statement of the company, prepared June 1, 1892, that the entire property was in a hopelessly bankrupt condition when it was planned to increase the capitalization to $2,500,000. The company was unable to pay even the interest on its floating debt, to say nothing of meeting the interest on its bonds already issued. These facts had, however, little influence upon Mr. Coffin. His company had a contract with the United Electric Securities Company by which the latter took bonds at the uniform price of 80; and whenever they could be taken at 60 there was nothing in the Coffinesque plan to prevent their manufacture, no matter how infinitesmal the chances of interest ever being paid on them.



POWER HOUSE TACOMA RAILWAY AND MOTOR COMPANY.

14 UNITED ELECTRIC SECURITIES CO.

$1,000,000 COLLATERAL TRUST BONDS.
SEVENTH SERIES.
Issued September 8, 1892.
Statement of Sales of Underlying Bonds.

BOSTON, MASS., August 1, 1894.

Underlying Bonds.		Sold to Date.
Atlanta Con. St. R'y Co.	$11,000	$11,000
Cumberland E. L. & P. Co.	125,000	------------
Hartman Gen. El. Co.	145,000	------------
Hudson Elec. L't Co.	200,000	------------
Indianapolis L. & P. Co.	21,000	21,000
Kingston Electric Co.	150,000	------------
Louisiana El. L't Co.	150,000	5,000
Macon Con. St. R. R. Co.	100,000	------------
North River E. L. & P. Co.	35,000	10,000
St. Paul & White Bear R. R. Co.	25,000	------------
Tacoma R'y & Motor Co.	200,000	------------
Waverly-Woodstock El. R'y Co.	90,000	------------
	$1,252,000	$47,000
Less sales to date	47,000	
Owned by the U. E. S. Co.	$1,205,000	

Average Price, 84.9.

To retire outstanding Fives at 103, the remaining underlying Bonds should be sold at 81.5.

Receipts from sales to date $39,896.00

Collateral Trust Fives redeemed and cancelled } $43,000, at a cost of 36,397.50

Balance . $3,498.50

UNITED ELECTRIC SECURITIES CO. 15

$1,000,000 COLLATERAL TRUST BONDS.
EIGHTH SERIES.
Issued January 11, 1893.
Statement of Sales of Underlying Bonds.

BOSTON, MASS., August 1, 1894.

Underlying Bonds.		Sold to Date.
Binghamton Gen. El. Co.	$78,000	------------
Buffalo Gen. El. Co.	100,000	$100,000
Butte Gen. Elec. Co.	200,000	------------
E. L. & P. Co., of Syracuse	200,000	12,000
Elgin City Railway Co.	75,000	------------
Hudson Elec. L't Co.	200,000	------------
Sea Shore Elec. R'y Co.	31,000	------------
Tacoma R'y & Motor Co.	200,000	------------
Union Railway Co.	167,000	167,000
	$1,251,000	$279,000
Less sales to date	279,000	
Owned by the U. E. S. Co.,	$972,000	

Average Price, 91.9.

To retire outstanding Fives at 103, the remaining underlying Bonds should be sold at 76.

Receipts from sales to date $256,375.00

Collateral Trust Fives redeemed and cancelled } $286,000, at a cost of 259,116.50

Over-invested . $2,741.50

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16 UNITED ELECTRIC SECURITIES CO.

$1,000,000 COLLATERAL TRUST BONDS.
NINTH SERIES.
Issued April 26, 1893.
Statement of Sales of Underlying Bonds.

BOSTON, MASS., August 1, 1894.

Underlying Bonds.		Sold to Date.
Butte Gen. Elec. Co.	$200,000	------------
Cleveland Gen. Elec. Co.	100,000	------------
Cumberland E. L. & P. Co.	60,000	------------
Edison El. Co., of N. Orleans	200,000	------------
E. L. & P. Co., of Syracuse	200,000	------------
Elgin City Railway Co.	75,000	------------
Hudson Elec. L't Co.	100,000	------------
Kingston Electric Co.	23,000	------------
North River E. L. & P. Co.	52,000	------------
Portland Gen. Elec. Co.	28,000	------------
Tacoma R'y & Motor Co.	200,000	------------
Union Railway Co.	12,000	$12,000
	$1,250,000	$12,000
Less sales to date	12,000	
Owned by the U. E. S. Co.,	$1,238,000	

Average Price, 92.5.

To retire outstanding Fives at 103, the remaining underlying Bonds should be sold at 82.

Receipts from sales to date . . . $11,100

Collateral Trust Fives redeemed and cancelled } $12,000 at a cost of 9,240

Balance $1,860

We present this week an additional statement, copied from the official records, showing the necessary expenditures for operation of the system for October, 1891, October, 1892, and for the four months ending October 31, 1892. This is worth noticing, chiefly because it shows beyond the possibility of denial that Mr. Coffin and Mr. Byllesby both had full information at hand concerning the actual condition of all these properties. They were not ignorant. They knew just how hopeless the case was in every instance before these increases of capitalization were made and the worthless paper foisted upon the investing community.

In our articles on the other plants so far treated in this series we have presented the official inventories, showing that, even when large amounts of money were raised from the sale of bonds, the local plants got little benefit in the way of equipment. The rule was to spend as little as possible for property, or rather for the parent Thomson-Houston (G. E.) Company in the East, to give as little as possible for the money received. In nearly every case, as we have proven, the total property account, even when padded with surprising audacity, was much less than the amount of bonds issued.

At Tacoma we find precisely the same conditions. In 1893, after Mr. Coffin had carried out his gigantic scheme for a capitalization of $2,500,000, the street-railway system was wofully deficient in equipment. The deal had been worked to its full limit. Every dollar possible had been realized from the sale of securities, and every dollar was misappropriated.

The Tacoma and Steilacoom branch had then, 1893, thirteen miles of track, forty-five lb. T rails, and *seven* cars.

The Tacoma system proper had one 150 H. P. engine, two of 750 H. P. each, and one of 300 H. P. There were six 150 K. W. Edison generators, twenty-six motor cars, equipped with W. P. 50s and W. P. 30s. The largest engine was a relic of the past, one of the original Corliss type, and had been in use in a sawmill for thirty years. It may have been valuable—as a museum curiosity.

It is easily seen that, even if the receipts had been much larger, every precaution had been taken against giving the bondholders any valid security for their investment in the way of good and efficient equipment.

We give our readers a view of the exterior of the power house of this $2,250,000 system. It needs no comment.

Now let us consider this Tacoma enterprise as a possible earner of money. Taking the same method of treatment as applied to the other properties, the justice of which is thoroughly established by the authorities, we find, taking the *official* statements of the Tacoma Railway and Motor Company as our basis:

The yearly fixed charges were:

Interest on bonds	$7 ,00 .00
Interest on floating debt @ 6 per cent.	44,183.00
Allowance for depreciation should have been 6 per cent. on $2,250,000	135,000.00
Dividends on $1,000,000 stock at 6 per cent.	60,000.00
Total	$814,183.00
which is 25 per cent. of what the road to be a sound property needed to earn per annum, or	$1,256,782.00
Actual earnings were (yearly rate)	$244,865.04

or less than one-fifth of what they must have been to justify the capitalization of $2,250 000 issued.

Deduct from $814,183, as above, the $60,000 item for stock dividends, which it may be argued did not need to be paid, and we have	$254,183.00

which is 25 per cent. of what the road needed

to earn in order to exist at all, or........... $1,016,782.00
about four times the gross receipts of the road
after it had been electrically equipped,
managed by supposed experts and capitalized for $2,250,000, with $250,000 of bonds
yet to be issued for "betterments."

To comprehend the full details of the marvelous scheme of financing which won for "young Coffin" (as Edwards of the Philadelphia *Press* referred to him) the title of Napoleon III. of Finance, it is necessary to keep in mind all the channels through which these worthless securities passed on their way to the private lockers of the small investors of the East. The all-important link in the chain was the United Electric Securities Company of Boston, which turned them over to the public through its own collateral trust series, holding the local company bonds as collateral only until they could be disposed of, when the collateral trusts were retired. This Securities Company still holds $600,000 of these Tacoma bonds, as shown by the accompanying fac-simile copies of pages 14, 15 and 16 of the official report of the company. In addition, the General Electric Company and the Street Railway and Illuminating Properties have $250,000 each, all awaiting the attention of the careful investor of the funds of widows and orphans in the East, or of other kinds of financial institutions.

So much for the Tacoma Railway and Motor Company, its bonds and their worth.

Considering the capitalization per capita of the population of Tacoma, the difference between the amount of securities issued and the amount which should have been issued is very large. The capitalization was $2,500,000. There were in Tacoma 36,000 inhabitants. The system would have had a fair chance of success if capitalized at $15 per capita, or $540,000.

A careful study of all the plants in the Northwest put in by the Northwest Thomson-Houston (G. E.) Company shows that not one has the possibility of ultimate success, and those which have not so far confessed bankruptcy must do so very soon.

RECEIVER FOR THE ST. CLOUD PROPERTY.

The St. Paul Title Insurance and Trust Company applied last week for a receiver for the St. Cloud City Street Car Company, which has defaulted on the interest on its $125,000 of bonds.

This is one of the companies whose affairs we have recently gone into at some length.

We are willing to go on record with the prophecy that *every local company* which the Northwest Thomson-Houston (G. E.) Company had to do with, will be compelled to go through a receivership and a reorganization, or go out of business altogether.

Prize Offered.

The Royal Scottish Society of Arts has decided to offer for competition a Keith prize of £50 for improvements in electric energy meters for domestic supply. Competitors will be expected to submit, in addition to a descriptive paper accompanied by detail drawings, a working meter adjusted for a mean pressure of 115 volts, and suitable for a house in which the minimum number of watts being taken at any time is 4,000. Special importance will be attached to the minimum load at which the meter can register correctly, and to the energy absorbed by the meter when the consumer is using a light load, or when no energy is being taken. Conditions of the competition were discussed and adjusted, and it was agreed that the award should be made during the session of 1896, the Society reserving the right to withhold the prize in the event of there being nothing deserving the award. Alternatively, the Society may award a smaller amount should anything meritorious, but not deserving the full prize, be sent in.

ELECTRIC TRACTION FOR TRAMWAYS IN TOWNS.

(From our Special London Correspondent.)

Before the Tramways Institute of Great Britain and Ireland the other day, Mr. Geo. Cawley read a paper on "A Method of Electric Traction for Tramways in Towns," with special reference to the Thwaite-Cawley system The author set forth a variety of figures and statements as to American experience, and considered the great success of electric traction in the States ample justification for Great Britain adopting it in earnest. His paper was divided into two questions:

(1) Which is the best electrical haulage method for any given line?

(2) How soon, having regard to financial and other preliminary difficulties, can our present horse haulage be supplanted by an electrical haulage arrangement?

A careful analysis of a large number of electric tramway accounts relating to Continental and American practice has been recently made, with the result that the average working cost per car mile, leaving out only the item of interest upon capital, comes out at 6½d. in America and 5½d. in Europe. The ratio of working expenses to receipts, taking both Europe and America together, is approximately 60 per cent. Mr. Cawley stated that if we wish to place ourselves on a level with electric tramway enterprise in America, we have plenty of ground to make up. The accumulator system could be fairly and simply applied without disturbance of a line, but, for reasons of working cost alone, it was not likely to be permanently adopted in English practice unless accumulators could be materially improved and lessened in weight. We have then the conduit or culvert system, and this is a relatively costly system to construct, but on account of the scope it gives for embodying practical solidity and durability in the working details, and to the convenient disposition of the conductors below ground, he ventured to think this system would be chiefly adopted for tramways. Although the conduit system has been adopted in several places in the United States and on the Continent, there is only one example of this system in England, i. e., at Blackpool.

The overhead trolley system as adopted in America, Mr. Cawley thought, would not be permitted on similar lines over here. Having regard to the general requirements of British tramway traffic, and to the opposition which many local authorities would give to the overhead system in towns, we may not unreasonably conclude that some form or other of the conduit system is the one most likely to be adopted for electrical traction on British urban tramways. The cost of construction would of course vary with local circumstances. The working expenses would be found relatively very low.

Mr. Cawley concluded his paper with a brief recital of some of the advantages claimed for his system:

1. The culvert is of sufficient dimensions to allow examination or repairs of the conductors or culvert track to be efficiently carried out.

2. The culvert can be kept quite free from water, mud, or dust, by a brush attached to the culvert locomotive.

3. The locomotive rails being laid inside the culvert, the tractive efficiency of the driving wheels is not affected by snow or frost.

4. When the culvert is once laid the street traffic need not be afterwards disturbed, except at long period intervals for the replacement of the tram-line rails.

5. Ordinary horse-haulage tramcars can be used without any structural alterations.

6. The electro-motors used are gearless, and yet run at a relatively high speed and efficiency.

7. All sparking above the street level is completely prevented.

8. All danger to the pedestrian public in the way of accidental electric shocks is entirely obviated.

9. Posts or other erections along the tramway route are unnecessary, and the appearance of the tramway thoroughfare is not affected.

10. The tramway rails as used for horse haulage cars need not be replaced by rails of heavier section.

11. The system can be conveniently worked in connection with suburban lines using either horse or electric traction.

12. The load on driving wheels of the locomotive is proportional to the traction requirements of the car.

13. The outward and return circuits can be entirely insulated from the earth or buried pipes, thereby preventing any destructive electrolytic action on outside property.

14. The system, in general design, is of a character to reduce the cost of repairs to a minimum, and to ensure the durability of the plant over a long period of years.

The Electrophone.

We are informed by the Electrophone Limited, of Shaftesbury Avenue, W., that the "eloquence of Dean Farrar on the occasion of his farewell address will not only reach his devoted congregation at St. Margaret's, Westminster, but his utterances, which cannot but be most impressive, will at the same instant be transmitted through the electrophone to his host of admirers in other districts of London, and probably to hospitals, thus enabling the invalided and those unable to be present for want of room and other reasons to avoid missing an intellectual discourse. St. Margaret's, Westminster; St. Anne's, Soho; St. Martin's-in-the-Fields; St. Michael's, Chester Square; the Highbury Congregational, Marylebone Presbyterian, and Christ Church, Birmingham, etc., are the churches amongst the leaders in this interesting and benevolent movement." The communication is dated the 15th ult., but the date of the function has not been vouchsafed by the company.

The Spectrum of Carbon from the Electric Furnace.

In a recent communication to the Académie des Sciences, M. Deslandres stated that M. Moissan recently pointed out that the carbons which he uses for his electric furnace are purified by the passage through them of the large currents employed. As it is very difficult to purify carbon by the chemical way, M. Deslandres emphasizes the importance and interest of this property of the electric furnace, especially to spectroscopists who often use pure carbon in qualitative analysis. It was on this account that M. Deslandres paid special attention to the statement of M. Moissan, and carried out an investigation to verify its correctness. M. Moissan placed at M. Deslandres' disposal two carbon electrodes, a positive and a negative, 20 cm. long and 5 cm. thick, which he had made use of in some electric furnace experiments. M. Deslandres took from each electrode small pieces of carbon at distances of 15, 10, 5 and 1 cm. from the arc. He found that the pieces which were taken from the electrode at some distance from the arc showed the ordinary impurities of carbon, namely, alkaline metals, together with copper, iron and silicium. When, however, he came to examine the pieces which had been taken close up to the arc, the bands denoting impurity finally disappeared, with the exception of the calcium bands, which, although very much reduced, always remain visible, a fact which M. Deslandres attributes to the lime wall of the furnace, which is probably partly volatilized when large currents are used. M. Deslandres attributes this purification of carbon to a purely physical cause, the impurities being much more volatile than carbon, and being therefore vaporized before it. The purest carbon was obtained from the mushrooms which form on the negative, and with one of these mushrooms M. Deslandres obtained a spectrum which contains fewer impurity bands than any of the spectra hitherto published.

LONG DISTANCE TRANSMISSION AT 10,000 VOLTS*—III.

(The Pomona Plant.)

BY GEORGE HERBERT WINSLOW.

Commercial lighting in Pomona was begun November 28th, 1892, and a telegraphic order was at once sent for another set of reducing transformers, to be used at San Bernardino, where the local circuits were already nearly completed. It was a condition of the franchise for the latter place that lighting should be begun before January 1st, and work was pushed rapidly on the transmission line, over 28 miles long, until it was finished. The order for transformers had, however, been given too late for them to be delivered in time, and it was decided to reduce the pressure at Pomona to 5,000 volts and to take to San Bernardino the half of the Pomona bank thus made available. In order to avoid the reheating which would have been required had the transformers been dismounted for shipment, the latter were hauled to San Bernardino on wagons without springs, after the lids had been packed so that the oil could not splash out. The transformers reached their destination after midnight, and the next day, December 31st, they were connected to the transmission line for a few moments to see that the latter was all right, after which all the lights on the circuit were thrown on for the night.

When the new transformers arrived they were set up and heated in the same way as the others. The heating was continued night and day until complete, without interrupting the regular lighting service. The change of both circuits to 10,000 volts was made February 16th, 1893.

The sub-stations at Pomona and San Bernardino are small brick buildings, one story high, with flat tin roofs and numerous windows. The Pomona building contains two rooms connected by a door near the switchboard. The front room is used as the office of the company, and the other as a transformer room. The 10,000 volt circuit enters over the door, and is connected directly to the bank of lowering transformers, no switches or other appliances being used on the high tension lines either there or at San Bernardino. The switchboard appliances are a Stillwell regulator, two 100-amp. marble fuse-blocks with double plugs and fuses, 100-amp. jawswitch, 150-amp. ammeter, compensating voltmeter, compensator and converter.

The San Bernardino sub-station is longer than that at Pomona, and is not divided by a wall. The transformers are placed in a row along a side wall and along part of the end wall next the switchboard. The transformers near the switchboard heat the most. This is probably due to the slight drop in wiring between them and the more distant converters. During the first year of operation a little new oil was put into the converters about every four months to make up for that evaporated, but none of the old oil was drawn off. The switchboard apparatus is like that at Pomona.

The Stillwell regulator has long been recognized as a valuable adjunct to the central station operating a number of feeders of different lengths from a single dynamo. Its utility is still greater in a system of long-distance transmission in which the transmission circuits are supplied from one dynamo, as was the case in this plant during its first year of operation, since it is not practicable to install such a system as to operate with small line-loss, and therefore means must be provided to compensate for the large differences in the pressure at the ends of the lines. The use of regulators at the power-house was impossible when but one bank of raising transformers was used for the two circuits. Even when it became possible by the use of separate banks of transformers, it was still undesirable because the attendant at the power-house would often have had to work both the regulators at once to properly compensate for changes in load, and his attention would have been required by the regulators at exactly the time he should have been free to attend to the generators. A regulator was therefore placed at each sub station, as already stated. These are each of 2,000 lights capacity and have a range of 10 per cent. up and 10 per cent. down. This variation of 10 per cent. (100 volts) is divided into 14 equal parts, so that each step corresponds to 7.1 volts. The diagram (Fig. 5) was taken one Sunday, while using only 5,000 volts, and shows the number of changes required during the evening at each station. The line marked "off" is the base line, and the divisions above and below correspond to the steps on the dial and show to what an extent the regulators were used to increase or decrease the pressure. This diagram shows how impossible it would be to furnish lights without using regulators, even on Sunday, when the load is much smaller than on other days. It also shows that on that day the pressure at Pomona was being mostly reduced while that at San Bernardino at times (as at the point marked "very bad light") could not be sufficiently increased. This indicates that the pressure of the lowering transformers at one of the sub-stations should be changed so as to make the pressure at both more nearly equal. In the present plant this is done by changing the number of transformers.

The distribution from both sub-stations is effected in the usual manner at 1,000 volts for incandescent lighting, the only point of interest being that a considerable number of Helios arc lamps are successfully used on the incandescent circuits.

While in use the transformers in the sub-stations give forth a continuous hum which depends for its tone on the number of alternations. This is an excellent indicator for the attendant, whose attention is instantly called to any change in the running conditions of the plant by the resulting change of tone. Its indications not only mark changes which are taking place and which can be detected on the voltmeter, but also give notice of coming changes before there is any other indication of them. It is thus possible to foretell a coming drop in voltage in time to use the regulator and thus keep the voltmeter needle perfectly still, though the voltmeter is a very sensitive instrument and the regulator is often moved four or five notches. The hum often changes, however, without any corresponding movement of the voltmeter, but the sound is then somewhat different. At rare intervals the switchboard lights will suddenly change slightly in candlepower before any change is noticeable on the voltmeter.

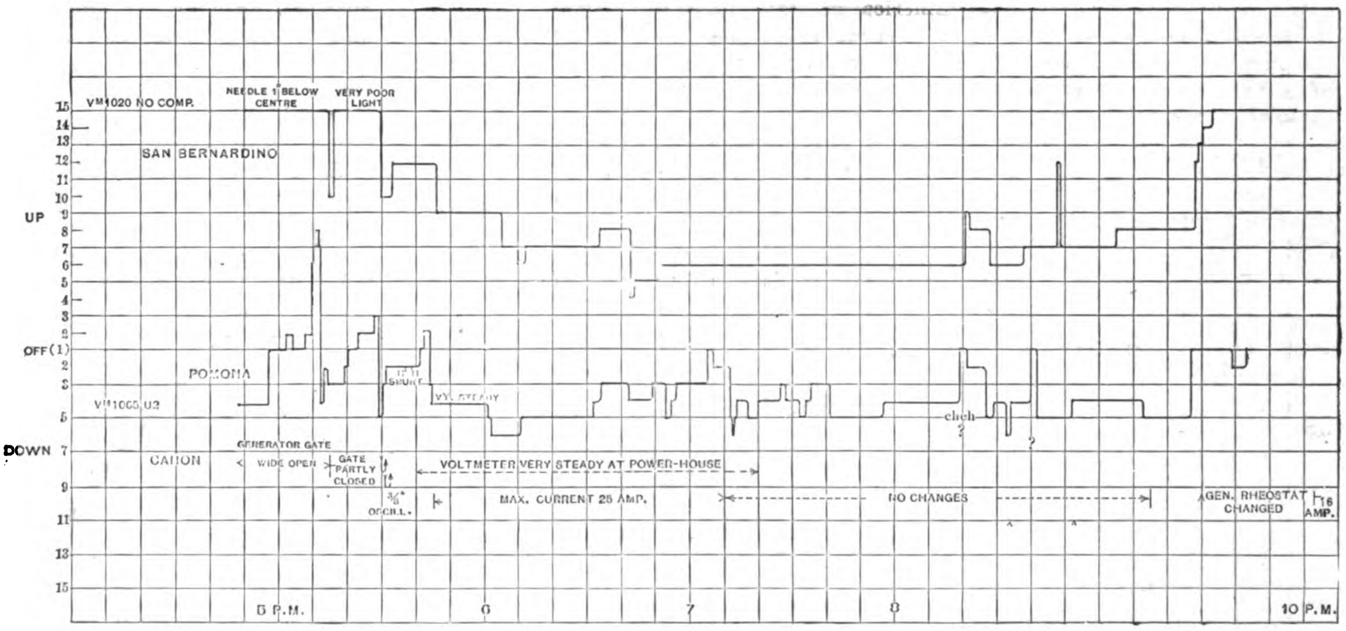

FIG. 5.—Record of Sunday, January 22, 1893, for Pomona, San Bernardino and Canon.

It is noticeable that the needle will often stand for a time perfectly still on the center, and, on a slight rise in the hum, will start gently, rising never more than three-quarters of an inch, and then as the tone gradually becomes lower, slowly fall back to the center, and stop without passing it. At other times the variation in hum is more sudden and the needle will rise and oscillate above the center. Again, the needle will oscillate equally about the center during a regular rise and fall of hum, its movement being apparently due to one impulse and not seeming to be modified by subsequent variations. There is no apparent change in candle-power of the lamps during the voltmeter changes noted. These notes were made while the plant was running at only 5,000 volts, but they were later confirmed when using 10,000 volts. During dry weather there is considerable intermittent oscillation of the voltmeter-needle without there being any change in load or any other apparent cause, while in wet weather the needle remains perfectly still for many minutes at a time, often for as much as half an hour. A possible explanation of this oscillation may be found in the presence of static charges on the line, due to atmospheric electricity. That the line is often heavily charged from the air is shown by a number of observations. One afternoon a painful shock was obtained on touching the line at the canon end, drifting clouds and a strong wind being noticed in the valley. Again, while using the telephone a report was heard in it so sharp as to cause momentary deafness. Later, after a moderate wind had been blowing for some time, loud reports were noticed on the telephone at long intervals. As the wind became higher the reports came oftener, and the intervals between the reports became shorter. It was evident that there was a discharge from the lines through the telephone (which was on a metallic circuit) and that it depended on the rate at which the wind blew. In order to get the strongest effect the two wires were connected in the usual way to the raising and lowering transformers, and one side of the telephone connected to one wire. On connecting the other side of the telephone to ground a sharp report was heard, and on maintaining the connection there was a sound as of steam escaping at a distance, with intermittent and very faint crackling. If the ground contact was made slowly there was a bright spark before the metals touched, and a loud report. If the fingers were interposed a smart shock was received. By making and breaking the ground connection rapidly, the line was prevented from accumulating a heavy charge, and no spark was visible, though a faint crack was heard. If a slight space was left between the telephone wire and the ground, a spark occurred at fairly regular intervals, and when the space was lessened the sparks became smaller and more frequent. When the wind lessened the sparks and reports became almost imperceptible, but on the wind becoming strong and blustery a large spark was again obtained. When one line wire was disconnected from the transformers at Pomona the effect obtained from grounding that wire was less owing to the reduction in capacity.

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*A paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

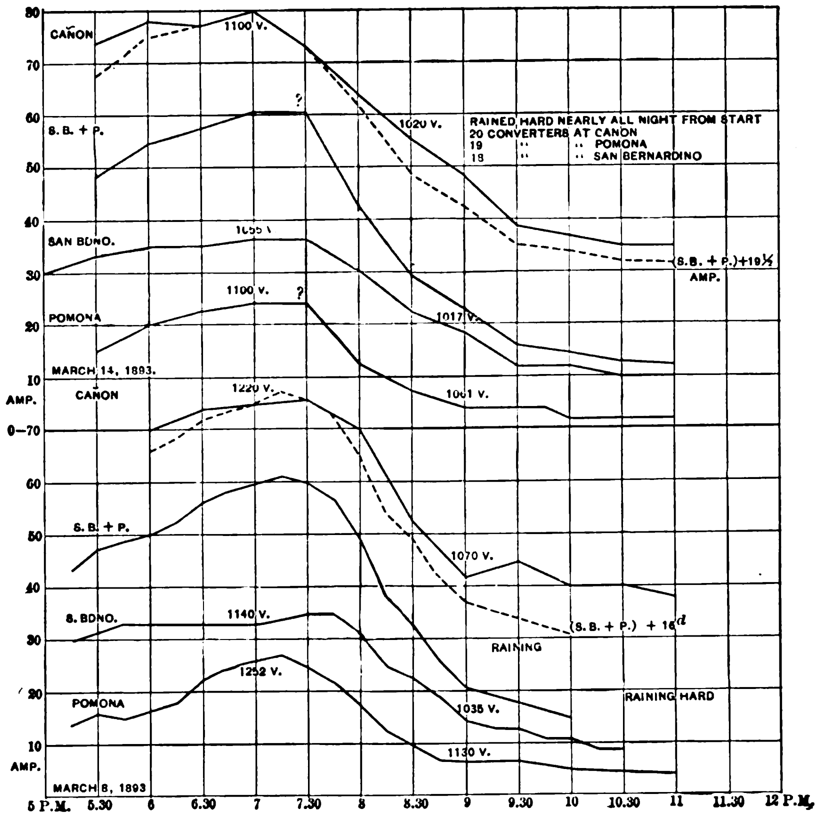


FIG. 6.—Ampere Curves. Showing Excess of Canon Load and also Decrease in Difference between Canon Load and the sum of Pomona and San Bernardino Loads as the Canon Load Increases. Note increase due to rain. Raining in afternoon and nearly all night at Pomona. Snowing throughout canon and a mile or so outside of mouth of canon. Eight inches of snow at power-house, covering insulators and cross-arms completely. One inch of snow on wires. Snow damp and clinging. No wind. Twenty conductors at canon, 19 at Pomona and San Bernardino. 12 P. M.

These observations, which were made on the Pomona circuit during hot, dry and cloudless weather, show conclusively that the lines were heavily charged by the action of the wind. The wind no doubt blows electrified air and dust against the wires, the latter thereby accumulating a static charge with a rapidity which we have seen depended on the speed of the wind.

Some curious conditions met with in the operation of the plant are shown in the ampere curves in Fig. 6, which were taken during very wet weather. Taking the maximum load measurements at 7 P. M. for March 14 and 8, we note that the total apparent energy delivered by the sub-stations is 73 per cent. and 75 per cent., respectively, of that delivered by the generator, while for a smaller load at 9 P. M. the respective percentages decrease to 47.6 per cent. and 48.6 per cent. in spite of the fact that the apparent energy delivered by the generator is in the latter case only half as great as in the former. These results are due to changes in the angle of lag caused by changing the load.

In the canon curve of March 8th, the load at 9.30 P. M is seen to have increased considerably, although the sub-station loads were decreasing. This increase was due to the fact that the rain, which had previously ceased to fall at Pomona, began again.

The electrical resistance of the Pomona circuit is 74.9 ohms and that of San Bernardino 156.4 ohms at about 90 degrees F.

The insulation resistance of the circuits varies from far beyond the limits of an 11-megohm bridge in dry, hot summer weather to as low as 0.65 megohm during light rain. The latter value is that obtained with the two San Bernardino wires in series, and represents an insulation-resistance per mile of over 37 megohms. On a clear, sunny day the insulation-resistances of one Pomona wire and of one San Bernardino wire were respectively 11 megohms and 5½ megohms, which are in the exact relation which would be expected.

The lines cannot be tested for grounds or for continuity with a magneto bell, as their capacity is such that the bell will ring loudly when the wire is perfectly insulated and the circuit open. This capacity also prevents the use of the ordinary converter test for line leakage, as the lamp on the secondary will burn as though there were a ground even when the line is perfectly clear. By adding lamps, however, the light may be cut down until the last lamp added extinguishes them all. This would not occur if the light of the first lamp was due to a difference of potential on the primary caused by a ground, as then the added lamps would become as bright as the first.

The primary current is thus seen to be limited, and to be due to the capacity of the line. If the proper number of lamps has been added to just secure darkness when the line is known to be free from grounds the converter may be used to show grounds on that line, since the presence of a ground will cause all the lamps to brighten. The line test should only be made after ascertaining with one lamp that the generator is not grounded, as otherwise the leakage current for the greater number of lamps might burn the insulation of the generator.

(To be continued.)

BOOK REVIEWS.

AMERICAN ELECTRICAL CASES. Vol. III. Published by Matthew Bender, Albany, N. Y.

Three volumes of this excellent series have now appeared within less than a year. The third volume contains 110 cases, selected from those decided between July 1, 1889, and January 1, 1892. During this time many interesting questions arose which are discussed in these opinions. To illustrate this: Ten of them relate to the interference of stronger with weaker electrical currents, involving the questions of induction and conduction and the reciprocal rights and duties of different uses of electricity, while eighteen relate to the rights of owners of land abutting on highways as against electrical companies occupying the streets.

There are valuable notes upon these as well as upon other subjects. Indeed, the notes are a useful feature of the series, not so much, perhaps, on account of their length, although there are quite exhaustive ones upon prominent topics, as because they furnish cross references which greatly facilitate the use of the volume. Many cases not reprinted in full are also abstracted in notes.

We are especially pleased with the index, upon which much labor has evidently been bestowed, and with excellent result. It is a combination of index with digest, arranged with a view of showing at a glance what the volume contains upon any given topic. It could hardly be better in plan or execution. The importance of keeping in touch with the growth and development of the law of electricity can hardly be over-estimated and the lawyer in general practice desiring to keep abreast of the times cannot afford to be without the American Electrical Cases.

The mechanical work is fine. Paper, type and plate work are of the best, and the make-up is all that could be desired. In one particular we note an improvement. The two preceding volumes were rather bulky; in this, although it contains practically the same number of pages, the publisher has, by using an almost imperceptibly thinner paper, quite materially diminished the thickness of the whole book and improved its appearance.

The publisher of this series has performed a valuable service to the electrical public. It not only makes the work of the regular attorney much easier, but it will enable any corporation of intelligent men to inform themselves as to their rights in various circumstances as established by previous decisions. It should materially lessen litigation and is entitled to rank as a great educator.

We hope that before the work is completed Mr. Bender will add a volume covering the decisions in all American electrical patent cases. There is nothing of this kind in existence so far, and it ought to be a profitable addition to the series. It certainly should find a place in the library of every student of the art.

The set is bound in full sheep, and the practical work is of a much higher grade than one is accustomed to seeing in ordinary law books.

(Vol. I, 915 pages; Vol. II, 935 pages; Vol. III, 893 pages; $6 per volume.)

General News.

What is Going on in the Electrical World.

Granville, N. Y.—A new electric plant is to be established here. Address the village clerk for details.

Lanesboro, Pa.—Surveys are being made for the construction of an electric road between this place and Susquehanna.

Mt. Airy, O.—The construction of an electric railway from this place to Venice, a distance of 18 miles, is contemplated.

Old Orchard, Me.—The construction of an electric road between this place and Kennebunkport at an early day seems probable.

Montgomery, Ala.—The Montgomery Cotton Mills, Montgomery, Ala., wants an electric light plant of 200 sixteen candle-power lights.

Canton, Miss.—N. W. Latimer, city clerk, can furnish detailed information as to the new electric light and waterworks plant to be erected by this city.

Kalamazoo, Mich.—The electric light plant, recently bid in by Cahill & Tate, has been purchased by Col. G. Edwin Dunbar, who will run it himself.

Minneapolis, Minn.—A petition has been presented to the court asking that the Globe Electric Light and Power Company be dissolved.

New York.—The partnership of Noll & Sibley has been dissolved. The business will be conducted as heretofore under the name of C. C. Sibley & Co.

Ottawa, Can.—The Ottawa Improvement Company intends to build a dam at Chaudiere Rapids and use the water power obtainable there in producing electricity. Fully 10,000 horse power can be secured.

Bronson, Mich.—Messrs. Bond & Rheubottom, of Union City, have been granted a 15 year franchise to establish an electric light plant in Bronson. Work on the plant will begin immediately.

Colorado Springs, Col.—A company has been organized, to be called the Garden and Glen Electric Road, for the purpose of building an electric line to the Garden of the Gods, a distance of two miles. The right of way has been secured.

Newburg, N. Y.—One of the new double-decker trailers for the Newburg and Orange Lake electric road has been received by the company. It is much admired, and reflects credit on its makers, the J. G. Brill Company of Philadelphia.

Riverton, Pa.—The Cumberland Valley Traction Company has purchased the rights and franchises of the New Cumberland and Riverton Electric Company. This latter is the company that was chartered to build an electric road from New Cumberland to Riverton and Shiremanstown.

Auburn, N. Y.—The street railway that the Auburn Inter-Urban Electric Railroad Company proposes to build will be about twenty-five miles long, extending from the northerly end of Jackson street in Auburn to a point on the "island" at the foot of Owasco lake.

McKeesport, Pa.—An application is before the court for the building of a new road from McKeesport to Rostraver township, a distance of nine miles. If the action of the court is favorable, the McKeesport and Port Vue Traction Company will build an electric line along the new road.

Flushing, Mich.—Proposals will be received until August 20 by W. H. J. Martin, president of the village council of Flushing for waterworks and electric light machinery and construction. H. H. Humphrey, electrical and mechanical engineer, of Detroit, may be applied to for information.

Boston, Mass.—The Railroad Commissioners have issued an order making it imperative that all electrically operated street cars shall be heated by electricity; those now heated by stoves must adopt electrical heating as soon as the stoves are worn out. All new roads are required to put in electric heaters.

City of Mexico.—General John B. Frisbee, of this city, formerly of California, has just received a concession for an electric railway from Julipa on the Inter-Oceanic Railway to Coroba on the Vera Cruz Railway, passing through an extensive coffee and fruit country. This is the first electric railway projected in the republic of Mexico.

Atchison, Kan.—The Atchison Railway, Electric Light and Power Company has its new machinery in operation and it is giving the utmost satisfaction. The dynamo is of the Wood type compound alternating, of 3 000 lamp capacity, and was furnished by the Fort Wayne Electric Corporation. A 2,000-light dynamo and a 125-light arc machine will be added at once. In addition to this, one of the railway generators now furnishing power will be replaced by one of 260 horse power.

Richmond, Ind.—For some months a number of capitalists in Wayne, Fayette and Union counties have contemplated the construction of an electric railway to touch the principal points in the three counties, and now it is announced that the line is assured. It will be sixty-five miles long, and open up the finest section in the eastern part of the State. It is estimated that the cost of putting the line through complete to carry both passengers and freight will be $700,000. Motors of a powerful make will be used for the freight traffic.

Gorham, Me.—The Portland Extension Railroad Company has been organized for the purpose of building an electric road from the terminus of the Portland Railroad Company in Westbrook to Gorham. The directors of the new company are Wm. G. Davis, Wm. R. Wood and Charles F. Libby, of Portland; Edward A. Newman, of Deering, and Wm. Wheeler, of Brooklyn, N. Y. The company is separate and distinct from the Portland Railroad Company, and will build and operate its own track and its own rolling stock, but will lease power of the Portland Railroad Company.

Savannah, Ga.—The bondholders of the Savannah and Atlantic Railroad, better known as the Tybee Railroad, have refused to accept the plan of reorganization proposed by the committee of the Central Railroad Company. It is the idea of the committee representing the bondholders, when they secure possession of the property (which was transferred to the Central Company on guarantees that have not been fulfilled), to make such improvements in the road bed and superstructures as will secure them against damage by storms, and to equip the line for electric cars

Detroit, Mich.—The Michigan Electric Company of Detroit has recently completed an arrangement with the General Electric Company and the Edison Illuminating Company, of Detroit, covering the selling agency of General Electric machinery and supplies in Michigan, and consequently the General Electric Company will at once close the office they have maintained in Detroit. This arrangement covers the entire line of General Electric manufactures, including lighting generators, motors, incandescent lamps, and all their various lines of machinery and supplies.

Harrisburg, Pa.—It is announced that a charter has been granted by the State department to the Gettysburg, Baltimore & Washington Railroad Company, with a capital stock of $750,000. The line is to run from Cemetery Hill, near Gettysburg, to Biddle's Mills, at or near the Maryland State line, with branch connecting with the Round Top extension of the Gettysburg and Harrisburg near the Little Round Top. It will be some thirteen miles long. E. M. Hoffer, of Hummelstown, president of the Gettysburg Railway Company, is the principal stockholder and president of the new company.

Philadelphia.—The stockholders of the street railway companies that were recently consolidated are sending in their acceptances by the thousands. The officials of the roads say that not a dissenting voice has yet been heard.—The Gerson Electrical Manufacturing Company, of Philadelphia, has filed an assignment to Geo. W. Wilgers.—Draughtsmen at the Baldwin Locomotive Works have been busy lately working up plans for the trucks to be placed upon the new type of electric locomotive which the Baldwin Westinghouse combination intend producing. It is probable that the completed locomotive will be ready for inspection in about three weeks.

Chicago, Ill.—The *Times* says: "Suburban residents along the lines of the Chicago and Northern Pacific and the Chicago, Burlington and Quincy railroads will soon be able to ride to and from the city on swift-running electric trains. The Northern Pacific is about to substitute electricity for steam on its line, and a new corporation is planning an extensive system of trolley lines along the Burlington to reach the towns of La Grange, Grossdale, Austin, Ridgeland, Oak Park and Lyons. The improvement proposed by the Northern Pacific contemplates the use of electric power instead of steam over its entire system, and is regarded by railroad men as one of the most important departures of years."

Niagara Falls, N. Y.—George M. Johnson of Buffalo, who is interested in a current water motor patented by William H. Britton, also of Buffalo, has been trying to interest local capitalists in another power scheme. Mr. Johnson states that the Niagara Falls and Lewiston Railroad people are considering putting in the motors along the line of the lower river and generating electricity by means of them for the propulsion of their cars. Mr. Johnson claims that electric energy can be generated by means of the motors and sold at Niagara Falls at from $5 to $8 per horse power. He claims they can be used all along the upper river on both shores. Models are on exhibition here.

Spokane, Wash.—Albert E. Humphreys and Martin King have inserted a notice in the Spokane papers announcing their intention to form a company under the name of the "Trail Creek Tramway Company" (limited liability), for the purpose of building, constructing, equipping and operating a tramway commencing at a point on the west bank of the Columbia river at or near the mouth of Trail creek and running to the mineral claim Iron Horse, situated on Monte Cristo mountain, in the Trail creek mining division of the district of West Kootenay, and also a telephone and telegraph line in connection therewith, with power to build, construct, equip and operate branch lines to the Columbia, Kootenay, and any other mineral claims in the said Trail creek mining division.

Albany, N. Y.—The Superintendent of Public Works has given Mr. Frank W. Hawley permission to use the level of the Erie Canal between Buffalo and Tonawanda in experimenting with the Cooper & Hewitt system of propelling canal boats with electricity. The experiment will take place September 25. It will be witnessed by the State officers and expert electricians from various parts of the United States.—The State Board of Railroad Commissioners has granted the application of the Utica and Herkimer Street Railroad Company to build a branch. This was the first application made by a street railway under section 9 of the railroad laws, which prescribes that street railways in future must apply to the commissioners for permission to operate a new line or extend one.

Nevada City, Cal.—The Nevada County Electric Power Company, a new corporation, proposes to operate the machinery of the mines hereabout by electricity. Water power to energize the dynamos will be obtained by damming the south fork of the Yuba River and conducting the water by means of a flume to the electrical power house to be erected at a point about four miles from Nevada City, to which place, and thence to Grass Valley, current will be transmitted by wire. The contract for the electrical machinery for a preliminary plant, which includes two 450 H. P. generators, has been let to the Stanley Electric Company of Pittsfield, Mass. The system to be used will be the "two phase alternating." W. F. C. Hasson, Andrew H. Hunt and W. R. Eckart are the contracting engineers.

Washington, D. C.—Work on the Washington and Great Falls Electric Railway is being pushed by the contractors, who hope to have the line ready for traffic by the end of the present month. The route chosen for the road is one of much scenic beauty, and among other attractions along the line will be the National Forum of Glen Echo and its Chautauquan amphitheatre, built to accommodate 10,000 persons, which, besides its lectures, musicales and didactic entertainments, can be made available for conventions, festivals and other things promotive of patronage.—The Rock Creek (Chevy Chase) Electric Railway Company has made a deal with the Washington and Georgetown Railway Company by which both companies will operate as one under the name of the Capital Traction Company.

"Two to Fifteen Days' Pleasure Tours."

(No. 8 of the "4-Track Series.")

This is a beautiful little book of sixty-four pages, narrow octavo, printed in two colors, issued by the Passenger Department of the New York Central, from the press of the Matthews-Northrup Company Complete Art Printing Works, Buffalo, N. Y.

It describes a series of tours occupying from two to fifteen days, arranged for the purpose of meeting the wishes of all classes of travellers, including trips to the Thousand Islands, Montreal, Saratoga, Lake George, the Catskill Mountains, Niagara Falls, Chautauqua, Adirondack Mountains, Berkshire Hills, Richfield Springs and many other famous resorts. Information concerning these trips is given—distances, time, fares, connections and all other details—with much precision. It contains ten maps engraved expressly for this work, and is profusely illustrated with a large number of new and beautiful half-tone engravings. A glance over this little book will convince you that the attractions of the New York Central are equaled only by their merit, and afford a choice which will suit every taste and every purse.

"Two to Fifteen Days' Pleasure Tours" will be sent free, post-paid, to any address in the world, on receipt of two 2-cent stamps, by George H. Daniels, General Passenger Agent, New York Central and Hudson River Railroad, Grand Central Station, New York.

COMMERCIAL PARAGRAPHS.

R. D. Nuttall Company, Allegheny, Pa., manufacturers of the Nuttall Trolley and other well known street railway specialties and supplies, have to run their factory double time to keep up with orders.

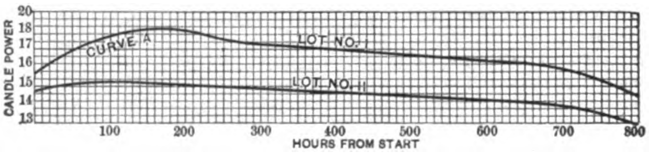
In order to give the business his personal attention Mr. W. D. Packard has assumed the general managership of the Packard Electric Company's plant at St. Catharines, Ontario. The factory has been equipped throughout with new and improved machinery, and is now in full operation manufacturing the well-known Packard lamps and transformers.

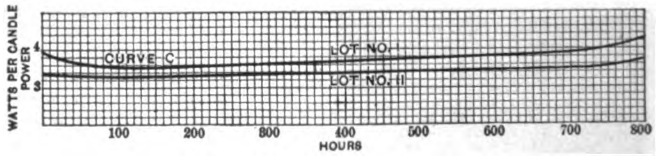
Some Recent Lamp Tests.

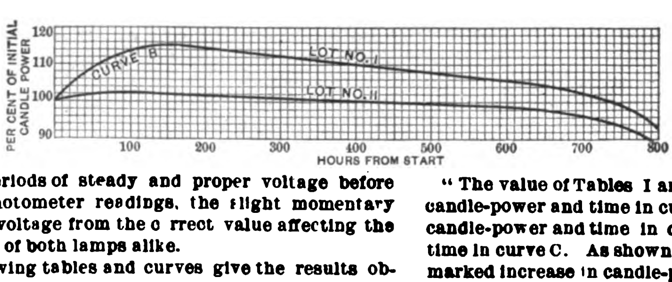
The following extracts are taken from the report of Prof. B. F. Thomas of the Ohio State University, Columbus, O., who recently completed a very interesting test of a make of incandescent lamps for which some very remarkable claims have been put forth as to the maintenance of candle power, increase (instead of decrease) in the efficiency of the filament during burning, etc.:

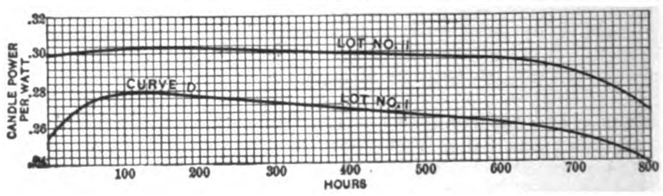
"Weston instruments were used for the current strength and voltage. For candle-power readings, a Sumner-Brodhun sighting box was adapted to an accurately graduated portable photometer bar, .00 inches long. The lamp under test was placed at one end of the bar, and a 100-volt 16 candle-power lamp, which had been used some time, was placed at the other end and served as a working standard. One hundred lamps, labeled '16 C. P., 100 volts,' were obtained for this test. They were about equally divided in two lots, having distinguishing marks inside the bulbs. Twenty-five lamps were taken at random from each lot for test. The mains from the station circuit were kept at as nearly constant potential as possible by an attendant at the switchboard, but the running of a motor on the circuit caused momentary abnormal changes in voltage. No attempt was made to secure unusual constancy for the reason that the circuit arrangement used enabled us to work the lamps under the conditions ordinarily existing in central station practice. The results may therefore be considered as a better indication of what lamp users may reasonably expect from similar lamps than if the lamps had been run at an unvarying voltage. From readings taken on different days, and at different times of day, the average voltage was about 99.

"The lamps under test, and the test lamp itself, were all in parallel, such arrangement making it unnecessary to wait for periods of steady and proper voltage before taking the photometer readings, the slight momentary variations of voltage from the correct value affecting the candle-power of both lamps alike.









"The following tables and curves give the results obtained. Tables I and II give for each of the lots 1 and 2 the number of lamps burning, the observed candle-power (average of each lot), and the average watts per lamp, at the several times at which readings were taken. From these readings the percentage of initial candle-power, the efficiency, and the candle-power per watt were computed and inserted in these tables:

TABLE I.

TEST OF PACKARD LAMPS, MAY, 1895.

Average of Lot No. 1.

Hours from start of test.	Number lamps burning.	Candle power.	Per cent. of initial candle power.	Watts per lamp.	Watts per candle power.	Candle power per watt.
0	25	15.54	100	61.60	3.96	.254
96	"	17.58	113.2	63.12	3 59	.270
144	"	17.84	115.0	63.62	3.57	.280
192	"	17.82	110.0	63.64	3 57	.280
252	"	17.53	113 0	63.55	3.63	.276
312	"	17.30	111.4	63.41	3.66	.273
360	24	17.04	110.0	63 20	3.70	.270
408	"	17.04	110.0	63.30	3.70	.270
480	"	6.68	107.5	63.00	3 78	.265
528	"	16.70	107.5	62.75	3 76	.266
600	"	16.35	105.3	62 64	3.83	.261
648	23	16.07	103.4	62.60	3.90	.256
696	22	15.83	102.0	62.60	3.95	.253
768	"	14.81	95.3	61.94	4.17	.240
812	"	4.50	93.3	61.51	4.24	.230

TABLE II.

Average of Lot No. 2.

Hours from start of test.	Number lamps burning.	Candle power.	Per cent. of initial candle power.	Watts per lamp.	Watts per candle power.	Candle power per watt.
0	25	14.77	100	49.60	3.36	.298
96	"	15.06	102	50.00	3 32	.301
144	"	15.13	102.5	50.23	3.32	.301
192	"	15.04	101.8	49.96	3.30	.303
252	"	14.96	101.2	50.10	3.35	.299
312	24	14.85	100.5	49.78	3.35	.299
360	"	14.82	100.3	49.75	3.36	.298
408	"	14.67	99.3	49.70	3.39	.295
480	"	14.65	99.3	49.52	3.39	.295
528	"	14.70	99.3	49.31	3.36	.298
600	"	14.50	98.2	49.33	3.40	.294
648	"	14 16	96.0	49.00	3 46	.289
696	"	13.87	94.0	48.93	3.53	.283
768	"	13.29	90.0	48.50	3.65	.274
812	"	12.97	88.0	48.26	3.72	.269

TABLE III (Lot 1)—*Economic Results.*

Hours from start.	Total candle power hours.	Total kilo-watt hours	Total cost of light.	Average cost in cents of 1 C. P. hour.
100	41.500	155.25	$36.05	.0869
200	89.950	314.00	67.80	.0754
300	133.570	472.80	99.56	.0744
400	175.530	628.0	130.60	.0744
500	216.4 0	779.3	160.86	.0743
600	256.090	929.9	190.93	.0746
700	292.100	1071.2	219.24	.0751
800	32 .5 0	1207.7	246.54	.0757

NOTE.—Cost of light based on an assumed price of 20 cents per lamp and 20 cents per kilowatt hour. Figures in last column obtained by dividing cost in fourth column by corresponding figures in second column.

TABLE IV (Lot 2)—*Economic Results.*

Hours from start.	Total candle power hours.	Total kilo-watt hours	Total cost of light.	Average cost in cents of 1 C. P. hour.
100	37.320	124.50	$29 90	.0801
200	75.0 0	249.90	54.98	.0733
300	112.370	374.80	79.96	.0712
400	147.940	494.20	103.84	.0702
500	188.220	613.20	127 64	.0677
600	218.170	731.70	151.34	.0694
700	252.130	844.40	174.88	.06936
800	284.360	966.10	198.22	.0697

NOTE.—Cost of light based on an assumed price of 20 cents per lamp and 20 cents per kilowatt hour. Figures in last column obtained by dividing cost of light in fourth column by corresponding figures in second column.

"The value of Tables I and II are plotted in terms of candle-power and time in curve A, of percentage of initial candle-power and time in curve B, and of efficiency and time in curve C. As shown by these curves, lot 1 shows a marked increase in candle-power on the start, reaching a maximum of 17.9 candles at about 175 hours, then decreases uniformly until 600 hours, when a more rapid decrease sets in. The candle-power does not fall to its initial value of 15.54 candles until over 700 hours from the start. Lot 2 shows only a moderate rise in candle-power with a maximum of about 150 hours, and then decreases uniformly to its initial value at 400 hours: curve C shows a marked increase in efficiency for lot 1 on the start, falling back to the initial value only after 600 hours. Lot 2 improves in efficiency also at the start, though to a smaller extent, and continues at a practically uniform figure for 600 hours. The decrease in efficiency for each lot after 600 hours is much less rapid than that usually met with.

"Tables III and IV give the total kilowatt hours spent on each lot of lamps and show the total cost of light and average cost in cents of one candle-power hour.

"It will be noticed that the breakage is remarkably small. No lamp of either lot showed any serious blackening, and the majority of the lamps were scarcely blackened at all."

The report ends by saying, that "taking economy, maintenance of candle-power and freedom from blackening into account, the results obtained are much superior to any heretofore published, and the New York and Ohio Company, of Warren, Ohio, whose lamp, the well-known 'Packard,' was used in this test, are to be congratulated upon their achievement in the manufacture of incandescent lamps."

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Atlantic City, N. J.—It is reported that C. A. Bradenburg, of Philadelphia is contemplating the erection of a hotel and theater building here to cost about $250,000.

Brooklyn, N. Y.—Plans have been prepared by Architect John Smith for a four story apartment house at 9.4 Bedford ave.

Cambridge, Pa.—A new hotel building is to be erected on Beach ave. at an estimated cost of $250,000; every modern improvement will be introduced; the structure will contain a theater, bath rooms, natatorium and a roof garden; it will be known as the Hotel Al Monte.

Chicago, Ill.—Plans have been prepared by J. D. Howath, Dearborn st., for a five story bank and hall to be erected for A. Kopperl, 569 South Canal st.; electric lighting and other improvements will be introduced... A six story factory is to be erected for M. D. Colfeen, Washington st., at a cost of $125,000; the specifications call for all modern improvements, including electric lighting.

Germantown, Pa.—A new residence is to be built for Mrs. W. Morris, at Overbrook, at an estimated cost of .40,0 0. The specifications call for every modern improvement.

Knoxville, Tenn.—A theatre building is to be erected for the Grand Opera House Co. at a cost of $60,000; the structure will be wired and fixtured throughout for electric lighting.

Lock Haven, Pa.—The opera house at this place is to be improved; a new electric lighting system will be introduced.

Rahway, N. J.—It is reported that a new electric lighting system is to be established here; address the clerk of the council.

St. Louis, Mo.—A fine edifice is to be erected for the Cumberland Presbyterian Church, after plans prepared by Architect Charles E. Ilsley; among the improvements introduced will be electric lighting....Plans have been prepared by J. L. Wees for a market and store building to be erected at a cost of $200,000; specifications call for passenger and freight elevators, steam heating, etc.

Tampa, Fla.—A new fire-proof hotel building is to be erected here by J. A. Wood and others at an estimated cost of $20 ,000.

Newark, N. J.—Architects McKim, Mead & White, of New York City, have prepared plans for a handsome residence for Robert W. Cumming, at 368 Mt. Prospect ave., this city; the structure will be provided with every modern improvement.

New York City. Architects Cady, Berg & See have completed plans for a new five story building to be erected in connection with the Museum of Natural History at a cost of $300,000; the structure will be equipped with the latest conveniences; a new electric plant will be installed.

to consist of a 150 horse-power engine and 100 K. W. dynamo ..Plans have been prepared by John G. Pangue for a seven story warehouse at 169 Mercer st.... Architects Clinton & Russell have prepared plans for 5 six story dwellings to be erected at 12- 0 West 55th st., for Wm. R. Montgomery, 2715 Creston av ..... A five story dwelling is to be built at 138 Waverley Place by Rev. G. P. O'Flynn; Architect George H. Stenton; the specifications call for the most modern improvements.... The club house at 111-119 East 58th st. is to be altered for the German Liederkranz Society; the plans call for the latest improvements.... Plans have been prepared by Architect Edward Wenz for 5 five story flat buildings to be erected on 102d st. for John Sturck & Co.; all modern improvements will be introduced.

Oquawka, Ill.—Plans and specifications have been prepared for the erection here of an opera house block by Wm. Wolf, of Galesburg.

Philadelphia, Pa.—Plans have been prepared by T. W. Roos, of New York, for a new ten story fire-proof building for the New York Mutual Life Insurance Co. at 1007-10 1 Chestnut st., at a cost of $800,000; the structure will be wired and fixtured throughout for electric lighting.

Providence, R. I.—The new club house which is to be erected for the Harbor View Club on Thames st. is to be wired and fixtured throughout for electric lighting; Architect Charles F. Chase prepared the plans; H. F. Minsher is secretary of the club.... Plans have been prepared for a four story brick and stone building on Mathewson st. by Benjamin D. Weeden; passenger elevators and all modern improvements will be introduced.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

AUGUST, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.40 P. M.	2	4.00 A. M.
2	......	..	....
3	12.40 A. M.	3	4.00 "
4	1.40 "	4	4.00 "
5	No light.	5	No light.
6	"	6	"
7	"	7	"
8	7.30 P. M.	8	9.30 P. M.
9	7.30 "	9	9.50 "
10	7.30 "	10	10.10 "
11	7.30 "	11	10.30 "
12	7.30 "	12	11.00 "
13	7.30 "	13	11.30 "
14	7.30 "	15	12.20 A. M.
15	7.30 "	16	1.00 "
16	7.30 "	17	1.10 "
17	7.30 "	18	2.10 "
18	7.30 "	19	3.30 "
19	7.20 "	20	4.30 "
20	7.20 "	21	4.30 "
21	7.20 "	22	4.30 "
22	7. 0 "	23	4.30 "
23	7.00 "	24	4.30 "
24	7.00 "	25	4.30 "
25	8.00 "	26	4.30 "
26	9.00 "	27	4.30 "
27	9.40 "	28	4.30 "
28	10.40 "	29	4.30 "
29	11.00 "	30	4.30 "
30	11.30 "	31	4.30 "
31	......	..	....

INCORPORATIONS.

The Central Light and Power Company, Montreal, Can.—to construct and maintain works for the manufacture of electrical machinery, apparatus, etc. Capital stock, $50,0 0. Incorporators: Richard White Edward H. Barker, Frank E. Kane and others.

The East Orange Electric Company, East Orange, N. J.—to establish and maintain electric plants for heat, light, power and telephone service. Capital stock, $150,0 0 Promoters: Roderick M. Sanger, Chas Jacobus, Alfred Lindsay, Montgomery Lindsay, East Orange; Wm. E. Runkle, Newark, N. J.

The New Bethlehem Electric Company, New Bethlehem, Pa.—to supply light, heat and power, etc, by means of electricity. Capital stock, $1,000. Promoters: John B. Thompson, Geo. L. Thomas, C. E. Andrews, W. M. Andrews, J. R. Foster, G. A. Berger, R. F. Mateer, F. L. Andrews, W. J. Mateer, S. Taylor Sheaffer, New Bethlehem.

The Fox River Development Company, Chicago, Ill.—to construct, operate and maintain water works, sewers, drains and electric light plants; lay water mains and supply pipes, and string electric light and power wires, etc. Capital stock, $100,000. Promoters: Preston W. Gray, John B. Ruhland, Thos. R. Cone.

The Kaweah Irrigation and Power Company, Visalia, Cal.—to acquire, buy and sell water and water rights; furnish power developed by water, electricity or other means; acquire, construct, operate and sell electrical railroads and electric plants; carry on a general manufacturing and merchandise business. Capital stock, $800,(00. Promoters: Elisha C. Ware, Chicago, Ill.; A. G. Wishon, Tulare; Geo. Hanna, John A. Pirtl, Los Angeles; O. C. Ainsworth, Pasadena, Cal.

The Homestead and Calhoun Park Street Railway Company, Homestead. Pa.—to engage in the conveyance of passengers by power other than locomotive Capital stock, $18,000 Promoters: Nathan H. West, Thos. L. Brierly, Geo. Gladden, Jas. B. Neel, Robt. M Elliott, John F. Milliken, Reid Kennedy, Joseph A. West, Homestead.

The Winchester Gas and Electric Light Company. Winchester, Mass.—to make and generate gas and electricity for lighting, heating, cooking, and furnish mechanical power. Capital stock, $50,000. Promoters: Lewis C. Pattee, president; David N. Skillings, treasurer; Hales W Suter, N. T. Apollonio, F. J. O'Hara.

The Salt Lake Citizens' Electric Light Company, Leadville, Col.—to construct and operate a system for furnishing light and heat, also power, in Lake County, Col., and Salt Lake County, Utah. Capital stock, $500,000. Promoters: Chas. Boettcher, John F. Campion, Geo. W. Trimble, Leadville.

The Island Pond Electric Light and Power Company, Island Pond, Vt—to acquire and own real estate, and conduct all transactions incident to a general electric lighting business. Capital stock, $10,000. Promoters: Geo. H. Fitzgerald, Z. M Mansur, H. E. Fitzgerald, L. A. Cobb, E. W. Bartlett, Island Pond.

The Northern Electrical Manufacturing Company, Madison, Wis.—to manufacture motors, dynamos, generators, etc. Capital stock, $50,000. Promoters: D. C. Jackson, C. M. Conradson, V. O. Fox, W. F. Vilas, Madison.

The Highland Park Passenger Railway Company, Pittsburg, Pa.—to engage in the conveyance of passengers by electric power. Capital stock. (0.000. Promoters: Wm. B. Rhoads, Joshua Rhoads, Allegheny; O. S. Decker. Robt. S. Frazer, Pittsburg; W. C. O'Reilly.

The North Susquehanna Transit Company, Danville, Pa.—to engage in the conveyance of passengers by electric power. Capital stock, $135.00 . Promoters: E. S. Whitney, Robt. E. Wright, Allentown; Edward R. Spousler, J. M. Fitzgerald, Wilson M. Gearheart, Harrisburg; James Scarlett, R S. Ammerman, John K. Gerringer, Danville, Pa.

The Pine Plains Light Company—to supply gas and electricity in Pine Plains, Dutchess County, N. Y., and suburbs. Capital stock, $10,000. Directors: John R. Thompson and Newton Hebard, of Amenia; Frank Eno, Frederick Bostwick, W. Bostwick and Charles S. Wilbur, of Pine Plains.

The Burton Electric Company of California, San Francisco, Cal.—to supply electricity for the heating, forging, smelting, welding and working of metals, minerals, ores, chemicals and gases; deal in all kinds of electrical machinery and inventions, etc. Capital stock, $1,000,000. Promoters: Geo. C. Perkins, J. R. Kendall, Oakland; John C. Richards, N. A. Harris Geo. E. Davis, G. A. Warner, San Francisco; Geo. D. Burton, Boston, Mass.

The Newark Electric Developing Company, Newark, N. J.—to manufacture electric appliances and machinery and to sell the same. Capital stock, $100.000. Promoters: Augustus Demarest, Eugene Eagles, Chas H. Madison, James H. Reinhardt, Newark, N. J.

The Delaware County Gas Manufacturing Company, Camden, N. J.—to manufacture and construct machinery, works, etc., for heating, cooking or lighting, and supply gas, electricity, etc., for heating, cooking or lighting, etc. Capital stock, $150,0 0. Promoters: C. Hazletine Basshor, H. C. Turnbull, Jr., Baltimore, Md.; John W. Baker, John J. White, Chas. L. Lagen, Philadelphia; Lewis Starr, Woodbury, N. J.

The Elliott Magnetic Electric Company Chicago, Ill.—to manufacture and sell the Elliott magnetic electrical and mechanical appliances for railway and other purposes and sell the right to persons to manufacture and sell the said appliances Capital stock, $1,000,000. Promoters: Wm. R. Elliott, Isaac C. Robbins, Chas. A. Emmons.

The Connersville Electric Light Company, Connersville, Ind.—to manufacture and produce electricity for illuminating and motive power. Capital stock, $15,000. Promoters: Edward W. Ansted, Wm. Newkirk, John B. McFarlan, James N. Heron, Thos. Downs.

The Dayton Electric Fire Alarm Company, Dayton, Ohio—to manufacture all kinds of electrical apparatus, machinery and appliances. Capital stock, 10,000. Promoters: Elihu Thomson, Samuel G. Cain, Newton R. Bunker, Harvey Cortland, Albert Beebe.

The Seattle and Rainier Beach Railway Company, Seattle, Wash.—to improve and operate the Rainier Avenue electric lines, which they have purchased. Capital stock, $30,000. Incorporators: Herman Chapin, E. W. Andrews and Josiah Collins.

The Portchester, Rye, Harrison and White Plains Electric Railway Company has filed certificate of incorporation at Albany, N. Y.; the company was organized to build an operate and electric railway connecting the towns named in the title. Capital stock, $150,000. Directors J. W. Lounsbury, William Ryan, J. O. Merritt, H. M. Henderson, William L. Ward, J. W. McCarthy, of Portchester; Charles D. Haines, of Kinderhook; Ebenezer Bull, of Harrison, and Frank Schirmer and John O'Rourke of White Plains, N. Y.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 6, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

543,867. Construction and Operation of Electric Railways and Tramways. Isaac W. Heysinger, Philadelphia. Pa. Filed April 11, 1892.

544,037. Converter System for Electric Railways. Thomas Harper, New Brunswick, N J. Filed June 29, [illegible]894.

544 05[illegible]. Conduit System for Electric Railways. James Thomas and William R. Thomas, Catasauqua, Pa. Filed Dec. 6. 1894.

544,157. Trolley-Wheel. Jesse Conway, Baltimore, Md., assignor of five-eighths to James F. Morrison, same place. Filed Jan. 4. 1895.

544,198. Electric Railway. Francis Taylor, Charlotte, N. C., assignor of one-half to Irvin W. Durham, same place. Filed Nov. 30, 1894.

544,209. Electric Railway and Tramway. Jean Claret, Lyons and Olivier Wuilleumier. Clermont-Ferrand, France. Filed July 25, 1893.

ELECTRIC LIGHTS AND APPLIANCES.

543,[illegible]92. Method of and Means for Extinguishing Electric-Arcs. William B. Potter, Schenectady. N. Y., assignor. by mesne assignments, to the General Electric Company, same place. Filed Nov. 30, 1894.

543,900. Electric-Arc Lamp. Charles E. Scribner, Chicago, Ill, assignor to the Western Electric Company, same place. Filed March 12, 1891

543,[illegible]65. Incandescent Conductor for Electric Lamps. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Aug. 7, 1882.

543,98[illegible]. Filament for Incandescent Lamps. Thomas A. Edison, Menlo Park. N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Oct. 20, 1882.

544,034. Electric-Lighting System. Edward F. Gavin, New York, N. Y. Filed Sept. 28, 1894.

544,0[illegible]6. Electric-Arc Lamp. John A. Mosher, Chicago, Ill. Filed May 11, 1895.

DYNAMO ELECTRIC MACHINERY.

543,836. Alternating-Current Motor. Engelbert Arnold Zurich. Switzerland Filed Oct. 9, 1894.

543,89[illegible]. Construction of Armatures for Dynamo-Electric Machines. William B. Sayers, Bearsden, Scotland. Filed Aug 16, 1894

543,907. Controlling Phase Relations. Charles P. Steinmetz, Lynn, assignor to the General Electric Company, Boston. Mass. Filed Sept. 9, 1893.

543,9[illegible]0 System of Electric Distribution. Elihu Thomson, Swampscott, assignor to the General Electric Company, Boston, Mass. Filed June 28, 1894.

544,094. Automatic Cut-Out for Electrical Converters. William J. Greene, Cedar Rapids, Iowa. Filed May 9, 1895.

544,118. Safety Electric Motor. William R. Polk, Jr., Atlanta, Ga. Filed Feb. 20, 1894. Renewed Dec. 24, 1894.

544,236. Controlling-Switch for Electric Motors. William J. Pohlman, Woodbrook, assignor of one-half to J. Edgar [illegible]rrion, Baltimore, Md. Filed June 4, 1895

544,261. Alternating-Current Motor. Robert Lundell, Brooklyn N. Y. Filed Oct. 2[illegible], 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

543 843. Telephone. John S. Biggar, San Francisco, Cal. Filed Nov. 16, 1894.

543,901. Telephone-Exchange. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov [illegible]2, 1894.

543,902. Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill assignor to the Western Electric Company, same place. Filed Dec. 8, 1894.

543,984. System of Multiplex Telegraphy. Thomas B. Dixon, Henderson, Ky. Filed Oct. 19. 1894.

544,077. Coin Signal Apparatus for Telephone Pay-Stations. Samuel Alexander, Hartford, Conn. Filed Nov. 13. 1893.

BATTERIES.

543,885. Electric Battery. Robert McL. McDonald and Alexander McDonald, Dalmuir, Scotland. Filed Nov. 18, 1894.

543,981. Primary Battery. George H. Gardner, Boston, Mass. Filed July 5, 1894.

544,180. Machine for Making Battery-Plates. Thomas T. Lewis, Philadelphia, Pa Filed March 28, 1894.

MISCELLANEOUS.

543,8[illegible]5. Short-Circuiting Device for Stopping Dental Motors. Francis N. Denison, Toronto, Canada. Filed Oct. 9, 1894.

543,865. Electric Meter. Jesse Harris, Lynn, Mass. Filed Oct. 4, 1894.

543,879. Automatically-Operated Fire-Alarm. Frank K. Ludlow, Madisonville, Ohio. Filed Dec 18. 1894

543,919 Method of Connecting Ends of Electric Conductors. John T. Beswick, Brooklyn, assignor to the General Incandescent Arc-Light Company, New York, N. Y. Filed Feb. 9, 1895.

543,929. Electric Temperature-Controlling Device. Sven A. Ekehorn, Milwaukee, Wis. Filed May 1, 1894.

543,933. Electric Signal for Railway-Trains. John C. Henry. Westfield, N. J. Filed April 20 1895.

543,960. Electrical Conductor. Gorham Gray, Boston, Mass., assignor to the Spiral Wire Company, Portland, Me. Filed Dec. 14, 1894.

543,963. Rheostat-Controller. Clyde Landers, Tacoma, Wash Filed March 27, 1894.

543,965. Electrical High or Low Water Alarm. Bernard McCabe, Boston, Mass. Filed Dec. 15, 1894.

543,966. Circuit-Closer. William Nutt, Crawfordsville, Ind. Filed Nov. 6, 1894.

543,978. Electric Condenser Charles S. Bradley, Avon, N. Y. Filed May 11. 1895.

544,015. Temperature-Regulator. George H Underhill and Ernst Glantzberg. Boston, Mass.; said Glantzberg assignor to said Underhill. Filed Nov. 17, 1893.

544,0[illegible]7. Rheostat. William O Meissner. Chicago, Ill. Filed Nov. 20, 1893. Renewed Jan. 11, 18[illegible].

544,084. Fire-Alarm Signaling Apparatus. Gilman W. Brown, West Newbury, Mass., assignor of one-half to Haydn Brown, same place. Filed Sept. 1, 1892.

544,107. Magneto-Electric Bell. Leland Moore, Brooklyn, N. Y., assignor of one-half to John C. Reilly, same place. Filed April 11, 1895

544,123 Electric Signaling System. Charles A. Rolfe, Chicago, Ill. Filed Jan. 8, 1895.

THE TELEPHONE WORLD.

THE BATTLE BEGUN.

The Bell Company Brings Suit to Test the Validity of the Berliner Patent of 1891.

The first decisive step of the American Bell Telephone Company to establish its alleged rights under the Berliner microphone patent of 1891 was taken at Boston on the 6th inst., when papers were served upon the National Telephone Manufacturing Company of Boston in a suit for an order restraining the National Company from alleged infringement of this patent. A hearing is assigned before the United States Circuit Court for the first Tuesday of September. J. D. Leatherbee, treasurer of the National Company, announces that his company will make a vigorous defence.

The National Company are manufacturers of a line of telephone exchange apparatus of which the "National" Granular Carbon Transmitter is a part. It is this form of apparatus which the Bell Company alleges infringes the Berliner patent.

While the Berliner patent has figured in the courts before, the present suit against the National Company is the first instituted by the Bell Company. In the bill in equity brought before the United States Circuit Court of the Massachusetts District in 1894, praying for the repeal of the Berliner patent of November 17, 1891, the Government was the plaintiff. It is well remembered that Judge Carpenter decided that the complainant had made out the case and that the patent was void and should be delivered up for cancellation, but the United States Circuit Court of Appeals, upon the appeal of the Bell Company, reversed this decision.

The National Company is not a member of the Telephone Protective Association, nor has it become identified with the organization of the Eastern Association. At a meeting of the executive committee of the former association, held in Cleveland on the 9th inst., it was concluded to take no action in the suit further than to send an attorney to Boston to determine what measures should be adopted.

New Companies Incorporated.

The Grenada Telephone and Telegraph Company, Grenada, Miss.—Capital stock, $250,000. Incorporators: B. L. Roberts, Emile Levy and H. W. Latimer.

The Columbia Telephone Company, Columbia, S. C.—Capital stock, $5,000. Incorporators: W. Y. Abrahams, W. B. Lowrance, F. D. Kendall, A. R Stewart, R. G. Johnstone, T. J. Harper and J. B. Friday.

The Standard Telephone Company of Washington and Baltimore.—Capital stock, $140,000. Incorporators: John W. Woodland, Bruce B. Gootee, Gen. Felix Agnus, Wm. S. Thomas and Robert M. Galt, all of Baltimore.

The Hamilton, Hughes and Monroe Telephone Company, Hamilton, Ohio. Capital stock, $5,000. Incorporators: C. E. Griesmer, F. M. Hughes, A. E. Schenck L. C. Shafer, J. E. Hughes and D. S. Rose.

The Rockport Telephone Company, Rockport, Texas—Capital stock, $10,000. Incorporators; C. W. Boothe, H. W. Crouse and E. A. Stevens.

The American Telegraph Supply Company, Atlanta Ga.—to manufacture and deal in telegraph supplies. Capital stock, $ 50,000. Incorporators: D. M. Dunn, F. J. Hoyle and S. H. Howell.

Coming the Western Company's Way.

Among the recent contracts secured by the Western Telephone Construction Company, Chicago, are the following: The Ticonderoga Telephone Company, Ticonderoga, N. Y., complete exchange equipment; the Elgin City Railway Company, Elgin, Ill., private system; the Altoona Phœnix Telephone Company, Altoona, Pa., complete exchange; the Wapokoneta Telephone Company, Wapokoneta, O., complete exchange; the Lansing Telephone Exchange Company, Lansing, Mich., 400 subscriber exchange complete; Barnesville, Ohio, complete exchange apparatus.

The Gerson Company Assigns.

The Gerson Electrical Manufacturing Company of Philadelphia, makers of the "Gerson" telephone and accessory apparatus, filed a deed of assignment on the 7th inst. to George W. Wilgus. The deed is dated July 15 and conveys no real estate. A schedule of the assets and liabilities has not yet been given out.

Milde Will Defend.

The Standard Telephone and Electric Company of Madison, Wis., which controls the Milde microphone patents in the United States, has received advices from Ch. Milde, of Paris, the inventor, that his patents will be defended against all claims for alleged infringement. Milde asserts that his microphone is non-infringing and will not be affected by the Berliner decision. He says:

"The principle of microphony is of course the same in our microphone as in every other microphone. But a principle cannot be patented, and such principle was known long before Berliner ever thought of making a microphone."

To Complete the Organization.

The representatives of the independent telephone companies comprising the Eastern Protective Association will meet in New York on August 15, to complete the work of organization and to map out a plan of campaign.

Resists the Tax.

The Western Union Telegraph Company has refused to pay the recently imposed tax of $20 for each telegraphic instrument in use in the State of Montana. Suit has been brought at Helena to test the law.

Some time since the New York and New Jersey Telephone Company secured a temporary injunction against the Elizabeth Mutual Telephone Company, Elizabeth, N. J., on the ground that it had not been organized under the State law governing such companies. The only alternative was for the company to reorganize, which was done a few days ago by the election of William H. Rankin as president, Peter Egenolf vice-president, Charles N. Trumble secretary, and Robert W. Waterbury treasurer. The new company will push the construction of its plant. A sharp cut in rates can be looked for when the new company gets its line in operation, which it expects to accomplish before October 1.

The Central Telephone Company has notified its local manager at Wabash, Ind., to reduce rates to subscribers below any rate which a rival company might make. The home company, composed of Wabash business men, will shortly open an exchange with 130 subscribers, and the Central Union people are determined, if possible, to drive it from the field. The home company rates are $2 and $1.50 a month, while the Central Union rates are $3 and $2. The Central Union has determined upon a bitter rate warfare, and within three months it is predicted will be furnishing service free.

In exchange for a franchise at Indianapolis, Ind., the Central Union Telephone Company offers to place wires underground and to establish and maintain, free of expense to the city, a new and modern police telephone system and to maintain the fire alarm telegraph. The Phœnix Telephone Company has also asked for local rights in that city, but the company has not yet organized so that it can enter into a contract with the city.

The Norristown and Philadelphia Telephone and Telegraph Company, in exchange for permission to construct a telephone line in Norristown, Pa., using the underground system, offers to pave all streets in which conduits are laid, to supply free phones for all borough offices and fire engine houses and pay to the borough annually 2½ per cent. of its net income.

O. D. Hardy, president; George Cockburn, vice-president; Jacob Stahl, treasurer; D. A. Reynolds, secretary and general manager; Walter Pratt, superintendent of construction, are the officers of the Lansing Telephone Company, organized at Lansing, Mich., with a capital of $25,000. The company proposes to commence business within sixty days.

The Jacksonville Telephone Company, Jacksonville, Fla., is to be incorporated with a capital of $30,000. M. B. Rice and W. M. Shine, of Tallahassee, and A. H. King, of Jacksonville, are the promoters. The company proposes to furnish telephones for $30 and $20 per annum. The canvassers have secured several hundred subscribers.

James F. Burns and others of Colorado Springs, Col., have filed articles of incorporation of the Colorado Automatic Telephone Company to operate the Strowger Automatic system in Colorado. The capital stock of the company is to be $500,000 and the principal office at Colorado Springs.

The Mutual Telephone Company, Petersburg, Va., will open its exchange in a few days with upwards of 300 subscribers. The Southern Bell Telephone Company has reduced its rates from $48 and $30 to $18 and $10 to meet the competition of the new company.

An ordinance has been submitted to the council of Terre Haute Ind., granting rights of way to the People's Telephone Company, which has been incorporated to do business in Edgar and Clark counties of Illinois, and Vigo, Vermillion, Parke, Clay and Sullivan counties of Indiana.

A movement is on foot to organize the Interstate Telephone Company at Trempealeau, Wis. The object is to span the Mississippi to the Minnesota side with a wire that will connect with the lines of the Northwestern Telephone Company now being constructed.

The Detroit Harrison Telephone Company, Detroit, Mich., has accepted all the provisions of the franchise granted by the city council except those relating to rates. The company will fix its own rates with subscribers.

The establishment of a long distance telephone line between Eufaula and Abbeville, Ala., may now be regarded as almost a certainty. As soon as a charter for the new company can be obtained a contract will be closed with a construction company.

The Chester and Philadelphia Telephone and Telegraph Company has asked for a franchise at Chester, Pa. The local Bell Company has taken no action yet on a petition of its subscribers to reduce rates one-half.

The officials of the Chesapeake and Potomac Telephone Company at Washington D. C., have declared the new telephones recently installed in the District offices in that city to be an infringement of the Berliner patent.

The Menominee Range Telephone Company, of Iron Mountain, is the first independent telephone company in the Upper Peninsula of Michigan. Subscribers are now being secured, and the exchange will be built at once.

Articles of incorporation of the Newark Telephone Company, Newark, N. J., have been filed. The company will do business in Newark, Hudson and Essex counties. Capital stock, $300,000.

The Tioga County Telephone Company, capital $2,500, and the Mt. Pleasant Mutual Telephone Company, capital $1,000, are two new Pennsylvania telephone companies.

J. G. McPhaul, a local capitalist of Sumner, Ga., is locating a telephone line from Poulan to Albany, by way of Tifton, Ga., the total length of which will be forty-one miles.

The Central District Printing and Telegraph Company, Pittsburg, will extend its telephone line from Uniontown, Pa., to Morgantown, W. Va., a distance of twenty-five miles.

The council of Haverhill, Mass., has rejected the proposal of the New England Telephone and Telegraph Company to place its wires underground in that city.

The Northwestern Telephone and Electric Company of Milwaukee will establish an exchange in Racine, Wis., if a franchise can be obtained.

The Saginaw Valley Mutual Telephone Company has asked for a franchise at Saginaw, Mich., proposing to give exchange service at $30 and $24 per annum.

A telephone company has been organized at Douglas, Mich., to connect Douglas, Saugatuck and Ganges with the outer world.

To meet the cut in rates made by the local company at Boone, Ia., the Iowa Union Telephone Company is giving free service.

The Berea, Kingston and Richmond Telephone Company has been organized at Berea, Ky., to construct a fifteen-mile line.

The Long Island line of the New York and New Jersey Telephone Company has been completed to Patchogue.

A telephone franchise has been granted by the council of Brazil, Ind., to F. C. Reagan and others of Lebanon, Ind.

J. H. Lovy can give information about the new telephone line to be constructed at Clarksville, Tenn.

A police signal telegraph system is to be installed at Greenville, N. J., at a cost of $8,50.

The Capital Telephone and Telegraph Company has been granted a franchise at Sacramento, Cal.

The construction of a telephone line from Brandonville, W. Va., to Somerfield, Pa., is contemplated.

A franchise has been granted to the Home Telephone Company, South Bend, Ind.

A telephone company has been organized at Lansing, Mich., with a capital of $30,000

The Postal Telegraph Company has been granted a franchise at Clinton, Ia.

A mutual telephone exchange company is to be organized at Staunton, Va.

Girard, Ohio, will soon have long distance telephone connection.

The telephone wires in Savannah, Ga., are to be placed underground.

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EDITORIAL NOTES.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

The Edison Licensees. The meeting of the Association of Edison Illuminating Companies at Detroit last week was tame and uneventful. On Monday, the day before the Convention proper, Mr. Coffin met with the executive committee, Beggs, Gilbert and Weeks (Marks and Stetson being absent), and had a genuine love-feast. When Mr. Beggs presented his report the next day to the association he said everything was settled, that all was amicable, every promise asked for had been made, that the interests of the parent company and the licensees were identical, and they were now working in perfect harmony.

Of course this latter statement is true as far as Beggs and Coffin are concerned. They have always worked in perfect harmony, and it was well known last year, when Mr. Beggs made his strong speech in Boston and was then appointed chairman of the executive committee, that the association had been duped. Beggs was just as certainly working for Coffin in Boston as he was a year earlier, or as he was at Detroit last week. The only technical paper of particular interest on the programme was not read—that of Mr. Emmet on alternating current work.

The attendance was small—not over half that of last year, the delegates themselves numbering no more than the salaried representatives of the General Electric Company present.

The experienced observer of affairs can come to but one conclusion. The association is on its last legs. We mean no disrespect to that body in saying this, as we have always been sympathizers with them in their unfortunate position. They paid millions for a patent right monopoly in their respective territories and they have not been without competition for a single day. Now every patent which they bought is absolutely valueless. True they have had some benefits in the way of low prices on apparatus, but that does not help them now, when the average price on all apparatus is one-half or one-third of what they paid.

Every Edison licensee station in America would be at the mercy of a new company starting to-day which could parallel their lines, equal and extend their service, with 40 per cent. of the investment.

No wonder that over one-half the licensees failed to waste car fare to attend this meeting. The General Electric Company no longer has the power to do them any good. Organization is futile.

While the larger stations, like Chicago, New York, Philadelphia, Boston and Brooklyn, may continue to send men once a year to hobnob with the General Electric agents, the rank and file will never return. They will not even pay their dues. They know that in every controversy the association has been beaten. They think, with some reason, that the affairs of the association have not been properly looked after. They can see that the interests of the parent company do not conflict seriously with those of the managers of the large stations mentioned, and that such men as Insull, Edgar, Marks, Beggs, and Gilbert, representing these large stations, are more likely to look out for No. 1. than to pay much attention to the interests of the stations in smaller towns—in other words the stations which care nothing about the Edison underground system.

The entire situation, broadly considered, only emphasizes the unprecedented mismanagement of the electric lighting business, and the manner in which bankers and speculators have bedeviled what should have been the grandest industry of the latter half of the 19th century.

* * *

A Great Engineering Feat. It is a popular way of stating a thing "largely" to say "it beats the world," and it has come to have an accepted meaning. But how shall we express ourselves when it is the World itself that is the hero of the feats that we would sing in song? To use a much quoted expression, "Echo answers, 'how?'" Well, the *Electrical World* is the hero whose trilbys we advert to now. Like the heroine of Du Maurier's great story, the *Electrical World* got there last week with both feet.

Here's one of them. In speaking of Mr. Pope's recent Institute paper on the reconstruction of an old electric lighting plant, and incidentally of the Pomona 10,000-volt transmission, it says editorially: "As a voltage of 10,000 has proved to be entirely practicable, a territory within a circle of 100 miles diameter can be as easily served from a central point as can one town from its own plant employing the usual voltage." Now that settles a much mooted question, and we are glad to have it settled. It is now decided by the wisdom of our contemporary that because an electric light transmission scheme has been extended to a distance of 28¾ miles, or in other words, because the use of 10,000 volts has been found practicable, therefore a circle having a diameter of 100 miles can be as easily served from a central point as can one town from its own plant.

This stated in the language of Euclid would be "The whole is not greater than any of its parts," but it must be remembered that the *Electrical World's* geometry is not Euclidian, for some months ago that oracle enunciated the fundamental proposition (to which this latter one is but a corollary) that "if our system of units were based on π, then the ratio of the circumference to the diameter of a circle would be unity."

Commenting upon this at a subsequent date, we gave as our conclusion that if this proposition were true then the circumference of a circle would be measured in square feet, its area in cubic feet, the area of a sphere in cubic feet and its volume in units of the fourth dimension. The diameter would also have to be expressed in terms of the circumference, viz., in square feet; so that if we had a wire extending from the center of this 100-mile diameter circle it would be 50 square miles long and the volume of the copper would be 50 miles to the fourth dimension and its cross section expressed in cubic mils.

Now according to the theory of the fourth dimensionists this additional dimension should enable us to put a large body inside of a smaller one, and to see from a single point of view all sides of a solid sphere (including the inside). Most of us do not carry this fourth dimension around with us in our vest pockets, so that there are several things which we cannot see or do. The *Electrical World*, however, breakfasts on π and carries the missing dimension in its hip pocket. It is therefore enabled to see clearly from a point of view in which we are blind. It readily sees how, since "a voltage of 10,000 has been proved to be entirely practicable, a territory within a circle of 100 miles diameter can be as easily served from a central point as can one town from its own plant."

This is one foot. The other, although not a mate, is "like unto the first."

On the next page, in describing the new system of canal-boat traction proposed by Frank W. Hawley, the *Electrical World* says: "In the car or traveler there will be a shaft, around which the *tower* (sic) will make three turns."

We suppose the word *tower* refers to the cable by which the canal-boat is towed and not to the small car which does the towing nor to the supporting tower by which the cables are held aloft. Our reason for discarding the second interpretation is the same that led Lord Dundreary to discard the idea that the expression "birds of a feather flock together" referred to a lot of birds having only one feather between them—it was absurd. We also think it is absurd to assume that the boats will be towed by the traveler or car turning around its shaft three times.

The only alternative left us is to suppose that the towing cable turns three times around the motor shaft and winds in one direction or the other as the motor goes forward or backward.

But assuming this to be the correct interpretation, will the *Electrical World* please tell us how they are going to keep the cable on the shaft? The latter must needs be of indefinite length else the cable will wind off the end. But a happy thought strikes us. We remember having heard of a Yankee invention which may possibly suggest a method. According to the story, owls have to crowd the chickens off the roost before they can catch them in their talons and fly off with them. All roosts are necessarily limited in length, so that no matter how long they are the owl can crowd the hen off the end if he only persevere. The Yankee solved the question by making the roost in the form of a closed circle (not the one with the peculiar relationship between circumference and diameter, but only just an everyday circle). The device was tried, and that night the inventor on going out to the henhouse found all the hens moving round and round on the roost, keeping rythmic side-step with the owl who was beginning to look discouraged.

We suppose the shaft upon which three bights of the towing cable are taken is a circular one and the cable as it winds or unwinds moves round and round as did the owl and the fowl.

Under the Searchlight.

Views and Opinions on Timely Topics.

THE PASSING OF THE BAD MAN.

The observant Western tourist of 1895, if he revisits the sections of the country which once had such a reputation for toughness, cannot fail to notice that the Bad Man is rapidly becoming extinct. The forces of civilization have become too strong for him. He no longer finds glory in terrorizing the community. When he talks too much he gets his face slapped, and if he pulls his gun or his knife nowadays he usually gets knocked down and then locked up. All this has been very discouraging to the men of the type of the Tearing Terror of Taos, and his species get rarer and rarer each year.

So it is in the electrical business. The Bad Man has had his day in robbery and bribery, and a good many of him are now getting their day in court according to the fundamental principle of English law.

For quite a period he was conspicuous; he accepted bribes openly, or gave them, as the case might be. He bought councils, purchasing agents, etc., with impunity. He took contracts away from legitimate competitors by the dozen score. He got to be a big man in his way. He wore diamonds, spent money freely, built rows of houses, gambled in stocks,—and the founder of the Bad Man school became president of the largest electrical corporation in the country.

But now all is changed. People no longer regard the Bad Man with feelings of admiration. His calling is gone, and grand juries and courts are wont to look upon him the same as upon any other criminal. He was all the time either a thief or a breeder of thieves, and it has taken but few years to end his career.

These remarks are called forth by two recent events—one the indictment of Maurice Hart at New Orleans, for perjury in connection with franchise matters; the other, the ousting of L. H. McIntire from his position with the People's Traction Company in Philadelphia, accompanied by suits brought by the company to recover various commissions paid to McIntire by different manufacturing companies—first of all, the General Electric Company.

A good many facts in regard to this latter matter are yet concealed, but a few of them are on record in the archives of ELECTRICITY. When Mr. McIntire took his position as general manager, chief engineer and electrician of the Philadelphia company, he had already been with the Thomson-Houston Company, and had seen the workings of the science of "addition, subtraction and silence" as practised by his superiors from C. A. Coffin down. Almost the first purchases which were made in Philadelphia under his advice brought a test of his honesty which he could not stand. He accepted an honorarium for purchasing just what he would have bought in any event. From that time on his development as a striker was rapid. He learned a quick way to riches, and nearly every concern which expected to sell anything to that system had to pay a commission. Two exceptions are known to us. That of the J. G. Brill Company and that of Siemens & Halske. John Brill went before the directors of the company, protested, and refused to be blackmailed. At the directors' meeting referred to, when Mr. Brill protested against what may be called the "McIntire idea" of buying goods, Mr. McIntire got up before the board of directors of his own company, and stated that the J. G. Brill Company did not know how to build a good street-car or a good street-car truck, and Mr. Brill showed the board of directors conclusively what was the governing reason for Mr. McIntire's opinion. And on the Siemens & Halske generators hangs a story. They were the innocent immediate cause of the present trouble. When Mr. McIntire was away on his vacation, Mr. Shelmerdine, the president of the road, decided to make certain purchases. When McIntire returned he found that his victims had been frozen out, and therefore he had lost a chance to make money. He blamed E. D. Mullen, Philadelphia agent of the General Electric Company, for the occurrence. So when it came to the purchase of generators he swung the trade to Siemens & Halske, simply for spite, though of course the company got good value for their investment, and no commission was paid.

Then Mr. Mullen seems to have retaliated, and turned over to the company certain vouchers for large sums paid to McIntire previously as commissions. Most of the sales of the General Electric apparatus to the People's Traction Company were made through Capt. Eugene Griffin, O. T. Crosby and E. D. Mullen.

Two weeks ago Mr. McIntire had a secret meeting in Cleveland with General Electric officials. Mr. C. A. Coffin was in Cleveland about that time.

We cannot predict just who will be hurt the most in the disclosures to follow, and do not care to. The trade will be purified by it all, and we do not see how McIntire can be sent to prison unless those who paid him the money go too.

The briber is as bad as the man who accepts the bribe.

In the New Orleans case there are nine indictments against Hart, as follows:

A SYNOPSIS OF THE SPECIFICATIONS.

Indictment No. 1, for Perjury—That Maurice Hart falsely swore before the grand jury on July 26, 1895, that Bier had asked for four notes of $25,000 each, as an accommodation, so as to use the collaterals attached thereto, when, in truth and in fact, Hart well knew that the notes were paid over to Bier for the purpose of hiding from the public and the grand jury the fact that the profit of $100,000 derived by Bier from the sale of the franchises of the New Orleans City and Lake Railroad Company had been paid to Maurice J. Hart.

Indictment No. 2, for Perjury—That on July 31, 1895, Maurice J. Hart falsely swore before the grand jury that a check for $7,483.33 had been paid to Bier as interest on notes, when, in truth and in fact, the money was paid to Bier for the purpose of defraying the whole or part of the expenses incurred by Bier in his trial for perjury.

Indictment No. 3, for Perjury—That on the 26th of July, 1895, Hart swore before the grand jury that he did not have in his possession Bier's ledger, when, in truth and in fact, he had possession and control of the book.

Indictment No. 4, for Perjury—That on the 8th of August, 1895, Maurice Hart falsely swore before the grand jury that a certain note for $25,000 had not been extended, when, in truth and in fact, he well knew that the note was extended sixty days from August 22, 1894, and that interest on the same was paid.

Indictment No. 5, for Perjury—That Maurice J. Hart on the 26th of July, 1893, falsely swore before the grand jury that Bier had made the purchase of the franchises on his own account, and that the loan to Bier of $50,000 by the Louisiana National Bank was not on securities furnished by Hart, when in truth and in fact, Hart well knew that Bier was acting as agent of the traction company and of Hart in purchasing the extended franchises; and that Hart also knew that if the traction company had not taken the franchises off Bier's hands Bier would not have been obliged to keep them.

Indictment No. 6, for Subornation of Perjury—That Hart instigated and suborned Bier to testify as he did in the suit of S. D. Peters et al. vs. the city of New Orleans, in the Civil District Court, which false testimony caused the indictment, trial and conviction of Bier for perjury.

Indictment No. 7, for Obtaining Money by False Pretences—That on November 22, 1893, Hart obtained feloniously and by conspiracy, through Henry Bier, from the traction company the sum of $100,000, part of the $800,000 to be paid by the traction company for the transfer of the extension of the New Orleans City and Lake Railroad privileges, and that of the sum of $100,000 Bier only got $15.000 from Hart as his share.

Indictment No. 8, for Obtaining Money, etc.—That on the 12th of November, 1893, Hart caused to be delivered by the traction company to Bier, through fraud and collusion, $72,000 in face value of the first mortgage bonds of the Crescent City Railroad Company as the 10 per cent. commission claimed by Bier for his transfer of the franchises to the traction company for the sum of $800,000.

Indictment No. 9, for Obtaining Money, etc.—That on January 5, 1894, Maurice Hart obtained through Bier, by fraud, conspiracy and collusion, from the traction company the sum of $5,080.55, because Bier falsely represented that he had been the bona fide purchaser of the franchises, and that sum of $5,080.55 was obtained as part of the interest on the sum of $800,000, the purchase price from the traction company of the extended franchises of the New Orleans City and Lake Railroad Company.

Mr. Henry Bier, who is now under sentence for perjury in this same case, has confessed, and it is upon his evidence chiefly that Hart is indicted.

Mr. Hart has been known for years as a Bad Man in his particular line—that of owning councils.

New Orleans is thoroughly stirred up, and the fact that Hart is wealthy and powerful is more likely to injure his case than to benefit him.

With two such cases in one month is it any wonder that the electrical Bad Man feels discouraged?

* * *

The Cotton States and International Exposition.

"At high noon on September 18," says the Atlanta *Constitution*, "in the presence of many thousand visitors and distinguished guests, the electric current will come bounding fresh from the hand of President Cleveland, and with a roar and a rumble the wheels will begin to revolve, and the Cotton States and International Exposition will be in full blast. As the current reaches the Exposition grounds a thousand flags will float to the breeze, engines will blow a long-continued whistle, thousands will wave their handkerchiefs, and with shouts and cheers the curtain will go up and the show will be on."

President Cleveland informed the committee that he could not possibly be present in person at the opening, and they have decided to have wires arranged so that by touching a button at Gray Gables Mr. Cleveland will start the Exposition machinery in motion.

* * *

WILL IT DISPLACE THE DYNAMO?

A Great Discovery.

(From the N. Y. Telegram.)

A lamp that will burn for 600 hours is the invention of George L. Roberts, an electrician, who sold to a tobacco company, for $80,000, the advertising rights of some of his electrical devices. The lamp of which Mr. Roberts is the inventor is charged with sand, into which two wires are run, which connect with one of the regulation bulbs used on all electric chandeliers. The battery is therefore the sand, but the method of charging it remains a secret with Mr. Roberts. Mr. Edison, after seeing Mr. Roberts's lamp, remarked that he thought he knew all there was to know about electricity, but Mr. Roberts had made a discovery which puzzled him greatly. Mr. Roberts presented Mr. Edison with some of this remarkable sand, but with no fear of having his secret discovered, for analysis happens in this case to kill all traces of the secret discovery.

Mr. Roberts made his discovery in Minneapolis in a purely accidental way. He was experimenting with acids in his laboratory and on the table was some sand over which two wires had fallen and crossed themselves. By an accident a bottle containing a certain acid was overturned and some of the acid ran into the sand at the point where the wires crossed. The result was a series of electric sparks.

At present Mr. Roberts is quite a sick man and is in Michigan for his health. Another of his inventions is to make seventy-two changes of color, in the hair, dress, tights, shoes, etc., of a dancer while she is in motion. The mechanism works by clockwork and the light gleams through the fabrics from a direct current. Mr. Roberts married a daughter of Pillsbury, the great Minneapolis miller.

We do not wonder much that Mr. Roberts is sick. He deserves to be, and we hope he will never get well enough to stuff another guileless reporter.

EDISON ILLUMINATING COMPANIES.

Proceedings of the Meeting at Detroit.

The Sixteenth Convention of the Association of Edison Illuminating Companies was held in Detroit August 13, 14 and 15.

The first session of the Convention was called to order August 13, at 10 A. M., by C. L. Edgar, president. The roll was called. Those present were:

J. W. Lieb, Jr., Asst. Gen. Mgr. Edison Ill. Co., New York.
W. S. Thompson, Inspector Detroit Edison Co., Detroit, Mich.
John I. Beggs, Vice-Pres. and Gen. Mgr. Cincinnati Edison Elect. Co.
Geo. A. Redman, Gen. Supt. Rochester Gas and Electric Co., Rochester.
Adolph Muller, Hagen, Germany.
A. M. Clark, Meter Dept., Detroit Edison Co.
W. S. Barstow, Gen. Supt. Edison Elect. Ill. Co., Brooklyn, N. Y.
Geo. Wiley, Detroit Edison Co.
Daniel McCoy, Pres. Edison Light Co., Grand Rapids, Mich.
Geo. W. Cato, Electrician Detroit Edison Co.
A. F. Walker, Supt. Edison Electric Co., Grand Rapids, Mich.
Sam'l Scovil, Vice-Pres. Cleveland Elect. Ill. Co., Cleveland, O.
Winfield S. Jewell, Gen. Mgr. Toledo Electric Co.
Geo. Peck, Pres. Detroit Edison Co.
Hoyt Post, Attorney Detroit Co.
C. L. Edgar, Vice-Pres. and Gen. Mgr. Edison Ill. Co., Boston.
Arthur Williams, Gen. Inspector Edison Elect. Ill. Co., New York.
B. E. Sunny, Gen. Electric Co., Chicago, Ill.
J. R. Lovejoy, Gen. Electric Co., Schenectady, N. Y.
Luther Stieringer, New York.
Robt. Lindsay, Gen. Supt. Cleveland Elect. Ill. Co.
S. D. Greene, Gen. Mgr. Light Dept. General Electric Co,
H. T. Edgar, Gen. Mgr. Edison Ill. Co., Atlanta, Ga.
A. D. Page, General Electric Co.
C. P. Gilbert, Gen. Mgr. Detroit Edison Co.
Caryl D. Haskins, Meter Dept. General Electric Co.
J. S. Crider, Edison Electric Ill. Co., Cumberland, Md.
Sam'l Insull, Pres. Chicago Edison Co., Chicago, Ill.
F. Sargent, Consulting Eng. Chicago Edison Co.
W. S. Andrews, General Electric Co.
M. A. Beal, Sec. and Treas. Forest Elect. Light and Power Co., Rockford.
Edwin R. Weeks, Gen. Mgr. Edison Elect. Light and Power Co., Kansas City.
Chas. R. Price, Treas. New Bedford Gas and Elect. Lt. Co.
A. W. Field, Sec. and Mgr. Columbus Edison Elect. Lt. Co.
Geo. R. Stetson, Pres. New Bedford Gas and Elect. Lt. Co.

After the roll-call the executive committee, represented by its chairman, Mr. John I. Beggs, made a report recommending the acceptance of the application of three companies for admission, viz., The Edison Light and Power Company, Pottsville, Pa.; the Toledo Electric Company, Toledo, O., and the Sault Ste. Marie Company, Sault Ste. Marie. The companies were admitted.

A report by A. E. Kennelly (for Committee on Lightning Protection, Grounding the Neutral in Three-wire Systems, Crosses with High Tension Systems) was submitted, accepted and committee discharged.

Addresses were then made by S. D. Greene of the General Electric Company, Mr. Insull of Chicago and Mr. Beggs of Cincinnati, on "The Relations of the General Electric Company to Edison Licensee Companies."

After considerable discussion, W. L. R. Emmet, of the General Electric Company, was called upon for a paper entitled "Some Comparison Between the Direct Current Low Tension System and the Alternating Current Multiphase System for Central Station Lighting." Mr. Emmet was unavoidably absent and his paper was ordered printed in the minutes. The session then adjourned.

The second session was held at 2 P. M. and the Storage Battery Committee made its report. Discussion followed. Mr. Muller of Hagen, Germany; C. L. Edgar and J. W. Lieb, Jr., gave their experiences. A paper by Messrs. Pierce and Hale was then read by C. L. Edgar of Boston. The title of the paper was "Energy Losses in the Boston Edison Stations." After discussion on this paper, the session adjourned.

The evening was given up to a car ride and visit to "Lallah Rookh" (by courtesy of the Detroit Edison Company).

SECOND DAY.

The third session was called to order at 10 A. M. August 14. A paper by W. S. Barstow on "Method of Charging for Current for Incandescent Lamps and Motors" provoked much discussion, and with Arthur Williams's paper, "Relation of Company to Customer," occupied the entire morning. The session adjourned at 1 P. M.

The fourth session opened with a discussion by Mr. Beggs, Mr. Greene and Mr. Howell on Incandescent Lamps, Welsbach Light and Acetylene Gas.

A paper by C. D. Haskins on "Facts in Relation to Mechanical Recording and Chemical Meters" was then read and discussion followed.

The evening was taken up by a drive and lunch on Belle Isle (by courtesy of Detroit Edison Company and General Electric Company).

THIRD DAY.

In accordance with past custom, the last day of the Convention, August 15, was given to entertainments. This took the form of a delightful sail along the river at the invitation of the Detroit Edison Company, who, together with the General Electric Company, received the thanks of the Convention for their past courtesies.

NOTES.

Among those present beside the delegates and representatives of the General Electric Company were Messrs. E. W. Little, of the Interior Conduit and Insulation Company; George McKinlock, of the Central Electric Company; P. H. Alexander, Electric Selector and Signal Company; B. F. Miles, National Carbon Company; John Crider, Washington Carbon Company; Bailey Whipple, Manhattan Electrical Company and representatives of ELECTRICITY, the *Electrical World* and *Electrical Engineer*.

Mr. Edison sent regrets for his inability to attend as he was unable to leave his mining interests at Edison, N. J.

The General Electric Company presented each member of the association with a handsome badge, representing the fields of a multipolar generator, from the center of which hung a miniature incandescent lamp. The title of the association, the place of meeting and the date were neatly arranged around the field.

The next Convention will be held in, or in the vicinity of Brooklyn, commencing the second Tuesday in August, 1896, and continuing three days.

American Electrical Works' Clambake.

The seventeenth annual gathering of the electrical fraternity for the purpose of eating clams as the guests of the American Electrical Works, Providence, R. I., took place on Saturday last at the beautiful grounds of the Union Club. There were nearly 200 guests present, every one of whom thoroughly enjoyed the day and were delighted with the clambake and the subsequent proceedings.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER VI.

Our Principles, Our Policy and the Justness of and Necessity for this Campaign.

The article in last week's issue on the Tacoma Railway property forms a temporary resting point in the discussion of the electric railway swindles in the Northwest, and we shall, for the present, suspend the further consideration and presentation of facts concerning the financing of various other properties of the same class and character in that territory, pending the compilation of an elaborate table of data, bearing directly upon those properties and similar ones. In the meantime we shall next week begin the publication of a series of articles on some of the electric lighting schemes and swindles founded upon them in the same territory, and shall show that in the lighting branch of the business the same methods were pursued and similar schemes were resorted to for fleecing the public as were used in connection with the financing of the railway properties, (already treated in the preceding articles under this title,) whenever the managers of the Thomson-Houston Electric Company's or later the General Electric Company's interests in that section found an opportunity, or could, by hook or by crook, devise one to suit the purpose and meet the requirements of their nefarious plans.

In the near future, however, we shall resume the discussion on the methods and results of financing other railway properties in that section of the country, and shall extend the scope of the inquiry and discussion so as to include all sections of the United States; and we shall clearly demonstrate that the scheme of operation carried on in the Northwest was not *peculiar* to that section of the country, but was in fact the scheme always resorted to whenever the managers of the Thomson-Houston Electric Company, or later the General Electric Company, had the power to manipulate the properties to suit their purposes, whether these properties were located in the Western, Eastern, Northern, or Southern section of the country.

In this broader and more fertile field we shall present absolute facts which will prove beyond the suggestion of a doubt that there was one master mind which originated this scheme of operation, and organized, directed and absolutely controlled the forces engaged in carrying it into effect. After the presentation of such facts as are now in our possession concerning the plan of the scheme and the general methods employed in its realization, and the results arising from its widespread application, we venture to express the opinion that no one will fail to clearly perceive who was its originator and director; and we venture the further opinion that no attempt to shirk the responsibility for its conception and reduction to practice, and no endeavor to transfer the burden of ignominy and disgrace, justly resting on the shoulders of one guilty person, to the shoulders of the but little less guilty lieutenants or underlings, who were the well paid tools under the control and direction of the master mind, or to the shoulders of the large force of carefully coached and unprincipled accomplices, will be of the slightest avail.

The information we shall give will incontrovertibly prove that in its conception, conduct and widespread extent; in its injury to and destructiveness of legitimate business and worthy enterprises, and in the number and wide distribution of persons affected and victimized by it, this vast, fraudulent electric scheme has never been equalled in this or any other country. When all its revolting details are seen; when the facts and figures clearly demonstrating its magnitude are brought out; when a complete view is obtained of all the devious, unscrupulous, and in many ways thoroughly dishonest methods by which the scheme has been worked for the nefarious purposes of those who expected to reap most from it, we think it will be frankly admitted to be a national calamity, and we are sure that all reputable persons will join with us in the sincere desire to see the industry purged of all those who have been responsible for the inauguration of this scheme of financing, assisted in bringing it about, or contributed in any way to its continuance.

Of one thing we are absolutely certain, namely, that all the numerous fraudulent schemes and fakes having for their foundation the applications of electricity, and foisted upon the public by some of the various parent companies in the field, will, sooner or later, clearly stand out before the eyes of the public, and will form an everlasting monument to perpetuate the memory of the rascality of their managers—a type and degree of rascality we believe and know to be unique, marvelous and absolutely incomparable in its barefaced effrontery and brazenness.

In its magnitude, and the broadness of its field of operation, this electric fraud vastly transcends the many fraudulent schemes which have characterized and disgraced the latter part of this century.

For magnitude, and for the baseness of the methods employed in its conduct, it casts into the shade the worst schemes engendered in the fertile and ingenious minds of those acknowledged princes of fraud, Jim Fisk and Jay Gould, whose doings still rankle in the breasts of all honest Americans and cause them to bow their heads whenever the frauds they perpetrated upon the investing public in this and other countries are brought to mind.

The peculiar plan of financing developed and carried into effect in the electrical business of this country constitutes another blot upon the escutcheon of American honor; and when its nature and extent are fully realized by the public, it is sure to cause a feeling of the most intense disgust in the minds of all who are jealous of the honor and good reputation of its citizens and the general welfare and prosperity of the nation. Of itself it constitutes just and sufficient cause for the sturdy founders of the republic to rise in their graves and invoke the curses of heaven upon the heads of that class of financiers and manipulators who hesitate not at the employment of any means, no matter how base, nor have the least scruple against the violation of any law in devising cunning and nefarious schemes designed to extract from the pockets of their fellow-beings their hard earned savings without equivalent return.

Such schemers and manipulators are the most dangerous enemies of their country. They are the destroyers of its credit and of the good name of its citizens, and their actions bring disgrace upon the entire nation. They are undermining the foundations of law, order and liberty, upon which the republic rests, and are making it more and more difficult, day by day, for all honest people in the land to earn their daily bread. They are the men most responsible for the scattering of the seeds of anarchy and socialism; and their doings are urging the people along paths which tend to upset the stability of our industries, our commerce and our finances.

They are the parasites of the human race; they feed upon its very life's blood, and paralyze the industries of the country in which they live. For do they not substitute for honest labor and honorable effort *mere schemes*, designed to richly line their own pockets and fill their own coffers to overflowing with the money rightfully belonging to others?

They are neither legitimate producers nor legitimate distributers of the products of others, nor do they usefully contribute in any way to the permanent establishment of the industries or commerce of the country. Whatever their hands touch is blasted by the fraudulent schemes ingeniously devised by them for fleecing their fellow-men; and by resorting to these schemes they reduce the power, ability and willingness of others who are in a position to assist in the establishment of industries, by destroying the confidence of the community in new enterprises, be they ever so worthy.

Such men are the bane of the human race; retarders of the development of its best interests; stumbling-blocks in the path of all earnest workers for the welfare of the nation. By the vast wealth, frequently acquired by many of them through the practice of their iniquitous methods, they set an example to the young men of this and other countries which is most deadly in its effects. For does not the vastness of their ill-gotten gains frequently stimulate others to follow the same course in life by the promise of speedy and rich reward for perfidy and baseness, and also induce the young men of this country to ridicule all honest work and honorable effort?

If anyone believes that an industry is benefited by the class of men who for years past have been largely instrumental in directing and controlling the electrical business of this country in the manner we have already clearly pointed out, that person is certainly mistaken.

Such methods as we have already proven to be in operation, and others of the same kind which we shall disclose later, must necessarily finally result in great injury to the business as a whole, and in suffering and final loss to everyone conscientiously and earnestly occupied in the development and conduct of any branch of it, and to any business allied to it or dependent upon it for any portion of its trade.

Permanence and continuous healthy growth of an industry are elements of more true value than that absolute uncertainty of continuance and that kind of growth invariably induced by stock-jobbery and fraud, no matter how great that growth may be.

Permanence and healthy growth should be, and always are, the objects sought to be attained by those having the best interests of an industry at heart. Neither can exist, however, in a business in which the moral sense of the workers in it is dulled, dwarfed, or wholly destroyed by the constant practice of chicanery, deception and absolute dishonesty—all three of these being the natural concomitants of stock-jobbery.

That *solid* success absolutely essential to the true welfare of all employed in an industry, and to its continuous prosperity, can only be secured by well-directed and sustained efforts on the part of all the persons engaged in it; and such success can then only be reached and the prosperity be maintained by seeing to it that those in charge of all departments of the industry have properly trained minds well fitted to cope with and successfully overcome the difficulties encountered in the establishment of it.

There is nothing more unfortunate than for a company engaged in the development of an industry to have as its principal or executive officer a man deficient in strict business morality, or one who will wink at or encourage others to depart from strict business rectitude. A company with such an executive officer must expect its entire staff of employees to soon become permeated with the same spirit, and it will not be long before even its own interests will not be safe in their hands. To wink at or encourage the practice of fraud on outsiders is to, sooner or later, *insure* its practice upon ourselves.

Honest, earnest, able workers are the men to be sought for to fill the positions of trust in an industrial enterprise. Such men seek to secure substantial and legitimate returns on the capital invested in it—to obtain *results.* Stock-jobbers and financial-jugglers care more for something that will temporarily startle and impress the public mind and ensnare their intended victims. This latter class of men labor for temporary *effects*—sensational effects, in contradistinction to permanent substantial *results.* Permanence and soundness of a business are of no importance to their schemes, and in fact are seldom or never taken into consideration by them. Moreover, they frequently ruin what would be, under skilful and intelligent management, a really profitable business.

Even where a business has for its foundation a perfectly sound and trustworthy basis, such a class of men as have largely directed and controlled the commercial part of the electrical business of this country for years past will undermine its foundation and bring it to ruin and into utter disrepute. For lacking that actual and intimate knowledge of its details, and that full knowledge of the principles upon which the art is founded, and being destitute of the skill and ignorant of the care needed to foster it and conduct it through the dangerous periods of its numerous trials and lead it to final success, they substitute for these essential requisites of success a low order of cunning and the worst species of knavery, which necessarily results in the establishment of a policy diametrically opposed to all good and trustworthy business principles, and which will ultimately and inevitably destroy every chance of legitimate profit being derived from it. Can any one doubt that this policy has almost constantly been pursued in the electrical business after our exposures? Does any one suppose that the same methods are not in full operation to-day? If so, we will shortly furnish the means for every one in the business to decide that question for himself.

Dishonesty in any industry is not beneficial to that industry and never can be. In fact it is subversive of the best interests of all engaged in any industrial enterprise in the conduct of which it constitutes an element. It is never resorted to, and never need be, by any sane person justly entitled to enter and occupy any position in any industrial enterprise, and who is also fully competent to understand and deal intelligently with the problems met with in carrying it on. On the other hand, it is almost invariably resorted to by those persons ignorant of the details of the business in which they engage and incapable of understanding its principles, and therefore wholly incompetent to properly and successfully conduct it. With this latter class of people, dishonesty and power of misrepresentation frequently constitute their principal means of doing business, and upon them they mainly rely to hold the positions they are really incompetent to fill with honor and credit to themselves or with any advantage to the interests they are supposed to guard and serve.

There has never been a time in the electrical industry when the services of such people were necessary, and at no time in its history has it been so evident that they have been the worst stumbling-blocks in the way of its successful prosecution, and the worst enemies it has had to encounter. The fatal effects of their vicious policy is becoming clearer every day, and if anything of much value is to be left of the business, they and their methods must soon be stamped out of existence.

We hereby give them fair notice of the warfare we shall wage upon them, until they are all forever driven from this field, which their operations have made too unsafe for the investment of capital, too unsavory for the endurance of all honest workers, and too dangerous for the best men in the trade to encounter.

Let all those legitimately engaged in any branch of the business, or dependent upon it for support, unite in an earnest effort to stamp out these men, and assist in banishing from the business such methods as have been resorted to by them, so as to save the industry from the further imminent and serious dangers threatening it, and that *before* the confidence of the public in electrical enterprises is totally destroyed. The already too manifest dire results to the business directly traceable to and caused solely by the methods pursued by the gang of schemers and financial-jugglers with which the business is infested, has greatly injured the whole enterprise; and so long as these men materially influence, or sensibly determine its future course, the business can never reach that degree of stability which inspires the confidence of capital, induces and insures honest work, and leads to final success in all those branches where success is possible.

Our battle cry is: Away with all who have resorted to, connived at, or assisted in the iniquitous methods which have disgraced and grossly injured this industry, and with all elements which tend to the further instigation, fostering and perpetuation of such methods!

Hear, O hear, all ye tricksters, adventurers, financial-jugglers, fraudulent-bond-manufacturers and manipulators, stock-jobbing swindlers, company-robbers and wreckers, debauchers of our patent system, now and for some time past largely engaged in the electrical field; and know ye that in ELECTRICITY *there exists indeed a* SUBTLE FORCE, *ever at work, which will eventually illumine with a glare equal to the brightest sunlight, and penetrate and dissipate the darkness with which you have surrounded your unscrupulous schemes, and will rend, with the relentless and irresistible power of that force, the structures of fraud you have erected in your disreputable careers.*

An Electric Hydraulic Shop Crane.

An unusual form of overhead traveling crane has been built by the Morgan Engineering Company, Alliance, O., to serve an open-hearth steel furnace in the Steelton Works of the Pennsylvania Steel Company. The main traveling girders have a span of 62½ feet, and the whole weight is about 113 tons. The trucks are mounted on horizontal pivots, with the wheels automatically adjustable to track irregularities, and driven by an independent electric motor. Another motor traverses the trolley, and a third independent one of 80 horse power drives a pair of 7x18-inch compound duplex pumps at a pressure of 700 pounds, actuated through 8-foot gear wheels. The main lifting cylinder is operated directly by the pumps, and has the load attached to the bottom of its piston rod. It is mounted so as to oscillate in all directions without danger of rotation about its own center, and is 21 inches inside diameter, with a stroke of 17 feet 6 inches.

BOOK REVIEWS.

The Elementary Principles of Mechanics. Vol. I, Kinematics (8vo, 225 pp.; price $3.50); Vol. II, Statics (8vo, 386 pp.; price $4.00). By A. Jay Du Bois, C. E., Ph. D., Professor of Civil Engineering in the Sheffield Scientific School of Yale University. New York: John Wiley & Sons.

These two volumes are an attempt to cover in a complete form the theoretical discussion of mechanical principles in a way to meet the wants of what may be termed first, second and third year students, the three collateral courses being distinguished as follows: the abridged course by large type, which is extended for more advanced pupils by copious additions in small type, and the advanced course, including applications of the calculus, which latter are enclosed in brackets. The method of treatment is that of precept and example, the text of each chapter being accompanied by illustrative numerical applications of the principles involved worked out in some cases with sufficient detail to enable the student to solve other examples which follow and to which the answers only are given. This plan is one that we have always commended in text books, as it constitutes a self help which no devotion of the teacher can adequately supplant.

The matter is exceedingly condensed both typographically and in methods of expression, and perhaps open to the criticism of being too much so. However, in so far as this is done without sacrifice of perspicuity it is an admirable feature, and we find that the author has generally succeeded.

We regard it as questionable if the attempt to combine three courses in one, as is done in this treatise, can ever produce as good results in any of the courses as can be attained when each is considered separately. The language and fullness which is adequate to the beginner is sure to be redundant for the more advanced student, and a compromise is disastrous to the former without presenting compensating advantages to the latter. This is our severest criticism of the treatise under review, that while it is excellent in its way the subject might have been handled to better advantage for the several grades of students for which it is intended had it been handled separately for each, having in view in each case the special requirements of the case.

Royal Handbook of Popular Science. By John Gall. 12mo, 196 pp., illustrated. New York: Thomas Nelson & Sons.

This little work is gotten up in dictionary form and is intended to serve as a handy work of reference for those who do not care to refer to more encyclopedic treatises. The scope of the book is confined to the physical sciences, with the exception of a few references to the more important topics of hygiene; and although with these limitations its size renders it necessarily very incomplete, the selection of terms to be defined has been done with good judgment and the definitions are clear, terse and reliable. The illustrations, of which there are many, are generally very well executed and judiciously chosen, and the book is altogether the best of its kind that we have seen.

In the House of Representatives at Washington, wires have been run to each desk from waiting rooms adjoining the Chamber where the pages will be hereafter obliged to remain until they are summoned. A push button connecting with the wire is affixed to every desk, and when a member requires the services of a page all he has to do is to touch the button; the attendant knows just where to go as the number of the desk is exposed in the waiting room when the button is touched. The old system is still retained in the Senate, the conservative Senators not being so quick to introduce innovations as the popular branch. Perhaps they do not wish to deprive themselves or their auditors in the galleries of the picturesque effect produced by the presence among them of the sprightly pages.

LONG DISTANCE TRANSMISSION AT 10,000 VOLTS*—IV.

(The Pomona Plant.)

BY GEORGE HERBERT WINSLOW.

(*Concluded.*)

A very good example of Prof. Fleming's "condenser effect" was met with in the summer of 1893, while the engineer was trying this converter test for measuring line leakage. The primary of a 1,000—100 volt converter was connected between the ground and one terminal of the generator, the other terminal of the latter being connected to one wire of the Pomona circuit. The resulting secondary pressure was 80 volts, which made one lamp burn dimly. When ten lamps were turned on, the pressure dropped to 14 volts. When all lamps were turned off the pressure became ten times as great, or 140 volts. One generator brush was then raised, and the second wire of the circuit was connected to the first. On completing the circuit again there was a sudden flash on the armature, followed by a crackling noise and a brush discharge which lasted until the circuit was broken. The Pomona wires were then disconnected from the dynamo terminal, which was left free. With this arrangement faint sparks and a glow were noticed, as though the armature winding were grounded on the core, but a Wheatstone bridge test showed an insulation resistance of over 10 megohms. Since then the machine has been used regularly and has not broken down, so it is evident the spark must have resulted from a sudden increase of the potential of the armature winding above that of its core, which latter was permanently connected to earth.

This sudden increase may be explained as follows: On closing the circuit the condenser formed by the line and the earth began to discharge through the metallic circuit afforded by the armature and converter windings, but the self-induction of this circuit checked the discharge so quickly as to produce an excessive pressure which could only be relieved by the discharge taking place through the insulation of the armature-winding to the grounded core, which is what happened.

A similar test was made on the San Bernardino wires in the previous January during dry weather, the only change being that the single lamp was not turned off. With only one wire connected, one 16 c. p. lamp came nearly to candle power. On connecting the second wire to the first (at San Bernardino) the lamp burned at full candle power. Ten lamps (the full load) were then put on the converter and burned dimly. As they were turned off one by one, the others brightened until the last lamp lighted up as before. This test did not cause any discharge on the armature, in spite of the fact that the circuit was twice as long and the capacity thus twice as great. The probable explanation of this is that the inductive resistance of the converter was not so great as in the other case, on account of the single lamp being left burning. It is also possible that the breakdown in the other test was assisted by the presence of copper dust on the winding.

A comparison of the San Bernardino switchboard voltmeter was made with a Weston instrument and gave important results.

1st. With *no load* the San Bernardino instrument was about 14 volts (11.2 per cent.) low at 125 volts, while at 97 volts it was only 11.7 volts (12 per cent.) low.

2d. With a *city load* (inductive, consisting of lightly loaded converters,) of 7½ amperes it was 11 volts low between 107 and 96 volts, while for 15 amperes it was only 8.5 volts low. Further increase in load caused further reduction in the difference, until for 40 amperes the instrument was only 5 volts low.

3d. With a *tank load* (non-inductive) of 9 amperes it was only 9 volts low at 99 volts, and as the load was increased the difference decreased until for 97 amperes the instrument read the same as the Weston.

It is evident from these observations that a voltmeter which consists essentially of a solenoid and a movable core is not the proper type of instrument for circuits such as those used in the present case, in which transmission circuits of great lengths are used in conjunction with transformers. The voltage at San Bernardino during the tests was therefore measured with a Weston portable voltmeter.

A comparison between the ammeters used at Pomona and San Bernardino showed that for readings above 67½ amperes the San Bernardino instrument read higher than the other. As there was no reason for considering one instrument more accurate than the other and no way of telling which was right, the San Bernardino readings taken during the test were reduced to the average of simultaneous readings on the two instruments.

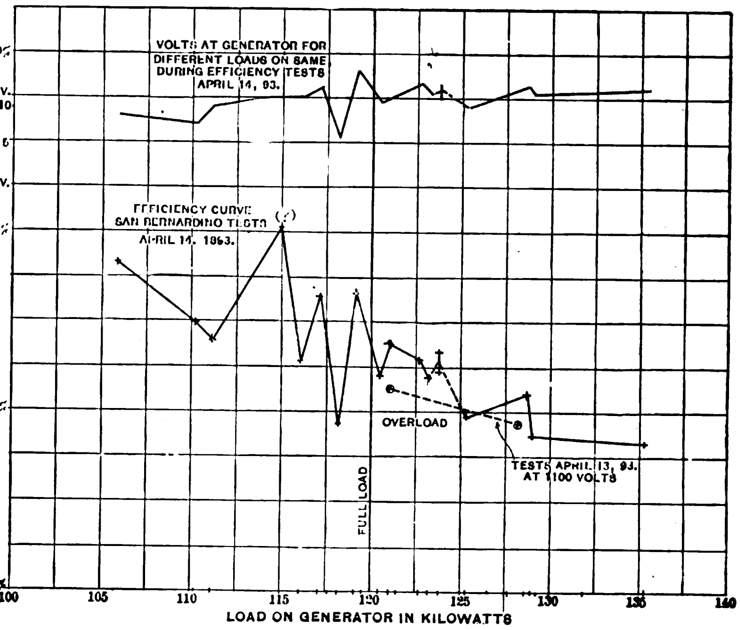

FIG. 7.

A short test of the Pomona circuit was made on April 11, the results of which are given in Table I.

A preliminary efficiency test on the San Bernardino circuit lasting five hours, during which the generator was kept at full load or overload, was made April 14, 1893. Readings were taken every fifteen minutes, and the efficiencies and the corresponding voltages for different loads are plotted in Fig. 7. The most prominent feature of this efficiency curve is its irregularity. This is, however, satisfactorily explained by referring to the curve of generator voltage, on which it is seen that the high efficiencies correspond to high voltages, and vice versa.

TABLE I.

EFFICIENCY TESTS. POMONA CIRCUIT.

April 11, 1893.

Canon (20 Converters).			Pomona (18 Converters).			
Amperes.	Volts.	K. W.	Amperes.	Volts.	K. W.	Efficiency per cent.
120	1100	132	105.85	919	97.28	73.7
118.5	1100	130.35	105.85	945	100.01	76.73
119.5	1100	131.45	107.4	929	99.78	75.9

It will be noted that the apparent efficiencies shown by the preliminary tests at San Bernardino agree very closely with the results of the long efficiency test there. On calculating the apparent efficiencies for different loads from data obtained by laboratory tests, and comparing them with the measured apparent efficiencies, it is found that they agree within 3 or 4 per cent. This very close agreement is exceedingly gratifying, particularly when we consider that the tests of the plant were made with ordinary commercial instruments, and that the laboratory tests were made about a year before the commercial tests.

TABLE II.

42½ MILE TRANSMISSION TEST. CIRCUIT TO SAN BERNARDINO, BY WAY OF POMONA, 85 MILES.

May 2, 1893.

Canon (20 Converters).			San Bernardino (18 Converters).			
Amperes.	Volts.	K. W.	Amperes.	Volts.	K. W.	Efficiency per cent.
95	1120	106.4	80.75	847	68.4	64.28
96	1130	108.5	78.8	865	68.16	62.82
100	1200	120.0	81..	893	72. 6	60.8

An interesting and unique test was made May 2, 1893, by connecting the Pomona line wires in series with the San Bernardino circuit, and transmitting about 100 H. P. to San Bernardino by way of Pomona. The length of the circuit was 85 miles, and the distance of transmission 42½ miles. This is the greatest distance yet covered by any transmission since the Frankfort experiments. The measurements are given in Table II. The apparent efficiencies are much lower than those indicated by calculations, as in the latter no account was taken of the capacity and inductance of the circuit. The voltage of the generator as measured is about 5 per cent. above that calculated, and the amperes measured notably exceed the amperes calculated. These results are attributable to the introduction of the Pomona loop, which added both capacity and inductance.

In order to reduce the cost of operation, the San Antonio Company first dispensed with the sub-station attendant at Pomona after 11 P. M. This they did some time before the acceptance of the plant, after assuming the responsibility for any damage which might result. No trouble occurred, and after the acceptance (May 6, 1893,) the same plan was put in operation at San Bernardino. After working in this way for several months, the Pomona station was started in the afternoon and then locked up until the next morning. This arrangement was made possible by running the generator so that the lights should not be too high at Pomona, the lights at San Bernardino being kept right by the attendant with the Stillwell regulator.

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*A paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

In January, 1894, another 120 K. W. generator was installed with an equal capacity of oil transformers, and the Pomona and San Bernardino circuits are now each operated from separate generators with separate banks of transformers of 10,000 volts. Since this change the San Bernardino attendant has also been dispensed with, and the bookkeeper starts up in the afternoon and then locks up the station for the night, as at Pomona. The voltage of the lamps on each circuit is regulated by the engineer at the power house, the generator pressure necessary at different loads to keep the lamps at the proper brilliancy being automatically indicated by the compensating voltmeter on each circuit. Thus after the plant is started the engineer has sole charge.

CATAPHORESIS AND SOLUTIONS OF H_2O_2 FOR BLEACHING TEETH, ETC.*

BY WILLIAM J. MORTON, M. D.

By cataphoresis is meant the movement of fluids, together with the substances they may hold in solution, from the positive pole of electrodes conveying a continuous current in tissue, toward the negative pole. As signified by the derivation of the word "cataphoresis," the substance held in solution "goes down" with the current, that is to say, moves with its ordinarily accepted direction of flow, just as in electroplating the metal held in solution goes down, i. e., from a higher to a lower potential, and is deposited on the negative electrode or cathode. This comparison to what takes place in electroplating might lead us to believe that cataphoric action was due to electrolysis, and it must be admitted that electrolytic and cataphoric action are not yet differentiated with sufficient clearness. But there is little reason to doubt that one action is as distinctive a property of the continuous current as the other. And, without entering into the reasons for this statement, it is enough to affirm, for all practical purposes, that fluids in tissue do move from the positive to the negative electrode. But there are exceptions even to this statement, for eosin travels from negative to positive, as also does an alcoholic solution of bromide of barium.

So much, in a brief way, for cataphoresis—the general principle. Should we desire to make use of this principle to introduce medicines into human tissue, we may refer to the procedure as cataphoric medication. And to avoid confusion and theory, and the contradiction that some substances in solution travel upward rather than downward, I have proposed the terms electric diffusion and electric medicamental diffusion. These terms at least express the facts.

To secure successful electric medicamental diffusion, several important points may here be noted.

(*a*) The medicine in solution must be brought into intimate contact with the tissue in order to constitute with it a comparatively continuous electrolyte.

(*b*) Metallic conduction [of the electrode, the positive pole] must end very close to where electrolytic conduction begins; that is to say, the absorbent material holding the solution must be thin, and allow the metal electrode to come as near as possible to the tissue.

(*c*) The negative electrode must be removed to a distant point.

(*d*) If the tissue to be treated is the skin, it must be well washed with soap and water, or ether or alcohol, to remove the natural oils.

(*e*) The solution used must be of neither too high a resistance nor of too low. If too high, like alcohol, ether, or chloroform, no current will be conducted; if too low, like a saturated solution of common salt, cataphoric effects will not be pronounced.

With a view of ascertaining if discolored teeth could be actually and practically bleached by cataphoric medication, I performed the following experiments, assisted by Mr. Wm. J. Evans, of McKesson & Robbins, who kindly supplied the teeth, the pyrozone and other chemicals required. But first, a word as to the necessary outfit. This should constitute (*a*) a galvanic battery of at least 40 Leclanchè cells, or of 30 red acid or Poggendorf cells, as sold in the ordinary portable battery, for a voltage of at least 60 volts is required; (*b*) a rheostat; (*c*) a milliamperemeter, and (*d*) a needle holder for platinum wire.

The experiments were as follows, omitting numerous ones made for control, or those affording no definite results:

The first point was to establish if solutions of H_2O_2 would conduct electricity.

Experiment 1.—H_2O_2 25 per cent., plus sulphuric ether 75 per cent A few drops laid upon a glass plate, platinum wire electrodes placed ½ inch apart, 40 cells equalling about 60 volts, gave only about one milliampere of current, a current strength too small for practical work.

Similar solutions of the same strength of H_2O_2 in chloroform, glycerol and distilled water gave in the first two instances no current, and in the latter about two milliamperes.

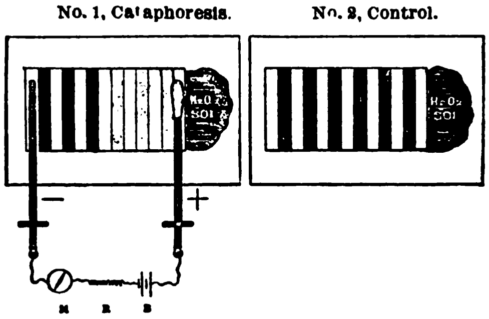
Experiment 6.—H_2O_2 25 per cent., plus sulphuric ether 75 per cent., plus dilute sulphuric acid a mere trace, gave 20 milliamperes, namely, sufficient for practical work if so desired.

Experiment 8.—H_2O_2 25 per cent., plus sulphuric ether 75 per cent., plus solution of chloride of sodium, afforded electric conduction, but the solutions did not mix, and therefore were impracticable to work with in that form.

Experiment 11.—A molar tooth containing a large cavity, leaving half of its crown still intact. The enamel of the crown was badly discolored by organic decomposition; the central divisions of the dentinal tubuli were well exposed; contrast was made by comparing it with another tooth to match the color, so that the shade could be determined. Cavity packed with absorbent cotton; rubber-dam adjusted, and the roots of the tooth imbedded in a piece of beef meat. Cotton was tightly wound about the platinum wire, constituting the positive electrode; the negative was another wire inserted into the beef about one inch away from the imbedded tooth.

Solution of chloride of sodium, two-fifths of a cubic centimeter, and one and three-fifths cubic centimeter of H_2O_2 25 per cent., water 75 per cent., made by shaking two parts of pyrozone 25 per cent. solution with one part of water, and separating the fluids in a funnel, was dropped on to the cotton with a pipette; the current was turned on and very quickly dried it, which was indicated promptly by the fall of the needle of the milliamperemeter, and more solution was continuously added. The darkened portion of the tooth bleached perceptibly white within a minute; current strength 25 milliamperes. Then about the same number of milliamperes was employed during five minutes; enamel perfectly bleached. The bleaching action was also evident at the ends of the roots of the tooth, the H_2O_2 having been conveyed there by way of the open pulp canals. These latter therefore, in actual practice, if exposed, should be closed by a non-conducting cement.

Experiment 12.—Two pieces of blotting paper, 1 x 2 inches, each laid on a glass plate, and six bars of blue litmus paper laid across the blotting paper thus:


No. 1, Cataphoresis. No. 2, Control.

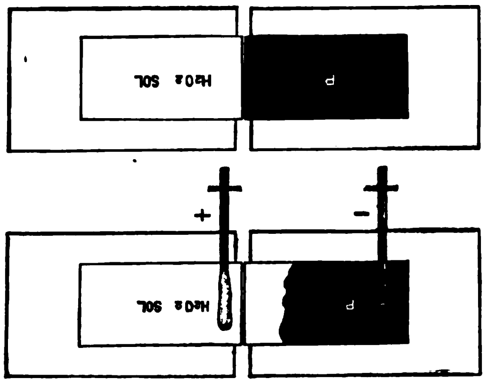
M, Milliamperemeter; R, Rheostat; B, Battery.

Two cubic centimeters of 25 per cent. aqueous solution H_2O_2 applied on glass at end of blotting paper; 50 milliamperes current. Blotting paper wet with a weak solution of chloride of sodium; current turned on. Almost immediately in No. 1 the litmus paper at the positive end began to bleach, and this bleaching progressed in perceptible steps towards the center, until within 4½ minutes the litmus paper on the positive end (three bars of it) was completely bleached of its blue color. The control experiment showed no change, proving that ordinary diffusion or chemical osmosis was not the cause of the result obtained in No. 1.

Experiment 13.—Four pieces of blotting paper, 1 x 2 inches, two pieces saturated with a decinormal solution of permanganate of potassium, U.S.P.—this stained them a chocolate color, two pieces saturated with 25 per cent. aqueous solution of H_2O_2. Each piece of permanganate paper was brought into juxtaposition with each piece of H_2O_2 paper. No. 1 for cataphoresis, No. 2 for control. (See illustration).

The H_2O_2 pieces of blotting paper were previously moistened with a solution of sulphate of soda; 50 milliamperes of current strength were applied as indicated by the platinum electrodes in the illustration. The encroachment of decolorization of the permanganate paper was noticed at once in No. 1; it progressed steadily, and at the end of five minutes had extended about one-third of an inch, thus proving cataphoric action, while the control, namely No. 2, showed but a trifling decoloration at the point of immediate contact.

No. 1 Cataphoresis.



No. 2 Control.

P, Permanganate solution.

EXPERIMENT 13.

Experiment 22.—Four pieces of blotting paper, each one 1 x 2 inches, were laid in pairs upon glass plates, so that the edges of each pair could be brought into contact. The blotting paper was wet with a solution of soda. Then four pieces of ozone test paper of about the same size were laid upon the pieces of blotting paper, the ozone paper in this way becoming slightly moist with the solution beneath it. This white ozone paper gives a bright blue reaction to H_2O_2.

See illustration, showing in No. 1 the control experiment, and in No. 2 the cataphoric effect which occurred, placing pyrozone, 25 per cent. solution ethereal, upon the right-hand papers. These, of course, were immediately colored blue. The pieces of glass were now so moved as to permit the pieces of paper to touch, and in No. 2 the current was turned on up to 50 milliamperes.

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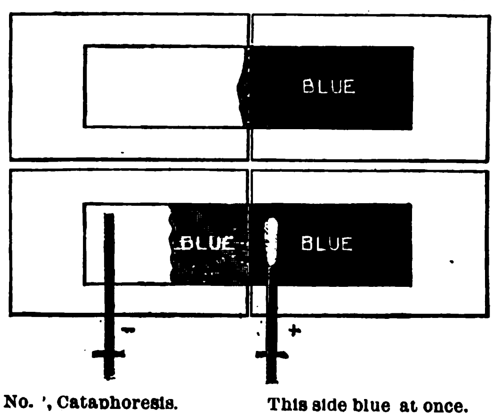
* From the Philadelphia "Dental Cosmos."

The result was most striking and most conclusive, for the H_2O_2 solution under the electric influence straightway began to invade the previously white paper and colored it blue for half of the distance toward the negative electrode, while in the control experiment little or no blue color was produced upon the white paper, except for a trifling distance from the point of contact.



EXPERIMENT 22.

CONCLUSIONS

1. Cataphoric action is a demonstrable property of the galvanic or continuous current.

2. The negative pole must be placed at some part of the body comparatively distant from the tooth, for instance the cheek, hand, back, or breast.

3. The pulp canals, if exposed, should be closed by a non conducting cement.

4. Solutions for cataphoric action should, if spirituous, aqueous, or with glycerol, be associated with some substance which makes them better conductors of electricity.

5. Experiment 22 teaches this most important fact, namely, that while ethereal solutions of H_2O_2 do not conduct electricity, and cannot therefore be used by themselves for cataphoric action, still this effect can be readily obtained when the porous material which holds such an ethereal solution has been previously moistened with a solution of sulphate of soda or some similar conductor.

6. The efficacy of bleaching agencies, as, for instance, H_2O_2 solutions, is greatly enhanced by the concomitant aid of electricity, namely, by cataphoresis.

A New Use for Accumulator Chests.

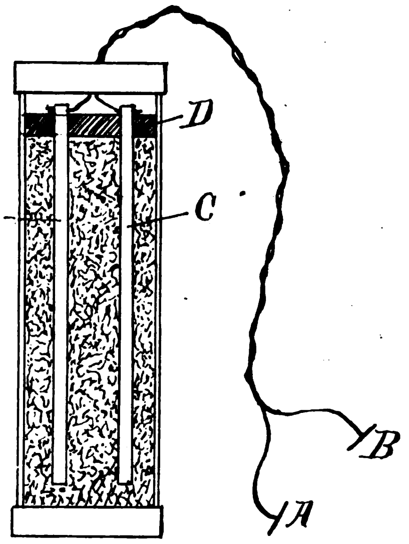
The Belgian customs authorities have discovered an ingenious smuggling trick. In the luggage-van of the express which runs between Paris and Brussels is a case which holds the accumulators when the train is electrically lighted. The guard of the express, a foreman porter, and an excise official of the border station Quèvy possess a key of this case, which, as a rule, no one thinks of examining. The other day, however, as the train ran into Quèvy, a customs inspector took it into his head to open the chest, and to his amazement he found snugly ensconced therein watches, chains, rings, bracelets, and other dutiable jewelry to the value of 7,000f. The guard and the foreman porter were quietly but firmly detained in Quèvy pending inquiries, which ultimately showed that the porter had for a long period been carrying on a contraband traffic for a well known jeweler, who, it is said, will be a heavy sufferer by the disclosure of his frauds on the customs officials.

THE THERMO-OZONE BATTERY.

Another Electro-Medical Fraud.

We have in the past received numerous letters from earnest parties inquiring as to the merits of Dr. Beckwith's so called thermo-ozone battery, to all of which we have replied by letter exposing its pretensions in no uncertain terms. The time has come, however, when it seems advisable to publicly expose its fraudulent nature, first, by reason of our further inability through lack of time and desire to reply to such letters, and second, because the device comes before the public with the indorsement of several gentlemen known to the electrical profession, who probably through ignorance have allowed their names to be used. These gentlemen are Messrs. W. T. Eckert, T. T. Eckert, Jr., Francis Broadnax and E. G. Cargill. Three of them are personally known to us, and it is with deepest regret that we see their names used as indorsers of a fraud as unmitigated as that of the electropoise, actina or the electric belt. We would gladly spare these gentlemen the pain of a well-merited rebuke, but there is a duty which we owe to the public as well as to ourselves which compels us to take the stand we now do.

In a little pamphlet issued by Dr. Beckwith it is stated that one of the editors of this paper "visited us February 28, 1895, and stated that he desired to make a full examination of our invention, and was ready to expose and publish any wrongful claims that were made respecting it." So far the statement is absolutely true, but it goes on: "The examination lasted nearly three hours, when he stated that the invention was scientifically constructed and capable of generating a thermal current of electricity. He procured a battery for Mrs. ——— and requested us to take charge of her case."



BECKWITH'S THERMO-OZONE BATTERY.

This is absolutely false. We made no examination of the battery at the time further than to take it apart so as to see the inside arrangement and to listen to the theories of its promoter. We did procure a battery—not for use of the party mentioned, nor was she placed in Dr. Beckwith's charge. Our procuring of the battery was for the purpose of testing it electrically.

The pamphlet goes on to say: "His opinion and conclusion are of more intrinsic value than volumes of sentimental testimony."

This being the case it gives us unusual pleasure in expressing our opinion of the battery and the claims of its promoter.

The accompanying cut is a sectional view of the so-called thermo-ozone battery, which may be described as follows:

It consists of a brass tube, $1\frac{1}{4}$ inches outside diameter and 5 inches long, hermetically sealed at either end with gutta-percha plugs over which are screwed brass caps.

Inside of the tube are placed two slender rods $\frac{1}{4}$ inch in diameter—one of copper and the other of zinc—marked in the sketch C and Zn. Around these is tightly packed a dry powder. These rods extend at their upper end through the gutta-percha plug D and to them are attached flexible cords terminating in the electrodes A and B, by which the battery is applied to the person.

The construction of the battery is such that it is entirely watertight, and the method of using it is to place the cylinder in a vessel of cold water (a la electropoise), and apply the electrodes. Now one of the claims is that a thermo-current of electricity is thus generated, and another is that there is also a galvanic current. As a matter of fact, the construction is such that a thermo-current would be impossible under any conditions, and a galvanic current equally impossible so long as the powder remained dry. Careful tests have shown the total absence of electrical currents under the conditions of use. If water is admitted to the cylinder a very slight current will flow for a very short time, but the battery polarizes so rapidly that this soon practically ceases.

Another claim is that by means of this battery drugs may be administered through the skin by what is termed electrical osmosis or *cataphoresis*. Drugs can be so administered under certain conditions by the assistance of the electric current, but it would be impossible to so administer it by this device, even supposing that it gave a current, for it would require something over sixty of the cells joined in series to produce any effect, because of its extremely low electromotive force. The battery gives no current, however, unless it leaks, and the one we examined did not leak at all.

Another claim is that it introduces ozone into the circulation. In the first place, gases cannot be administered by cataphoresis, and in the second place this battery could not under any circumstance whatever produce the slightest trace of ozone. Very high potentials are required for this, and even if these were at hand, the method of applying the electrodes to the body are such as to practically preclude its formation. There is still another point. Supposing that the ozone were generated and introduced into the system by cataphoresis, the results would certainly be disastrous—perhaps fatal.

In the popular mind, ozone is health-giving, revivifying and beneficial in every way. This is a misconception. It is most violent in its action, and even when inhaled in small quantities produces alarming symptoms. To introduce it into the blood would be suicidal.

To conclude, then, the battery itself has nothing scientific about it, but is a bungling and cheap attempt to deceive, and in the second place the theory which Dr. Beckwith advances, and by which he hopes to mislead the public as to its curative properties, is as bungling and unscientific as the battery itself.

Personal.

Mr. Walter H. Knight has resigned his position with the General Electric Company, and will engage in engineering on his own account.

J. M. Davey, late superintendent of the American Electrical Manufacturing Company, St. Louis, was a New York visitor last week.

Mr. J. T. Hambay, general manager of the Beacon Lamp Company, Boston, Mass., has completed a swing of the Western circle and reports the indications for fall trade to be favorable.

Mr. James I. Ayer has just returned from Bar Harbor and looks brown and rejuvenated.

Mr. J. H. Rhotehamel, who is as well known as the popular Columbia lamp, was in the city last week, looking happy and feeling jubilant over recent large awards in competitive bids based on merit alone and *not* on prices.

General News.

What is Going on in the Electrical World.

Harvard, Ill.—An electric lighting plant is to be established here in the near future.

Uxbridge, Mass.—There is some talk of connecting Milford with Oxford by an electric road.

Milaca, Minn.—This village has voted to bond itself to put in electric lights and water works.

Pasadena, Cal.—The Pasadena and Los Angeles Electric Railway has been completed at a cost of nearly $400,000.

Elyria, O.—James L. Mauldin, of Cleveland, has been granted a franchise for an electric road between this city and Lorain.

Summit, N. J.—The township committee have decided to accept C. P. Bassett's bid for supplying the town with electric lights.

Henderson, Ky.—The city council has ordered an election to be held September 24 to decide whether Henderson shall have electric lights.

Ocala, Fla.—John R. Martin has secured $9,000 of the $10,000 wanted to build the Ocala and Silver Springs electric road, and a survey is being made.

Cincinnati, O.—Carroll B. Vastine, of Chicago, has organized a $500,000 company to manufacture soap by a process in which electricity will be used.

Hyde Park, Pa.—William Farrel has submitted to the board of trade a proposition to establish an electric light plant in Hyde Park, utilizing the culm banks in the neighborhood as a source of power.

Wilmington, Del.—The survey of the route for the proposed Chester and Wilmington electric road between Claymont and Shellpot has been completed.

Santiago, Cal.—George B. Kerper, owner of the Santiago Cable Railway Company, will change the system to electricity, and will extend the line to National City.

Anapee, Wis.—The electric light plant in this city, owned by Joseph Wodsedalek, was destroyed by fire on the 6th inst.; the plant was valued at $20,000.

Pawtucket, R. I.—The Dunnel Manufacturing Company have substituted electric motors for steam power in the operation of their calico printing machines.

Freeport, Ill.—The South Freeport and Cedarville Electric Railway Company has petitioned the council for a franchise to operate an electric car system in this city.

Spokane, Wash.—The Consumers' Light and Power Company has been granted a fifty-year franchise and has ordered the entire plant for a large electric light system.

Killingly, Conn.—The Killingly and Brooklyn Street Railway Company is to establish an electric street railway to connect the surrounding villages with Danielson.

Nebraska City, Neb.—An Eastern firm has written to Mayor Bartling offering to buy the present horse-car company's interest and franchise and put electric cars on the line.

Rantoul, Ill.—The Rantoul Electric Company has been granted a franchise to put in an electric light plant. The Western Electric Company of Chicago will furnish the plant.

Franklin, N. H.—Franklin is to have an electric street railway. At a recent meeting of local capitalists a strong company was formed with Hon. Warren F. Daniel as president.

Watkins, N. Y.—The early construction of the proposed Watkins and Havana Electric Railroad is hoped for as a number of New York capitalists have become interested in the project.

Williamstown, Mass.—Construction work on the electric road between this town and North Adams is in progress; it is expected that the road will be in running condition in about two months.

Phœnix, Ariz.—The Phœnix Light and Fuel Company and the East End Electric Light Company have been combined by the sale of the East End (Gardiner) works to the Light and Fuel Company.

Newport News, Va.—It is understood that O. P. Loomis, a manufacturer of dynamos, motors and other electrical appliances, intends to remove his works from Bound Brook, N. J., to Newport News.

Fort Wayne, Ind.—Arrangements have been made with the Toledo Construction Company for the building and equipment of the Fort Wayne, Lake Everett and Columbia City Electric Railway.

Baltimore.—The branch line of the City Passenger Railway from Baltimore street to Camden station is now operated by electricity. This was the last horse car in the city except the Traction Company's Waverly line.

Jacksonville, Fla.—The Jacksonville, St. Augustine, Palatka and Tampa Electric Railway Company, recently organized with a capital of $200,000, expect to have a part of the line, if not all, in operation next winter.

Nevada, Mo.—Col. Geo. W. Dudley, of St. Louis, has been granted an electric light and power franchise by the city council. Col. Dudley will buy the horse car system in this city and equip and operate it as an electric road.

Warren, O.—The county commissioners have granted the Trumbull Electric Company a franchise from Warren to Leavittsburg.—The Mahoning Valley Electric Railroad Company has been granted a 25-years' extension of its franchise.

Allegan, Mich.—The Harrison Electric Light and Power Company have just closed a deal whereby they become the owners of the Edison Allegan Light Company's plant. They will build a large brick plant near the old one and consolidate the two.

Lima, O.—Local capitalists are taking up the right of way for an electric line between this city, Wapakoneta, and St. Marys. The projected line will pass through a number of small towns, which it is intended to supply with electric light.

Jersey, City, N. J.—It is probable that new bids for lighting this city will be advertised for as soon as the corporation counsel decides whether the street and water board can give out the contract at once or must wait until the beginning of the next fiscal year.

Morristown, Tenn.—The Morristown electric light plant has been sold at auction and bid in by the General Electric Company of Boston for $4,000. The company intends to continue operating the plant after making some needed repairs on the machinery.

Toronto, Can.—The Toronto Railway Company, which operates by electric power the only street railway in Toronto, has recently issued £823,000 of first mortgage 4½ per cent. sterling bonds. Of this amount £250,000 was issued in Canada, and the remainder in London.

Brooklyn, N. Y.—At a meeting of the shareholders in the bicycle railroad scheme, a few days ago, F. W. Dunton said the construction of the road would begin as soon as $100,000 had been paid in. Up to the date of the meeting $62,204.60 in cash had been received and was deposited with a trust company.

Schenectady, N. Y.—It is now announced as a certainty that the General Electric Company is to concentrate all of its plants in this city. Work on the necessary buildings will begin at once and as soon as completed the works at Lynn, Mass., and Harrison, N. J., will be closed and the plants brought here.

Little Rock, Ark.—The Little Rock and Little Rock Edison Electric Light companies have consolidated under the name of the latter company and under the management of J. A. Van Etten. The following officers were elected: Dr. C. M. Taylor, president; S. R. Allen, secretary; Oscar Davis, treasurer.

Niagara Falls.—The Niagara Falls and Lewiston Railroad Company has elected the following directors: John M. Brinker, Robert W. Jones, F. C. M. Lautz, Daniel O'Day, Herbert P. Bissell, D. N. Evans, W. S. Pitman, Frank M. Brinker, Bert. L. Jones, C. D. R. Stowits, Charles R. Huntley, E. T. Brinker and F. A. Mohr.

Youngstown, O.—A new electric company, composed of H. F. Kaercher and others, has been formed here, and has come out as a rival to the Youngstown Electric Light Company, which has had a monopoly. The new company has asked for a franchise, and agrees to furnish electric light 25 per cent. cheaper than the old company.

Tuskegee, Ala.—A proposition has been made to the citizens here by a party who is connected with the electric power company of Montgomery to build an electric line from this place to Chehaw on the Western road. It will be built, it is said, if the citizens will donate $5,000 and the right of way. An effort will be made to raise the amount.

St. Louis, Mo.—Bids will be received until September 6 for a twenty-ton electric travelling crane for High Service Pumping Station No. 3.—Articles of incorporation of the International Electric Company have been filed here. They show a capital stock of $15,000, fully paid. The firm will manufacture incandescent lamps and other electrical appliances.

New Castle, Pa.—J. S. Hays, formerly chief electrical engineer for Andrew Carnegie, and Robert Peebles of this city have consummated a deal by which they become owners of the stock of Hon. J. R. Finley of Monongahela City, Pa., in the New Castle Electric Power and Arc Light Company, the incandescent plant and New Castle Artificial Gas Company.

Marion, Ind.—R. A. Page and C. H. Grant, of Chicago, have been here making investigation in regard to the building of an electric railroad from this city to Chicago, and especially looking after the right of way from Marion to Logansport, which part will be built first. The exact eastern terminus has not yet been decided upon but will probably be in the gas belt.

Toledo, O.—It is reported that the Toledo and Maumee Valley Electric Railway Company has practically secured the complete right of way for its tracks from Perrysburg to Bowling Green. The company has had this scheme in contemplation for several months, but has not until a few days ago been able to secure the right of way through Wood county to the county seat.

Santa Cruz, Cal.—An "electric cycle road" between this city and Capitola is projected by a number of prominent citizens. The plans and specifications of the new road have been drawn. It will be built on the L. C. Presley railway system, engineered by D. E. Condon, the builder of the San Francisco City Hall dome. The cars will carry freight as well as passengers. A speed of at least seventy miles an hour is expected.

New York.—The Board of Fire Commissioners have come to the conclusion that the present system of fire alarms in this city needs improving and extending, and hope to accomplish this by a more general use of auxiliary fire-alarm boxes, by placing them in private houses, factories, lumber yards, dock sheds, etc. A minute or two gained in notifying the firemen will, it is believed, result in saving much valuable property.

Chicopee, Mass.—The city government has passed an order authorizing the city to make a contract with Daniel G. Canty for the erection of an electric light station according to plans submitted by F. R. Richmond, architect, the price thereof not to exceed $16,500. An order was also passed to procure plans and specifications for the equipment of the plant; also an appropriation of $20,000 was made for the purpose of erection and equipment of an electric light station.

Pottsville, Pa.—The Williams Valley Street Railway Company has secured right of way over the whole of the route between Tower City and Lykens, and will begin the construction of the road at once. The directors of the company are William A. Marr, of Ashland; Moses Mervine, of Reading; George Cockill, Peter Cress, E. C. Wagner and J. H. Babb, of Girardville. Chas. H. Barmhardt, of Girardville, is the secretary and treasurer of the corporation.

Richfield Springs, N. Y.—The trustees of this village a few days ago gave a hearing to those interested in the Little Falls and Richfield Springs electric railroad. Several prominent men advocated the building of the road, while others were opposed, one of the latter objecting that "it would bring Sunday visitors to Richfield Springs," and another that "he was opposed to common people visiting Richfield where $10 a day people were wanted." The hearing was adjourned to the 28th inst.

Pittsburg, Pa.—The board of trustees of the Carnegie Library have awarded the contract for the electric light plant for the building to the Westinghouse Electric and Manufacturing Company. The plant contracted for will cost about $18,000. The board of trustees have determined to make the Library the best lighted public building in the United States, and believe the arrangements of electric lights fixed upon will give the desired results.--The *Leader* states that the Westinghouse Company paid out to its employees at Brinton on the 9th inst. one of the largest pays in its history. About $160,000 was divided among the 8,500 hands for two weeks' work.

Sacramento, Cal.—The *Bee* says: "One of the most marvelous exhibitions in the world's history will be seen in Sacramento on the night of the 9th of September. That is a broad assertion to make but Sacramento stands ready to back it. There have been electrical displays in this and other countries, but no city has yet gone far enough to have a carnival. Sacramento will have one, and it will be a 'peach.'" In the procession will be six floats, brilliantly illuminated, symbolizing local and historic events connected with the introduction of electricity. Electrically illuminated arches will span the streets, and the parks and prominent buildings will be lit up to the best advantage.

Appleton, Wis.—The Appleton Edison Electric Company is in a peck of trouble. The city council has revoked its street railway charter and annulled its contract for street lighting, and the company has been placed in the hands of a receiver, A. Ledyard Smith, on the application of the New York Security and Trust Company, which sets forth that the company is insolvent and unable to pay interest on its bonded indebtedness. The company admits the truthfulness of this allegation and has filed a statement of its indebtedness, amounting to $189.510, of which $77,580 is bonded indebtedness and $111,930 is composed of claims for wages and unsecured debts.

Jefferson City, Mo.—A syndicate of Iowa capitalists, who have recently bought the famous Gunter spring in Camden County, Mo., and 5,000 acres of land surrounding it, propose to build an electric railway connecting Jefferson City with the spring and also to put in a mammoth electric plant at the spring to be operated by water power. They say that there is power enough at Gunter to supply the entire State with electricity. It is one of the largest, if not the largest spring in the world, bursting forth a river at the foot of one of the highest peaks of the Ozark mountains. It is surrounded by some of the most wildly picturesque scenery on the continent.

San Francisco, Cal.—The *Call* states that the Clear Lake Electric Company has about perfected arrangements for converting the waste water power of Clear Lake, Lake County, and Cache Creek (about seventy miles from San Francisco) into electric energy that will be transmitted to San Fransisco, Oakland, Benicia, Mare Island, Vallejo, Santa Rosa and other cities along the line, where it will be used to give light and power. The water will be carried in five-foot pipes from the dam, to be erected at Cache Creek, to a point known as Wilson's Farm, a distance of 12 miles, where the power plant will be established, and in traversing that distance will have a fall of 454 feet. In connection with the transmission scheme an electric railroad is to be built connecting Clear Lake with the town of Rumsey.

St. John, N. B.—R. P. Strand, organist of Trinity Church in this city, is the inventor of a new electric organ which is said to be an improvement on those hitherto in use. "It is simply wonderful," says a local authority, "to see the amazing rapidity with which the most florid passages can be executed. Trills and reiterated notes which have hitherto been a laborious task are rendered in the easiest manner possible on this organ. One great point the inventor claims is that he has swept away the troublesome pneumatics from every part except the draw-stop action, and here, where there is no quick repetition needed, they are not open to the same objections. The organ is operated by a direct electric system. There is no intermediary between the magnet and the valve, therefore the response is absolutely instantaneous."

All About Block Signals.

"Block Signals on the New York Central," the latest addition to and No. 17 of the popular "Four-Track Series" of "America's Greatest Railroad," is from the press of the American Bank Note Company; contains 64 pages, narrow octavo, beautifully printed on coated paper and illustrated with graphic pictures of signal apparatus and its application to the traffic of a great railroad. The text is from the pen of a celebrated English expert on Block Signals, and the subject is treated in a way that cannot fail to interest the average traveler as well as the technical engineer. It is believed that this, the latest of railway safety devices, has never before been so thoroughly and comprehensively described and illustrated as in this book.

A copy will be mailed to any address, free, postpaid, on receipt of three 2-cent stamps, by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

COMMERCIAL PARAGRAPHS.

"Compressed Air" is the title of an elaborate publication, otherwise known as Catalogue No. 8, just issued by the Clayton Air Compressor Works, Havemeyer Building, New York. The book is richly illustrated and contains a description of the manifold applications of this form of power.

The Swinging Ball Lightning Arrester, manufactured by the George L. Colgate Company, 136 Liberty street, New York, has met with constantly increasing favor among managers of electric power plants during this season. The sales largely exceed those of all previous seasons combined.

The Delaware Hard Fibre Company, Wilmington, Del., have recently more than doubled the capacity of their plant and are now running night and day. They have just been awarded the contract for supplying the General Electric Company with fiber.

New Beacon Lamps.

With the reorganization of the Beacon Lamp Company, Boston, the manufacturers of the well-known Beacon Lamp are now equipped to produce lamps in large quantities and at fair prices. Every variety of lamp for commercial use, including series, multiple and miniature decorative lamps, will be made.

Columbia versus Edison.

After numerous comparative tests made by a large central station in this country of the new type Edison and Columbia lamps, the results attained show that after 500 hours' burning the Edison lamps gave but 7 C. P., while the Columbia, after 600 hours gave 18¼ C. P. As a result of these tests an order was placed for 20,000 Columbia lamps, and a previous order for a like number of Edison lamps was cancelled. The net price for each Columbia lamp was five cents higher (or $1,000 on the total order) than the price of the Edison lamp but the purchaser did not hesitate to pay the difference.

Wheeler's Electric Switch.

This switch was invented by L. Wheeler, a motorman in the employ of the Sioux City Traction Company. The only one in operation is that at the junction of Pearl and West 7th street lines, Sioux City. The apparatus consists of electric magnets in a water tight box built of iron with wooden lining to hold the magnets firm and to separate them from the iron so as not to affect their magnetism. The rod connecting the armature with the switch tongue is enclosed in an iron case, which is screw fitted to the iron box with packing box at the end of the case. This rod is fitted with a device for lengthening and shortening if affected by the temperature, also with rubber cushions for lessening the concussions. This part is in the ground, about four inches below the switch. The car device for operating the switch consists of an iron tube supported in front by a hinge, and so constructed as conduct the return wire from the controller to a steel brush under the platform of the car. When the brush is up the return current runs to the ground in its usual course, but when the brush is down the return current passes to a false rail placed between the track rails about thirty feet from the switch and which is connected by wire with the electro magnets. The brush is held in position by a steel coil spring or weight, and is lowered by pressure of the foot on a treadle. If the switch is not in proper position just before the car passes over the false rail the motorman puts his foot on the treadle and causes the steel brush to come in contact with it, and as stated above, the return-current passes to the false rail, thence through the wire to the magnet, which pulls the armature to it and so turns the switch tongue. After passing the switch, if desired, it can be reset, thus leaving it as it was originally. In gathering up the points of the switch it will be seen that the car device does not interfere with the drawbar in any shape or form; that the return current is used; that the false rail can be placed far enough from the switch to enable the motorman to see that the switch is set before he reaches it, thus avoiding the necessity of ever backing the car because of a failure to throw the switch; that there is permanent magnetism enough to hold the switch tongue firm till the rear wheel and trailers have passed over the switch, thereby saving possible derailment and accident; that the switch can be reset at will, after the car passes over it; that in cold weather if the switch tongue is frozen fast and cannot work there is no possible chance for breakage as is the case when switches are operated by some mechanical device; that if the apparatus, or car device, gets out of order in any way a switch hook can be used as if no switch throwing apparatus were attached. The device can be attached to any electric car and not interfere with its work.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Augusta. Me.—Plans have been prepared by Architect John C. Spofford for a new city building to be erected here; the clerk of the city council can furnish detailed information.

Brooklyn, N. Y.—G. B. Dearing will build a seven story flat in Lefferts Place, east of Classon ave.....C. Welcher will build 4 three story apartment houses, north side of Granite st., east of Broadway....Benjamin Wolf will build 18 four story apartment houses, on east side of Powell st., south of Sutter; also a four story apartment house, southeast cor. of Powell st. and Blake ave.; also a four story apartment house, southeast cor. of Powell st. and Sutter ave.

El Paso, Ill.—A new Christian Church is to be erected here; the structure will be lighted by electricity.

Ithaca, N. Y.—Plans are being prepared by Architect Miller for a new residence to be built for O. L. Beane; specifications call for modern improvements.

Kansas City, Mo.—Plans have been prepared by W. W. Rose for a five story office building for F. T. Altman at 11th and Walnut sts.; two passenger elevators will be introduced.

Montpelier, Vt.—Work will soon be commenced on the erection of a new residence for H. S. Colton, on 1st ave.; the specifications call for the most modern improvements.

Newark, N. J.—Plans have been submitted to the committee of citizens who have organized for the purpose of building a new hotel in this city; estimated cost, $500,000.

Newburg, N. Y.—Plans have been prepared for the completion of the Federal Building in this city; Supervising Architect Aiken, of Washington, D. C., can be addressed.

Newport, R. I.—It is reported that a handsome country residence is to be built on Narragansett ave. in this place by Robert Goelet; every modern improvement will be introduced.

New York City.—A fire-proof mercantile eight story building will be erected at 118 West 34th st. for Amund Johnsen; Architect George Keister, 140 West 34th st....A five story fire-proof factory will be erected at 519-521 West 58th st. for W. and H. Zinsser; Architects Delano & Cordes, 130 Fulton st....Leopold R. Trou will build a seven story warehouse at 150 Bleecker st....Architects Flagg & Chambers have prepared plans for a skating rink and club house for the St. Nicholas Skating and Ice Co. at West 66th st. near Columbus ave; the structure will be provided with the latest improvements....Miss Serena Rhinelander, 14 Washington Square, will erect a three story club house, south side of 85th st., west of 1st ave.....Ormiston Tait has plans in preparation for a seven story apartment house at northwest cor. of West End ave. and 91st st. for Frederick Haas; the building will contain elevators, electric wiring, fixtures, etc....Architects Neville & Bagge, 215 West 125th st., are preparing plans for 2 five story flats, on 80th st., east of Amsterdam ave., for Joseph Cirrito; also for a five story flat and store building, which Bingham Bros. are to erect at 152d st. and St. Nicholas ave....Steven Upson, of Athens, Ga., will build a seven story apartment house, after plans prepared by a New York architect, at northeast cor. of 112th st. and 5th ave....Thomas E. Satterthwaite, 531 5th ave., will build five story brick dwelling, south side of 55th st., west of 5th ave....Henry H. Vail, 179 West End ave., will build a four story and basement brick dwelling at Riverside Drive and 75th st....Theo. A. Cordier, 1 East 166th st., will erect a five story brick store and flat building, at cor. of 166th st and 4th ave., at a cost of $141,000; Architect John Hauser....Plans have been prepared by C. P. Gilbert for a four story brick residence at Riverside Drive and 74th st., for George S. Macy, 61 Park ave.

Pittsburg, Pa.—A 16 story building is to be erected at 5th ave. and Smallman sts., to be known as the Park Building, for Wm. G. and David E. Park, Architect George B. Post, 33 East 7th st., New York City.

Rockford, Ill.—Bids will be received until August 31, by the Supervisors of Winnebago County, for a passenger elevator, direct acting, to carry 2,260 pounds safely at 200 feet a minute with a voltage of 250 at the engine and have a run of 31 feet more or less from the basement to the court room floor; all bids must include the plans and specifications and a full description of the elevator, also all needed changes in the building to put the elevator in place; Bernard Weber, chairman of Committee on Building and Grounds, 114 North Main st., Rockford.

Scranton, Pa.—An eight story office building is to be erected here at a cost of $150,000; Secretary D. D. Atherton can furnish detailed information.

Toledo, Ohio.—Architect Sturgis is preparing plans for a $35 000 music hall to be erected on Madison st. by W. H. Currier.

Washington, D. C.—Hause & Herrman will build a six story brick store at 901 7th st. N. W., to cost $50,000....Mrs. McKnight Moses will build a handsome residence at 2106 16th st. N. W., Architect W. J. Marsh.

INCORPORATIONS.

The Octoraro Telegraph and Telephone Company, with headquarters at Oxford, Pa, has filed articles of incorporation. The officials of the new corporation are: President, S. Ralston Dickey, Oxford; vice-president, Edgar L. McSparren, Goshen, Lancaster County, and secretary and treasurer, Eli McKissick, of Oxford.

Arrangements are being made to incorporate the Fayette County Telephone Company at Vandalia, Ill., with a capital stock of $5,000. An exchange will be established in Vandalia, and lines will be run from Ramsey and Shobonier and Brownstown and Hagerstown.

The Phœnix Telephone Company, Indianapolis, Ind., has elected the following officers: R. K. Syfers, president; Charles F. Smith, vice-president; A. B. Gates, secretary and treasurer, and George W. Stout, Charles A McCleary, E. M. Churchman and W. N. Gates, directors.

The Brothers Electric Cable Crane Company, Newark, N. J.—to manufacture, buy, sell and deal in electric cables, cranes, electric apparatus, cars, boats, engines, boilers, motors and all kinds of machinery, life-saving apparatus, etc. Capital stock, $6,000 Promoters: Wm. F. Brothers, Sarah E. Brothers, Brooklyn, N. Y.; Isaac R Brown, Jr., Maria A. Brown, Plainfield, N. J.

The Clarksville Cotton Oil Company, Clarksville, Texas—to manufacture and sell cotton and its products, supply the city with water and electric light, and manufacture and sell ice. Capital stock, $50,000. Promoters: D. W. Cheatham, J. M. Aydelotte, Jos. M. Sivley, John W. O'Neall, Clarksville, Texas; F. H. Bailey, Paris, Texas.

The City of Weatherford Water, Light and Ice Company, Weatherford, Texas—to supply water and electric light and motive power to the citizens', and manufacture and sell ice. Capital stock, $8 ,000. Promoters: M. H. Arnst, Platt V. Bryan, Elmira, N. Y.; G. A. Holland, W. P. Anderson, Weatherford, Texas; W. T. Hudgkins, Texarkana, Texas.

The Denver, Globeville and Golden Rapid Transit Company, Denver, Col.—to construct and maintain street railway lines, to operate by electricity, cable, gas, or any other motive power. Capital stock, $100,000. Promoters: Lewis E. Lemen, Geo. S. Parsons, Irving F Root, Denver; R. R. Lingo, North Denver; S. R. Wright, Highland, Col.

The Valparaiso Light and Fuel Company, Valparaiso, Ind.—to engage in the purchasing, owning, operating and maintaining of light, heat and power plants in Valparaiso. Capital stock, $50,000. Promoters: Chas. A. Sweet, Chas. Burgerson, E. F. Van Ness.

The Kokomo and Greentown Street Railway Company, Kokomo, Ind. Capital stock, $50,000. Directors: W. E. Snow, A. Avery, C. H. Hillon, J. S. McDonald, all of Detroit; F. H. Allen, of Kokomo.

The Mountain Electric Light Company, Summit, N. J.—to sell, build and operate electrical plants for lighting, heating and power, in Union, Morris and Essex Counties, New Jersey. Capital stock, $100,000. Incorporators: Carroll Bassett, Adolph Wagner and Frederick Green, all of Summit.

The Hinsdale Electric Light Works, at Chicago—to furnish light, heat and power. Capital stock, $2,000. Incorporators: Henry L. Gardner, Frank E. Bradley and Arthur M. Morgan.

The Electric Construction Company, Hartford, Conn.—to engage in general electric construction, and putting in telephones. Capital, paid up, $5,000. President, L. W. Fish; secretary, Harry P. Horne.

The Dunmore Electric Street Railway Company, Dunmore, Pa.—to build and operate a street railway between Dunmore and Scranton, and from Scranton to Carbondale. Capital stock, $75,000. Incorporators: P. J. Horan, of Dunmore, president of the company; I. H. Burns, E. J. Lynett, T. E. Boland and M. J. Sweeney.

The Mendota Light and Heat Company, Mendota, Ill—to furnish gas and electricity for light, heat and power. Capital stock, $25,000. Promoters: John Goedtner, Anton Kneigen, Geo. H. Madden, Newton Imus, Geo. C. Schuetz, Philip Erlenborn.

The Kane Electric Company, Kane, Pa.—to supply light, heat and power, or any of them, by electricity to the public in the borough of Kane, McKean County, Pa., and other persons, partnership, etc Capital stock, $1,000. Promoters: C. H. Kemp, F. A. Lyte, Joshua Davis, Thos. L. Kane, W. P. Weston, Kane, Pa.

The Argentine Water and Light Company, Portland, Me.—to manufacture and deal in gas, electricity and machinery, fixtures and apparatus, for gas works, water works and electric light works in the city of Argentine, Kansas. Capital stock, $150,000. Promoters: W. C. Eaton, Geo F. Noyes, Henry M. Verrill, all of Portland, Me.

The American Electric Fuse Company, Chicago, Ill.—to manufacture and sell electric fuse and fusible cutouts, and other electrical appliances. Capital stock, $25,000. Promoters: Eugene Hildebrand, Clarence E. Brown Ralph W. Bowman.

The Bennington Gas and Electric Light Company, Bennington, Vt.—to manufacture and distribute gas or electric light or both. Capital stock, $75,000. Promoters: Henry S. Jackson, Franklin S. Frisbie, Wm. H. Kimball, Geo. Senter, Benjamin V. Page, Boston, Mass.

The Washington, Woodside and Forest Glen Railway and Power Company, Washington, D. C.—to build and operate an electric railway. The officers are: Frank T. Browning, president; Julian C. Dowell, vice-president; W. Riley Deeble, treasurer, and Frederick Benjamin, secretary.

The Flavel Terminal and Townsite Company has filed articles of incorporation at Astoria, Ore. The object of the company is to build waterworks, electric railroads, warehouses, etc. Capital stock, $500,000. Incorporators: G. Wingate, Alfred Kinney and D. M. Stuart.

The Texas Telephone Company, Bonham, Tex. Capital stock, $5,000. Incorporators: J. G. McGrady, A. B. Cross and George M. Heard.

The Danville and Northwestern Electric Railway Company, Danville, Ill.—to construct and operate a railroad from Danville in a northwesterly direction through Potomac and Rankin, Vermilion County, to Gillman, Iroquois County, with a branch line starting north of Potomac northwesterly to Paxton, Ford County, and another branch commencing west of Danville, southwesterly to Fairmount, thence southerly to Sidell, Vermilion County, thence northeasterly to Georgetown, thence northerly to point on said line west of Danville. Capital stock, $100,000. Incorporators: William T. Cunningham, John W. Dale, William P. Chandler, W. S. Mathias and Robert Holmes, all of Danville; J. W. Layne and J. K. Butz, of Potomac, and W. W. Hatch, of New York City. The first board of directors are: W. T. Cunningham, William P. Chandler, W. S. Mathias, W. W. Hatch and Robert Holmes.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

AUGUST, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	11.40 P. M.	2	4.00 A. M.
2	......	..	....
3	12.40 A. M.	3	4.00 "
4	1.40 "	4	4.00 "
5	No light.	5	No light.
6	"	6	"
7	"	7	"
8	7.30 P. M.	8	9.30 P. M.
9	7.30 "	9	9.50 "
10	7.30 "	10	10.10 "
11	7.30 "	11	10.30 "
12	7.30 "	12	11.00 "
13	7.30 "	13	11.30 "
14	7.30 "	15	12.20 A. M.
15	7.30 "	16	1.00 "
16	7.30 "	17	1.10 "
17	7.30 "	18	2.10 "
18	7.30 "	19	3.30 "
19	7.20 "	20	4.30 "
20	7.20 "	21	4.30 "
21	7.20 "	22	4.30 "
22	7.10 "	23	4.30 "
23	7.00 "	24	4.30 "
24	7.00 "	25	4.30 "
25	8.00 "	26	4.30 "
26	9.00 "	27	4.30 "
27	9.40 "	28	4.30 "
28	10.40 "	29	4.30 "
29	11.00 "	30	4.30 "
30	11.30 "	31	4.30 "
31	......	..	....

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 13, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

544,283. Conduit for Electric Conductors for Railways. Frank L. Capps, Newark, N. J. Filed Sept. 18, 1894.

541,306. Conductor for Electric Railways. Paul C. J st, Chicago, Ill., assignor to Albert G. Wheeler, same place. Filed Feb. 6, 1893.

544,312. Trolley for Underground Electric Railways. Myron D. Law, Washington, D. C., assignor to Albert G. Wheeler, Chicago, Ill. Filed Jan. 31, 1894.

544,313. Traveling Contact Device for Electric Railways. John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Company, Chicago, Ill. Filed Sept. 5, 1893.

544,391. Electric-Railway Conduit System. Lorenzo H. Sherwood, Mount Vernon, N. Y. Filed Sept. 7, 894.

544,471. Trolley Wheel and Bearing. Edmond Verstraete, St. Louis, Mo., assignor of one-third to Ernest G. Bruckman and Samuel E. Bruckman, same place. Filed Nov. 22, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

544,331. Globe-Netting for Arc Lamps. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Sept. 18, 1894

544,503. Support for Incandescent Lights Charles A. Carmany, Middletown, Pa. Filed Sept. 8, 1894.

544,529. Electric-Arc Lamp. Richard H. Cunningham, Richmond, Va. Filed Sept. 8, 894.

544,578. Electric-Arc Lamp John H. J. Haines New York, N. Y., and Alexander B. Fernald, Jersey City, N. J. Filed Nov. 20, 1894.

544,579. Electric-Arc Lamp. John H. J. Haines, New York, N. Y., and Alexander B. Fernald, Jersey City, N. J. Filed Nov. 20, 1894.

544,6 4. Electric-Lighting Attachment for Gas-Burners, Frank A. Webb, Beverly, Mass., assignor of five-eighths to Rufus H. Woodbury and John B. Webb, same place. Filed March 11, 1895.

DYNAMO ELECTRIC MACHINERY.

541,289. System of Electrical Distribution. Stanley C. C Currie, New York, N. Y. Filed Nov. 27, 1893. Renewed Dec. 21, 1894.

514,339. Commutator Connection for Dynamo-Electric Machines. Henry H. Wait, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 1, 1895.

44,343 Magnet-Forming Machine. Orlando P. Briggs, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 20, 1894.

514,358. Commutator-Brush Holder. George J. Junker, Mount Vernon, Ill. Filed Nov. 9, 1894.

54 ,361. Construction and Method of Operating Dynamo-Electric Machines. Frederick H. Loveridge, Coldwater, Mich. Filed Aug. 2, 1894.

541,365. Synchronism-Indicator. Ralph D. Mershon, Pittsburg, Pa. Filed Nov. 2, 1894.

544,396. Winding of Dynamo-Electric Machines or Motors. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, of New York. Filed Jan. 27, 1894.

544,6 3. Combination-Dynamo. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 24, 1890.

TELEPHONE AND TELEGRAPH APPARATUS.

544,335. Telephone-Switch. Frank R. Whitney, Lewiston, Me. Filed June 30, 1894.

544,341. Multiple-Switchboard System. Oro A. Bell, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Feb. 21, 1893.

544,345. Printing-Telegraph. Charles L Buckingham, New York, N. Y. Filed April 16, 1894.

544,346. Printing-Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y.; said Germann assignor to said Buckingham. Filed Jan. 10, 1895.

544,347. Printing-Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y.; said Germann assignor to said Buckingham. Filed Jan. 10, 189 .

544,348. Printing-Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn N. Y.; said Germann assignor to said Buckingham. Filed May 20, 1895

544,369. Plug and Cord for Telephone-Switchboards Frank R. McBerty, Downer's Grove, assignor to the Western Electric Company, Chicago, Ill. Filed Sept. 18, 1894.

541,384. Single-Cord Grounded-Circuit System for Multiple Switchboard. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 1, 1 90.

541,385. Test-Signal for Multiple Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed July 7, 1891.

544,386. Telephone-Switchboard Apparatus. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 28, 1894.

544,388. Telephone-Exchange System. Charles E. Scribner, Chicago, Ill, assignor to the Western Electric Company, same place. Filed May 13, 1892. Renewed Feb. 11, 1895.

544,545. Signal Apparatus for Telephone-Exchanges. Joseph J. O'Connell, Chicago, Ill., assignor, by mesne assignments, to the American Bell Telephone Company, Boston, Mass. Filed April 17, 1893.

5 4,546. Apparatus for Telephone Exchanges. Joseph J. O'Connell, Chicago, Ill., assignor, by mesne assignments, to the American Bell Telephone Company, Boston, Mass. Filed April 17, 1893.

544,644. Fountain Ink-Roller for Telegraph-Registers, Charles A. Rolfe, Chicago, Ill. Filed Oct. 13, 1894.

SIGNALS AND SIGNALING APPARATUS.

544,387. Electromagnetic Signal. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 8, 1895.

544,567. Electrical Signalling Apparatus. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Sept. 24, 1894.

MISCELLANEOUS.

544,158. Vessel for Electrolytic Separation. Wilhelm Borchers, Duisburg, Germany. Filed Dec. 31, 1894.

544,224. Electric Alarm-Lock for Tills. Charles Helm, Indianapolis, Ind. Filed April 23, 1895.

544,278. Electric Rheostat. Francis B. Badt, Chicago, Ill., assignor to the Siemens & Halske Electric Company of America, same place. Filed May 31, 1895.

544,332. Electromagnetic Damper for Measuring-Instruments. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Sept. 18, 1894.

544,,368. Strong-Current Arrester. Frank R. McBerty, Downer's Grove, assignor to the Western Electric Company, Chicago, Ill. Filed May 31, 1894.

514,372. Manufacture of Electric Cables. William R. Patterson, Chicago, Ill. assignor to the Western Electric Company, same place. Filed Aug. 24, 1891.

544,373. Art of Drying Electric Cables. William R. Patterson Chicago, and Charles H. Rudd, Evanston, assignors to the Western Electric Company, Chicago, Ill. Filed Sept 30, 1894.

544,374. Art of Drying Cores of Electric Cables William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 18, 1892.

544,383. Electric Grounding-Switch. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 6, 1887.

544,430. Support for Electrical Batteries Used on Vehicles. Thomas Froggatt, London, England. Filed May 1, 1895.

514,486. Automatic Safety Appliance for Electric Conductors. Adelbert E. Hutchings, Detroit, Mich. Filed May 9 1893.

544,501. Cleat for Holding Electric Wires. Elisha W. Buffinton, Fall River, Mass., assignor of one-half to Albert F. Dow, same place. Filed March 15, 1895

544,514. Electric Gas-Lighter. Erik Or ing, Stockholm, Sweden, assignor to the Aktiebolaget Inventor, same place. Filed Feb. 5, 1895.

541,530. Apparatus for Insulating Wire. Tobias N. Hallanger, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 14, 1891.

544,531. Insulated Electric Conductor. Tobias N. Hallanger, Chicago, Ill., assignor to the Western Electric, Company, same place. Filed Feb. 18, 1893.

544,552. Electrotherapeutic Appliance. John E Wiles, Milwaukee, Wis. Filed Jan. 14, 1895.

544,610. Process of and Apparatus for Extracting Ores by Electrolysis. Edward W. Clark, Butte, Mont., assignor of two-thirds to Edwin M. Clark and the Western Iron Works, same place. Filed Nov. 5, 1894.

THE TELEPHONE WORLD.

The French Berliner Patents.

In view of the pending suit of the Bell Company against the National Telephone Manufacturing Company, alleging infringement of the Berliner patent, everything of an early date which may have a bearing upon the validity of the patent in suit is now of extreme interest. Among the earlier patents granted to Berliner himself are several French patents, which by their expiry have, as some suppose, invalidated the American patent bearing date of 1891, but applied for some fourteen years previously.

Below are given the specifications of these French patents which have been translated especially for our readers.

The first one bears date of January 8, 1880, and is French patent No. 134,481, for improvements in microphonic and telephonic apparatus, and reads as follows:

1. A microphone or contact telephone having no rubbing electric contact and having the electrodes maintained in contact with one another, with a variable pressure by the pressure exerted by a body moving or sliding freely by the action of gravity at an angle inclined to such contact, substantially as above set forth and for the purpose specified.

2. In a microphone or contact-telephone having no rubbing electric contact, the combination with a vibrating surface forming one electrode, of a pin forming the other electrode, and sliding freely on a suitable support inclined at an angle to the vibrating surface and connected to the battery in such a manner that its free movement on the support will not be interfered with, all substantially as above set forth and for the purpose specified.

3. In combination with a vibrating surface forming one electrode, the block A, provided with an opening or perforation inclined downwards to the vibrating surface, a conducting pin or cylinder having a carbon extremity and sliding freely in the said inclined opening so as to make contact at its extremity with the vibrating surface and a connection between said pin and the battery, which will not interfere with the free movement of the pin or cylinder, all substantially as above set forth and specified.

4. The combination of the diaphragm, the carbon block E, the damper H, the block A, the pin sliding freely in an inclined opening in the said block and the flexible conductor C.

5. A microphone or contact-telephone having only one contact affected by sound waves, and consisting of two electrodes in contact with one another, which contact is varied during its transmission of sounds by variation in the pressure upon such contact of a pendulous weight, which is kept out of its point of rest by the interposition of said electrodes and is supported in such a manner that there is no lateral movement or pressure between the electrodes.

6. In a microphone or contact-telephone, the combination of a vibrating surface forming one electrode, a pendulous weight forming the opposite electrode, with or without a device for changing the inclination of the same weight, and a band or ribbon of a flexible substance suspending the said weight, which band or ribbon may or not be a conductor.

7. In a microphone or contact-telephone, the combination of the flexible band O, or hinge, and the supporting strip L.

8. In a microphone or contact-telephone, the combination of the diaphragm, the carbon block E, the carbon tip b, the adjustable weight F, the plate I, the flexible band O, or hinge, and the supporting strip L, with or without the frame S and adjusting screw M 1.

9. In combination with a diaphragm of carbon or other material forming one electrode, the self-adjusting opposite electrode capable of sliding into contact with the diaphragm, and of being firmly fixed into position after having adjusted itself in said contact.

10. A damper for the diaphragms of microphones or contact telephones consisting of a ring of soft indiarubber or other elastic material held down upon the diaphragm by a screw passing through said ring.

11. The combination of a diaphragm of carbon or other material forming one electrode of the current with the opposite non-elastic electrode, capable of sliding freely toward the diaphragm until both electrodes come into contact with one another.

12. The combination of two opposite electrodes, one of which has its weight so regular as to exert pressure upon the other, and is capable of being firmly fixed into position.

13. The combination of two electrodes, one of which is fixed, and the other capable of sliding so as to exert by its weight a pressure upon the other, and capable of being fixed after regulating.

14. The combination of a diaphragm with a conducting block attached to it, the whole mounted upon a block provided with a perforation at right angles to the diaphragm, and combined furthermore with a movable electrode which, after contact with the diaphragm, may be maintained in place by the device shown in Fig. 12.

15. In a microphone or contact-telephone, an electrode suspended and maintained in place by a permanent magnet.

16. In a microphone or contact-telephone, the use of hardened carbon electrodes and their fabrication, as above set forth.

The second is an addition to the first and appears in the records as a certificate, dated July 1, 1880. It has the following claims:

1. In a microphone or contact-telephone the combination of a diaphragm, a damper formed of a flexible lever and a regulating screw resting upon the said diaphragm with two electrodes of variable contact placed between the tip of the said screw and the edge of the diaphragm.

2. In a microphone or contact-telephone the combination of a diaphragm forming one of the electrodes of the current with a suspended weight forming the opposite electrode, and with a device permitting the varying of the inclination of the suspended weight.

3. In a microphone or contact-telephone the combination of the diaphragm B, the carbon block P, the carbon piece b the weight F, the plate I, the flexible band or hinge O, bearing the plate N, the plate D and the regulating screw M.

The third, No. 159,049, dated December 8, 1883, contains the following claims:

1. A space or capacity containing a quantity of free particles or powder crossed by a current, and simultaneously compressed by a movable and variable weight applied to it.

2. The combination of the conducting powder M with the disk G, resting directly upon said powder and the disk E, perforated and covered with a platinum plate F, applied below the powder.

3. The combination of the parts described under 2, with the ring D and the conducting disk C.

4. The disposition mentioned under 3, combined with a weight in shape of disk G, provided with a handle, and with the speaking trumpet A, with a flexible tube.

The fourth, No. 160,930, of March 13, 1884, reads as follows:

I claim:

1. In a microphone where the variation of the contact pressure ordinarily takes place only at one point between the two poles of a galvanic current, the combination of two or several of these single contacts, through which pass simultaneously parts of the current of a battery.

2. The disposition of two or more single contact microphones upon the same diaphragm.

3. In a microphone, the combination of two or more pendulum contacts with pendulums of equal or different sizes and equal or different weights.

4. The dispositions of the claims under 1, 2, 3, or those of any of them, in combination with a diaphragm fastened to only one point of its circumference.

5. The disposition of the claims under 1, 2, 3, or those of any of them, in combination with a diaphragm suspended like a pendulum and adjusted by means of a movable screw, if so desired.

6. In combination with the claims under 4 or 5, the use of one or more springs or like accessories to regulate the vibration of the diaphragm.

7. The disposition of several microphonic contacts in pendulum shape upon the same rod, substantially as described above, and on the whole as represented in the four diagrams.

The last of importance is No. 174,835, of date March 17, 1886, and is intended to cover one form of the granular carbon transmitter. It reads thus:

My invention relates to that class of microphones or telephonic transmitters wherein a small quantity of conducting grains is enclosed in the electric current, and causes the latter to vary according to the number and the strength of the sonorous waves. I use in combination with that small quantity of conducting grains a vibratory plate, preferably of conducting carbon, as well as a piece of solid and conducting carbon which is sunk in the said grains. Furthermore, I make use of certain mechanical improvements, for the purpose of securing the best possible return.

The said improvements are as follows:

1. A bent, cone-shaped, sonorous funnel, of soft rubber or other similar elastic material.

2. A certain number of holes in the vibratory plate, which although too small to afford passage to the grains resting against the plate, allow nevertheless of a partial passage of the sonorous waves coming across the plate.

3. I enclose the said small quantity of grains in a chamber of a smaller diameter than the vibratory plate, and I provide that chamber with a soft protruding ring, which rests lightly like a cushion against the vibratory plate without being fastened to it.

4. I combine my apparatus with sliding bars enclosed in the circuit of the electric current, thus making it possible for the apparatus to be easily moved upward and downward for the convenience of different persons who may want to use it and moreover doing away with the use of flexible conductors for the electric current.

May Become One.

At the meeting of representatives of the telephone manufacturing companies interested in the organization of the Eastern Protective Association, which was held in New York on the 15th inst., no definite action was taken. There is a disposition to seek a union or amalgamation with the Western Association, and if there be no formal organization of the Eastern Association it is quite probable that the two associations will be resolved into one.

An agreement between the Citizens' Telephone Company, Pensacola, Fla., and the Southern Bell Telephone Company is being negotiated, whereby the members of the Citizens' Company will encourage the patronage of the Bell Company and discourage the establishment of any opposition for the term of five years, and suspend its efforts toward the construction of a telephone exchange in that city. As a consideration the Bell Company will reimburse the Citizens' Company for all money expended in securing its charter, and all other expenses, and return to each stockholder the full amount of money paid in; it also agrees to make a reduction of 10 per cent. from present rates to all telephone subscribers who will sign a contract to use the Bell Company's telephones for five years. This will make the net rates $36 and $27 per year. The Citizens' Company will not surrender its charter, but will keep it alive by annually electing officers.

The Blue Earth Valley Telephone Company, Blue Earth City, Minn., has secured local rights of way and will at once begin the construction of its plant. The line will be built from Elmore north, via all intervening villages, to a connection with the long distance telephones now in operation from Mankato to the Twin Cities, and will connect at Elmore with the Western Union electric system in Northern Iowa. A line connecting with the same will be built from Fairmont east to Wells, connecting all intervening villages in Faribault County.

A franchise has been granted to the Atlantic City Telephone and Telegraph Company, Atlantic City, N. J., conditioned upon free service in all city, fire and police departments and the payment of ½ per cent. of the gross receipts to the city.

The city council of Quincy, Ill., has granted a franchise to the Postal Telegraph Company. For the first year the company is to be free of tax; at the end of that time a special franchise tax of two per cent. on gross receipts is to be levied.

The new Standard Telephone Company of Baltimore, recently incorporated, is preparing to contract for the construction of a plant of 5,000 instruments, with facilities for an extension of an additional 5,000 'phones.

The Gratiot County Telephone Exchange Company expects to extend the line from Ithaca to Maple Rapids, Pompeii and other towns in Southern Michigan. A line to Alma and St. Louis is also projected.

J. B. Rice, of Sparta, and H. M. Fowle, of Tomah, Wis., will at once commence the construction of a telephone line from Sparta to Tomah, passing through Angelo, Lafayette and Tunnel City.

The Vermont Telephone and Telegraph Company, of Montpelier, Vt., organized in 18[illegible]8 under a special charter from the Legislature, has now nearly 2,000 miles of wire in use, with about 500 subscribers.

The Phœnix Telephone Exchange at Huntington, Ind., has been purchased by Charles F. S. Neal, Charles N. Zion and Philip Alder, of Lebanon, Ind.

W. D. Wilbur, John Troy, J. L. Daly and others, are interested in the establishment of a new exchange at Red Hook, N. Y.

F. A. Faxon, T. K. Hanna, W. F. Johnson and associates have applied for a telephone franchise at Kansas City, Mo.

A third line is being built by the Postal Telegraph Company between Philadelphia and New York.

Waycross, Ga., is to have a telephone exchange, work on which will begin as soon as a franchise has been secured.

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EDITORIAL NOTES.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

The Forbes-Rowland Controversy.

The Editor of ELECTRICITY received some days ago the following letter from the Editor of our English contemporary, *Lightning:*

To the Editor of ELECTRICITY,
6 Park Place, New York.

DEAR SIR: Referring to the reference, in your issue of the 11th ult., to "Prof. Forbes's Serious Charge," I think it only right to draw your attention to the first paragraph on page 102 of our current issue (8th August), copy of which has been duly sent you. On page 104 of the same number, you will see a letter from Mr. Francis L. Stetson, vice-president of the Cataract Construction Company, and on the first page a letter from Prof. Silvanus P. Thompson on the advantages of alternating currents for transmission of power purposes. Yours faithfully,

THE EDITOR.

Office of *Lightning*, 117 Bishopsgate Street Within, London, E. C., August 8, 1895.

In due time there came to hand the issue of *Lightning* for August 8—the issue referred to—containing in addition to the letters of Mr. Francis L. Stetson and Prof. Silvanus P. Thompson the following editorial, to which reference was made:

It seems as though we were never to hear the last of the Rowland-Forbes dispute raised by the interview we published last February. We opened the last number of ELECTRICITY (U. S. A.) a day or two ago, and found Prof. Forbes's letter to *Lightning* of July 11 there quoted, with this astonishing comment:

PROF. FORBES'S SERIOUS CHARGE.

In the "reply" of Prof. Forbes to Prof. Rowland, printed on another page, the former says: "The officials of the Niagara Company have informed me and others that he (Rowland) was employed only to get him to withdraw his opposition to alternating currents." This is a serious charge, the truth or untruth of which is a far more important matter to the community than any other question at issue in this whole matter. We expect Prof. Rowland to take such action as men of repute do when grossly libelled. It is, even if untrue, a public confession that the Niagara Company does not hesitate to resort to bribery in the conduct of its business.

When we showed the cutting to the professor he said he could not understand what it meant. As it dawned upon him that he was supposed to have stated that Prof. Rowland had accepted a bribe to report contrary to his convictions, his face was a curious study of mingled amusement, disgust and amazement. His explanation after that was quite unnecessary, but lest any of our readers should have understood him in the same sense as did the editor of our Transatlantic contemporary, we give it here. The officials of the Niagara Company were satisfied that the alternating current was the best to use, and that any competent man who fairly considered the subject would come to that conclusion. They believed Prof. Rowland to be competent, but thought that his adverse report was owing to an insufficient consideration of the merits of the alternating system. If they did not again employ him, he might well never give the matter further thought, nor, if he did, was there any reason that he should acknowledge that he had been wrong.

But his opposition, that of a man reputed to be the first authority in the States on matters electrical, was calculated to injure the prospects of the company, and it was well worth while to pay for his education in the theory and history of alternate current work, and so secure the withdrawal of that opposition.

Replying to this, we must say that we fail to see wherein Prof. Forbes has bettered his case much. In the explanation credited to him he has used somewhat less blunt language than in the original charge, but the accusation remains essentially the same as it was before, viz., that Prof. Rowland was employed simply to neutralize his opposition to the use of the alternating current at Niagara. The language of the first statement implied in a brutal way that Prof Rowland's employment was offered as hush money; the language of the present conveys the idea that Prof. Forbes and the Niagara Company employed a less direct method, and instead of simply putting a few bills into Prof. Rowland's hands, undertook to *educate* him at their own expense up to their way of thinking. The sequel showed that when Prof. Rowland had been sufficiently "educated" according to their ideas they refused to pay the legitimate tuitional expenses, and the professor had to seek redress in the courts. We think that the latter is scarcely less heinous than the former. But of the two men involved in this dispute we are sure that all fair-minded men would rather be in the position of the accused than in that of the accuser. Prof. Rowland's position before the public to-day is certainly one of more dignity than that of his accuser, Prof. Forbes. Prof. Rowland needs no apologist. No one who knows him would for a moment suppose that his silence could be bought for any sum within the gift of either Prof. Forbes or the Niagara Company. That he should change his opinion as to the merits of the alternating current is not to his discredit, and is doubtless due quite as much to advances in the art as to any "education" which he received at the hands of either the Niagara Company or Prof. Forbes. It certainly *is* to the discredit of the other side, however, if it is true, as alleged by Prof. Forbes, that the Niagara Company deliberately planned a bribe, and it makes very little difference whether that bribe as planned took the form of a cash fee or the form of an "educational" course.

Prof. Forbes is an able engineer and as such is honored by all in the profession. His abilities, however, do not extend to that control of personal action and utterance that are usually ascribed to great men and necessary in a gentleman. He has been very unfortunate both in expression and action, and whatever the results of the Niagara scheme prove to be, his friends wi l ever regret the position in which he has unnecessarily placed himself.

Particularly in his attitude to American engineers has he been unfortunate. A connection which should have cemented more firmly the professional bonds between engineers in England and America has through the mighty egotism of this stranger to professional etiquette but loosened them.

In view of the fact that it was an American waterfall, that it was American capital and enterprise that rendered the scheme of development possible, and the other circumstances, it would have been a graceful courtesy on the part of Prof. Forbes, even though he considered that no one in this country was competent to criticize his plans, to have first described those plans to an audience of American engineers. He saw fit, however, not to do this. That American engineers did not openly resent this snub does not imply that they did not appreciate it, but rather that the exceedingly bad taste displayed reflected more eloquently upon the snubber than could any words from their own mouths.

Fortunately for England, Prof. Forbes does not stand as a type of the English gentleman either here or in his own country. It is a great pleasure for us to be able to say that an insinuation that he does would be as quickly resented by American engineers as it would be in England. His almost brutal attack on Prof. Rowland, while placing the Niagara Company in a very unpleasant light, can but react against its author; and on second thought it occurs to us that Prof. Rowland can do nothing so dignified as to continue the silence which he has thus far maintained. But it does seem to us that the officials of the Niagara Company who have been thus involved in Prof. Forbes's ill-considered charges should either make good his assertions or clear their skirts by an unequivocal disavowal.

Our contemporary, *Lightning*, by its reference to the letters of Prof. Thompson and Mr. Stetson, seems to imply a belief that we ourselves question the wisdom of the choice of the alternating current for the Niagara scheme. Nothing could be further from the fact. We did question at the time the wisdom of employing the low frequency of 8½, and it is now well known that the Westinghouse Company absolutely refused to bid on the specifications containing this requirement. The frequency of 25 was a compromise between what the Westinghouse engineers then thought was best and what Prof. Forbes wanted. It seems that subsequent experience has not changed the opinions of the Westinghouse Company, for Mr. Stillwell in his *Cassier's Magazine* article says: "At present the only practicable way to utilize Niagara power for lighting purposes is by substituting motors for the engines now used in arc and incandescent lighting plants. . . . When the demand for current to be used for lighting purposes becomes sufficiently important to justify a change in the apparatus, . . . a certain number of generators of *higher frequency* may be installed."

Bell Company vs. National Telephone Co.

The impression prevails in independent telephone circles that the issue at law of the American Bell Telephone Company vs. National Telephone Manufacturing Company is a collusive suit, entered into with the implied, if not direct understanding that the defence will not be made strong or vigorous enough to convince the court that the Berliner patent of 1891 is invalid, and that the injunction will issue as a matter of course.

Electricity hopes the impression may prove to be an erroneous one, but in chronicling the fact that such an impression prevails deems it no more than fair to state the facts which have given rise to the feeling now existing among telephone manufacturers.

Ever since the decision reversing the finding of Judge Carpenter was handed down by the United States Circuit Court of Appeals, every independent telephone manufacturer in the field has been expecting such a suit as has recently been instituted by the Bell Company against the National Company. The telephone manufacturers realized quite as early as did the Bell Company the great importance of the rehabilitated Berliner patent. They know that if the Bell Company is able to maintain the validity of this patent the microphone transmitter will remain in the clutches of monopoly for thirteen years to come. They know, too, that if the opportunity is offered it can be demonstrated beyond all reasonable doubt that Judge Carpenter was right when he said: "The patent is void and shall be delivered up to be cancelled."

The independent telephone manufacturers have not gone into the business blindly. The majority of them are experienced in practical telephony; they are posted on patents and the practices and methods of the Bell Company, and have long been anxious and willing to have that company throw down the gauntlet. It is therefore to be expected that when issue is invited on a patent of doubtful validity these manufacturers would very much desire to obtain as full information as possible concerning the suit.

The papers in the National suit were served on August 6. As soon as the fact became known, the telephone manufacturers, and others interested in the development of the promising new industry, besieged the National Company with requests for information.

The following letter, written by Mr. J. D. Leatherbee, treasurer of the National Company, and received at this office, contained about as much information as any of the inquirers has been able to obtain:

> The undersigned gave to the Associated Press an outline of the whole matter to which you refer. It is a fact that the Bell Company has sued us, and that we shall contest the suit.

The information given to the Associated Press embraced nothing more than a brief statement of the fact that suit for alleged infringement of the Berliner patent had been brought. Almost simultaneously with the requests for information came offers of assistance from many of the leading telephone companies who were anxious to be made co-defendants in a suit the outcome of which is of vital importance to the independent telephone business. These offers have likewise been declined. Urgent requests to have the National Company identify itself with either or both of the Telephone Protective Associations have met with no encouragement, the officials of the company declaring it to be their intention to fight its battles unassisted.

A knowledge of these facts, and possibly others, coupled with a realization of the inequality of the contestants in this legal battle, is responsible for the lack of faith in the defence to be offered in the suit.

It should be borne in mind, though, that the Bell vs. National contest will be watched by the best legal talent that can be employed by the individual and associated interests of the independent telephone trades, as well as by Electricity. Should any evidence of collusion develop, the consequences will be remembered longest by those having the most to do with it.

Notwithstanding the persistence with which information as to the scope and character of the suit has been denied to those desiring to acquire the same, Electricity is able, in the current issue, to present to its readers the first publication of the full text of the bill of complaint.

* * *

The French Berliner Patents.

We printed in last week's issue translations of five of the earlier microphone transmitter patents granted to Emil Berliner in France, which it seems are relied upon somewhat by the opponents of the Bell Company to invalidate the American patent granted to the same inventor in 1891, declared invalid by Judge Carpenter and rehabilitated by the United States Circuit Court of Appeals.

It will be seen that all of these are strictly detail or species patents and are limited to specific methods of accomplishing what is broadly claimed in the American patent of 1891. Recurring to the latter, we find that it claims to cover "the method of producing in a circuit electrical undulations similar in form to sound waves by causing *the sound waves to vary the pressure between electrodes in constant contact* so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit."

The hope of the defence so far as these particular patents are concerned is based on the Bate decision, which settled once for all the question as to the limitation of an American patent by the expiry of the *same* foreign patent granted to the *same* inventor prior to the granting of the American patent. Just how broadly this principle will be interpreted by the courts remains to be seen. As already shown in these columns (p. 261, May 29,) there is another question involved, which has not yet been authoritatively settled, and that is the effect of a foreign patent granted to another person, or of a foreign *species* patent (which those under discussion undoubtedly are) granted to the same or another person before an American *genus* patent (which the American 1891 patent certainly is).

There seems to be some difference of opinion on this question among those whose opinions are entitled to respect, but the preponderance of opinion is that unless the foreign patent previously granted is for the same thing substantially, the American patent is *not* limited by the foreign patent, and that a foreign *species* patent does not limit by its earlier expiry an American genus patent, even though the two be granted to the same inventor. There, however, seem to be grounds for doubt in this case, for the courts, so far as they have expressed themselves, have differed. As already pointed out, in Commercial Canning Company vs. Fairbanks Canning Company, where this question was involved, the Court leaned to the view that a foreign species patent did limit an American genus patent when granted and expiring before the latter; yet the opinion on this point was not expressed with that clearness and decisiveness that are desired in a controverted question.

In the Government suit for the annulment of the Berliner patent a British species patent granted to Lake (Berliner's agent) in 1880 and expiring in 1894, was held by Judge Carpenter to limit the American patent. Other decisions could be cited where the opposite view was held by the Court, so that until the question is brought to a court of last resort it will remain an unsettled one. In the United States Circuit Court of Appeals, where it was hoped that an authoritative construction would be placed upon this question, it will be remembered that it was not considered at all, and that the Berliner patent was merely reinstated in the same position as that of any other patent issued from the Patent Office. The Berliner patent, therefore, starts out anew and without prejudice, and its validity must be maintained in the courts in the same way as that of any other patent. All previous litigation in regard to it practically goes for naught.

As regards the question as to the effect of the expiry of a foreign species patent upon an American genus patent it is difficult for us to understand how, where there is no question as to the character of the two patents—where there is no question that one is a species patent and the other a genus patent—there can be any question as to the ultimate answer.

Where an individual makes an invention, he aims to cover it as broadly as possible in his first patent, and then in subsequent patents to cover the specific means to the desired end. It certainly does not seem just that when an inventor has given to the world a new art, for instance, that he should jeopardize his rights by subsequent more specific patents which tend to increase the usefulness of that art, and we do not believe that this idea has ever been upheld by the courts. On the other hand it is a recognized principle in patent law that an *improvement* cannot dominate the thing improved. We need only cite the original Bell telephone patent as an illustration. It was for a method of transmitting articulate speech *by means of undulatory* electrical currents. In the earlier litigation it was once held by the opponents of the patent that it was invalid because it constituted a monopoly of the art. The reply of the Bell Company was, that if this were true it was but accidentally true, for Bell had merely patented one general or specific method, viz., by means of *undulatory* electrical currents, and that he was thereby limited to that method, all other methods were open to the public, and if the defence, or any one else, could find another method of transmitting articulate speech, they were welcome to it, and could use it without infringement. Now, subsequent to Bell's discovery some one else (let us say Berliner) discovered a new way by which sound waves could be translated into these undulatory currents of electricity. This method, in the language of the patent, was "by causing the same waves to vary the pressure between electrodes in constant contact." Assuming this patent to have been obtained by prescribed methods, in full conformance with the law, it was a good and valid patent, yet it was subservient to the fundamental Bell patent, and could not in any way limit the latter. Berliner by reason of his patent was not entitled to make and use telephones because the earlier patent of Bell's covered the very thing which made Berliner's device useful. Berliner's device was merely an improved method, or another method of accomplishing that which Bell had previously accomplished. Nor can it be successfully held, we think, that Berliner's patent is invalid by reason of its covering a principle. As with Bell, he patented a specific method for translating sound waves into similar undulatory waves of electricity. While this method happens to be one of the most convenient ones at present known, it is by no means the only method. Bell's original method is one, and there are various others; so that if the early Bell patent, which though specific and limited to a single method practically covered the art of telephony, was held to be valid against this argument, there can be little hope that the Berliner method, which is by no means so exclusive, can be adjudged invalid for the same reason.

We are among those who believe that the extension of the Berliner patent is in direct subversion of the intent of the patent laws and of public policy, and believe that if the defence in the suit against the National Company is conducted honestly and with ability it will be so declared. We look upon the conduct of the Government's recent case in annulment as having been almost insanely bungling, and trust that the case of the public in the present instance will not be the disgrace to the legal profession that the former one was.

Under the Searchlight.

Views and Opinions on Timely Topics.

"*As a voltage of* 10,000 *has proved to be entirely practicable, a territory within a circle of* 100 *miles diameter can be as easily served from a central point as can one town from its own plant employing the usual voltage.*"—Electrical World.

* * *

WE receive an occasional letter reminding us that Mr. H. M. Byllesby is no longer a factor in the electrical business, and raising the question whether it is good newspaper judgment to criticise him so severely. Some of our correspondents ask the question, What is the grudge which ELECTRICITY has against Mr. Byllesby? We have no grudge whatever against Byllesby, but an undying grudge against the wrong which Mr. Byllesby did in his capacity as agent for Charles A. Coffin in the Northwest swindle. Moreover, we do not see why any sympathy should be wasted on Mr. Byllesby. It is susceptible of proof that during his last year with the Westinghouse Company, from which he drew a high salary, he also received pay directly from Mr. Charles A. Coffin.

It will be remembered that at the historic annual meeting of the Westinghouse Company, held in Philadelphia, Mr. Byllesby had secured proxies on a large proportion of the stock, and then voted the stock to depose Mr. Geo. Westinghouse from the presidency.

There are also on record various other transactions of Mr. Byllesby, such as taking good collateral to the amount of $200,000 and putting it up with a bank for a $25,000 loan, the object being, of course, to cripple the Westinghouse Company as fast as possible.

If there is anything in Mr. Byllesby to entitle him to sympathy we do not know of it. He distinguished himself as one of the most proficient graduates in the school of crime conducted in Boston by Mr. Charles A. Coffin, and the records of the Northwest Company, now in our possession, furnish abundant grounds for an indictment of both Byllesby and Coffin in the courts of the State of Minnesota.

* * *

IN a letter directed to Mr. H. M. Byllesby by Mr. C. A. Coffin, a copy of which is before us, we find the following sentence: "I consider it a fair rule of business that the investor in our securities is entitled to a *fair share* of the profits of the enterprise." Who was to get the other share?

* * *

WE do not wish to question the good faith of the preferred stockholders of the Northwest Company who are in the movement to make Mr. Coffin disgorge, but we do question their judgment. Why not have a receiver appointed, in three States if necessary, and compel the production of the official records—those at least which are not now in the office of ELECTRICITY. No courts or receivers can get our originals. The whole world, however, can read ELECTRICITY, which will publish all the leading and pertinent facts.

* * *

How would Mr. Coffin like to explain in court his connection with the Butte General Electric deal? Has the firm of Byllesby & Levis been dissolved?

* * *

NEXT WEEK we shall resume the publication of original documents in connection with the Northwest G. E. articles. Our archives contain a complete record of the company from the original contract between Gilman and Coffin in 1888 down to the time when Mr. Byllesby was deposed from the presidency at an adjourned meeting in Schenectady and Mr. Howard Levis appointed in his stead. All financial statements, lists of stockholders, private reports of Gilman and Byllesby to Coffin, records of local plants, Coffin's letters of instruction, photographs of notes, checks, etc., are at hand, and will be printed from week to week.

NOTES OF A WESTERN TRIP.

The Field of One of the Thomson-Houston Financing Schemes Visited by a Staff Correspondent.

Among the banks used by Mr. Coffin to carry the Northwest enterprise along was the Euclid Avenue Bank of Cleveland, of which Mr. Charles F. Brush had been president. On August 29, 1893, the Northwest General Electric Company had on deposit at this bank $3,658.81, and had discounts from the bank amounting to $99,367.50.

The well posted electrical fraternity in Cleveland are considerably interested in the developments in the McIntyre matter at Philadelphia. The People's Traction Company bought 125 Sperry equipments, and at the time nobody could see just why. I understand that Mr. B. F. Miles, of the National Carbon Company, formerly an officer of the Sperry Company, is anxious that the entire truth be told.

Throughout the West and Northwest there is a universal feeling of jubilation. Crops of all kinds were never better, prices are fair, and the farmers will soon again have money to spend. They have had very little, as we all know, for two years. The great grain fields of the Dakotas were all harvested two weeks ago, and the crop is now safe. In Western Minnesota potato growers are taking in from 200 to 250 bushels to the acre.

One of the attendants at the Edisonian Convention at Detroit unmentioned in last week's report was Mr. Scott Hayes, who is, temporarily we hope, out of the electrical business.

Standing on the corner in front of the Great Northern Hotel in Chicago one evening I was accosted by twelve beggars in just ten minutes nearly every one of them able-bodied men. On leaving the depot at St. Paul almost the first thing to be noticed were the signs of the agencies proclaiming the want of help in the country all the way from St. Paul to the Coast. Hundreds of men were needed, and the wages offered were from $1.25 per day and board to $1.75 per day without board, with either free transportation or a very low rate.

The general feeling in Chicago over business prospects is better than at any time since 1893. The larger companies are busy now, and all the hustlers are ready to make their best efforts this fall.

There will be a general feeling of regret that the Appleton, Wis., Edison Company is being wound up by a receiver. This was the first Edison station in the world; a railway plant was also added. This was also a historic plant, being one of the earliest Van Depoele operations, the motors being mounted on the platforms of the cars. The station was run by water power, the further use of which was recently forbidden by the Secretary of War. Simultaneously a competing plant was hustling for business, and the old concern is ruined. Mr. A. L. Smith, one of the original promoters, was appointed receiver. There are $150,000 of bonds on the plant. While the company was in the worst of its troubles in regard to power, the General Electric Company garnisheed its revenues for July through the firm of Kurles, Spence & Kurles, of Milwaukee. The Appleton Company were trying to sell arc lights at $50 per year per lamp. Mr. Ord's instructions to the receiver are to sell the plant at once for whatever it will bring. He says, "What we want is cash." The company has a floating debt of $111,000, chiefly to the General Electric. By the way, I wonder if John I. Beggs, John Muir, and J. P. Ord have ever explained what became of the $6,000 paid to Mr. Beggs on the Appleton deal?

At Winona I found the street railway system in just about the condition I expected. Cars are no longer run on Sundays, the equipment is worn out and must soon find a resting-place in the junk shop.

At a ball game in Chicago I met Mr. Russell B. Harrison, who has made as thorough a study of street railway matters as his father has of politics—and this is saying a good deal.

At Oshkosh I went over the proposed route of a great interurban system connecting that city with Neenah, Menasha, Kaukauna and Appleton. I shall take pleasure in an early article in showing the foundation upon which the millions of securities of this system rest. The manufacture of bonds is not yet an obsolete branch of the railway business.

I was unable to meet Mr. T. A. G. Moe, who was so busy he was hard to locate. In addition to his duties as motorman on the St. Paul and White Bear Lake Railway, he is now burdened with the management of the system, having been appointed receiver.

One of the celebrities I met in St. Paul was Col. W. C. Plummer, whose mellifluous voice has been heard in Republican conventions in State and National affairs for a quarter of a century. Col. Plummer left Western Pennsylvania about 1880, and, of course, made his mark in the Northwest. He has been a politician and a rattling good newspaper man for so many years that nobody remembers just how long. He is taking a vacation this summer in St. Paul, and constructing language which he will hurl against his Democratic opponents in the Dakotas this fall when they venture to argue that the glorious yield of crops has been caused by a Democratic Administration. The Colonel's title has been changed since his removal to the West. In Pennsylvania he was called "Parson" Plummer. One time when he was on the Titusville *Herald* a printer died, and being a member of the Typographical Union and a communicant in the Roman Catholic Church, his priest refused to perform the burial service. Plummer volunteered to take the place of the clergyman. I recalled this incident to him, and he laughed heartily as he related that, after exhausting all his oratorical abilities to strike a sympathetic chord in the audience at the funeral, he was likely to fail entirely. But when the coffin was being lowered into the grave he said in pathetic tones, "Poor Jim Brady, he will never set any more bourgeois at thirty cents a thousand." At this the widow shed tears, and the assembled printers joined in the general chorus of grief.

The proprietors of the Depot Hotel at La Crosse, Wis., deserve a substantial memorial from the traveling public for the quality of meals which they serve. Few hotels in the country have better service, and no other railroad restaurant is to be mentioned in the same breath.

On the train from Chicago to St. Paul I met Jerry Coughlin, who has been a conductor on the Chicago, Milwaukee and St. Paul system for twenty-five years. He is now president of the Irish-American Bank in Minneapolis, and is reputed to be worth $250,000. I did not ask him where he got it. His salary is $1,200 a year.

Notwithstanding all the rumors to the contrary, I found things running very much the same at Butte. The faro and roulette tables have been taken in from the sidewalks, but the doors of the gambling establishments are still wide open, and the places are well patronized for 24 hours a day. We take it that the old-timers who visit Butte must imagine themselves back in the forties or fifties. The fine business blocks, of which there are quite a number, have been scattered among the mining shafts, and the town presents a strange composite picture. Most of the mining and smelting establishments run 24 hours a day, working three shifts of men of eight hours each. This furnishes activity for the gambling houses and saloons almost continuously.

The Butte General Electric Company gets $2.50 per month for a 16 candle power lamp, which seems high, but inasmuch as the plant is bonded for a half million dollars, and there are less than 20,000 people in Butte, including the floating population, it is not difficult to see where this enterprise must end.

The superficial observer would say that the street railway system of the Twin Cities is a veritable gold mine for the owners. It no doubt has been a gold mine for the promoters. When we reflect that in a community of 300,000 people this system has out about $27,000,000 of securities, the thoughtful man must wonder where the investor is coming out, even if the cars were running full for fifteen hours a day. However, one thing I noticed on the cars of the system is to be commended; it was an automatic attachment for closing gates and raising the platforms just before the car starts. The platform is dropped and the gates opened again instantly upon stopping the car. This is a device which ought to be universally adopted in all large cities.

After all the rubbish which has been heard and printed in the East during the last year or two in regard to the substitution of electricity for mules on the Erie Canal, and the expected improvement in canal service thereby, it was refreshing to note the sensible views on the canal question held by a majority of people in the Northwest—people who will be equally benefited with New York State in the ultimate solution of the great canal problem. There is very little talk heard in that section about electricity or any other make-shifts. What they want is a deep water passage-way to the seaboard, and they know that without that the canal problem will never be solved.

I met in St. Paul a former acquaintance, whose name I will not mention. He had been in Wall Street up to 1890, and while he had considerable money left he felt that the speculative fever was getting too strong within him and he moved to St. Paul to get away from it. He says he jumped from the frying-pan into the fire, and that the first venture he went into in St. Paul was a speculative one, in which he lost about half his fortune. He is now settled down, however, in a conservative business, and is looked upon as one of the leading financiers of the Twin Cities.

GEN. A. M. STOUT.

Gen. Alexander M. Stout, one of whose sons, Stanley S. Stout, is quite prominent just now in pending telephone litigation, died August 25, at the Presbyterian Hospital, Chicago. He was a native of Kentucky, and on the breaking out of the civil war raised the First Regiment of Home Guards of that State and subsequently raised and commanded the Seventeenth Kentucky Regiment. He took part in every battle in which his regiment was engaged, and received from his fellow officers a jeweled sword inscribed "For gallantry at Chickamauga."

After the war, Gen. Stout attempted to practise law at Louisville, but sentiment was so strong against him as a Union soldier that he found himself almost an alien in his native State. He became Acting Commissioner of Patents at Washington, and afterward practised law there until 1879, when he removed to Chicago.

THE NIAGARA PLANT AT WORK.

A dispatch from Niagara Falls states that on the 26th inst. the Cataract Construction Company for the first time put its machinery in operation for commercial purposes. On that day the 5,000 horse power Westinghouse dynamo (No. 2 was set in motion and the electric current generated by the mammoth machine was transmitted over an underground cable about a mile long to the aluminum works of the Pittsburg Reduction Company. Everything worked to the satisfaction of all who witnessed the significant event.

"Now that *American* engineers have utilized the Falls of Niagara for commercial purposes," etc., etc. So runs a paragraph in the *Hekker*, but Prof. Forbes will no doubt be astonished to learn that he is a Yankee, in spite of the fact that he pronounces Niagara as if it were Nee-a-gahra.

Apropos of Prof. Forbes and Nee-a-gahra, the self-advertising correspondence in the *Times* appears to have petered out. We were much amused at the egotism of the first letter of the series from the Professor. "*I* have received reports," "When *I* designed the 5,000 H. P. dynamos," "When *I* settled upon the machines," "*I* took upon myself a great responsibility," "*I* selected as manufacturers the General Electric Company," "Matters which *I* had to arrange for," "When *I* decided upon alternating currents," "When *I* adopted low frequency," and "*I* have been confirmed." There are so many I's about that it seems to us that Prof. Forbes must be the lineal descendant of Argus.—*Electricity* (London).

General Electric's Financing Policy.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

How Bonds are Manufactured for New England Investors.

CHAPTER VII.

The Plan of Establishing Local Electric Light Plants and Forming and Conducting Local Electric Companies Founded on Them.

In treating of the methods employed in establishing local electric lighting plants, and in forming companies to take them over and operate them, we shall at present confine our attention mainly to the operations in the Northwest connected with plants installed by the Northwest Electric Construction Company, the predecessor and progenitor of the Northwest Thomson-Houston Electric Company, and by the Northwest Thomson-Houston Electric Company and its successor, the Northwest General Electric Company. Subsequently we shall follow this discussion by a series of articles on the history of these three Northwest sub-companies, giving the details of their origin, conduct and of the financial transactions in which they engaged, and of the final utter collapse of the whole swindling scheme. In this series we shall show how thoroughly alike were the expedients for raising money employed by these companies and those used by the parent Thomson-Houston Electric Company, and *prove* that the resources of the sub and parent companies were identical and of the same worthless or shattered character, and will satisfy everyone that the means and methods employed in availing themselves of the use of these worthless or shattered resources to prolong their iniquitous existence were in all of these companies of exactly the same kind.

Still later we propose to deal with the whole general plan followed in building up the Thomson-Houston Electric Company's *factitious* and *fictitious* business; and show how and to what extent the many trust, fiduciary, banking, mortgage and loan and securities companies of this country were dragged into this scheme, and exactly *how* a very large number of electric properties of this country have been financed by the management of the Thomson-Houston Electric Company. In these articles we shall trace the origin and evolution of that company, and demonstrate by numerous examples taken from its actual career just how that company became the buccaneer, filibuster, pirate and debaucher of the entire electrical industry of this country, giving in detail the various means resorted to in the conduct of its business and the schemes devised and carried out with the express intention of fleecing the public and of endeavoring to force all other concerns to the brink of ruin, and to secure complete control of the industry.

Some of our readers may be prone to exclaim that this is all ancient history and of no present value or interest. They may admit that it may all be true, but claim that to discuss the matter *now* serves no useful purpose, and that the doings of the past cannot be accepted as an index of the methods at present in vogue, or be of any service in deciding upon what may be expected in the future. To them we reply that we will show that though the methods now used have doubtless been in some particulars changed by reason of force of circumstances and pressure brought to bear on the management of the General Electric Company (neither of which they have the power to effectually resist); it is nevertheless true that the general object and intentions of the management of that company are still the same as those which influenced the management of the Thomson-Houston Electric Company, and furthermore, the older and the more recent methods are substantially the same in effect.

But a moment's careful consideration of the subject ought to lead anyone to clearly perceive that these matters are not affairs of ancient history, but are of the utmost *present importance*, and of vital and immediate interest to all concerned in the prosecution of the business and conservation of the industry, and are also of the greatest moment to the trustees of estates, trust, mortgage and loan companies, fiduciary and banking institutions, widows and orphans, and investors generally. For is it not a fact that there is still in existence an enormous amount of these worthless or practically worthless so-called electric securities, and that efforts are constantly being made to dispose of them to the public through various financial institutions and also by companies expressly organized to float them? Furthermore, is it not absolutely true that the Thomson-Houston Electric Company's main source of strength, its power to set at naught the vested patent and business rights of others, and its ability to injure all those legitimately engaged in the industry, and to wrest from its competitors business not equitably belonging to it, rested not on any real, material or substantial originality in or superiority of the machinery, apparatus and appliances made and furnished by that company, or on legitimate superior business ability of its managers, or on the ingenuity, originality and skill of its inventors, designers and engineers, but rather on the capacity of its managers to raise vast sums of money almost entirely by the means and methods we have already portrayed, and which we shall much more completely delineate in the future?

Are not all the statements in the preceding question also true of the General Electric Company? The management of the General Electric Company is to all intents and purposes the *same* as that of the Thomson-Houston Electric Company. Is it possible to suppose that there has been such a change of heart as insures its complete conversion and the entire abandonment of its former iniquitous ways and methods? Are we to assume that the principles, or rather absolute want of principles, which characterized that management's former course have been essentially modified, and that its future career will be marked by an earnest desire to conscientiously abstain from all further attempts to wipe out by foul means honest competition, and to forever forswear the practice of chicanery, stock-jobbery, deception and fraud, and in the future strive to cultivate a spirit of justice and fairness to all competitors and good-will toward and sincere interest in the welfare of the users of electrical apparatus?

Are the many station managers of this country, who only a short time ago were threatened with complete destruction by the schemes worked by that management to induce the municipalities in which they operated to enter into the business as competitors, or by the inducements offered to gas companies to enter as competitors the very fields which their own licensees occupied and for which they had paid the Thomson-Houston Company and its allies so much money, to be deluded into believing that the management of the General Electric Company has completely changed its policy, and if so, that it has been done voluntarily and permanently?

Have the station men forgotten, or are they likely soon to forget, how the allied companies of the Thomson-Houston Electric Company were used (by the very same management as now directs the affairs of the General Electric Company) to harass, distress and render wholly unprofitable, and in many cases threaten with total destruction, the business which many of them had been induced to enter by the plausible stories of the prospective, and said to be certain, very large profits of the electric lighting business, ingeniously worked out and spread before them by the carefully coached agents and accomplices of this very same management?

Have the stockholders and managers of many of the local electric lighting companies in this country had obliterated from their memories all recollection of just how these allied companies of the Thomson-Houston Electric Company were instigated to enter the territory of which they had good and just and full legal grounds to believe they were the exclusive owners, by reason of the fact that they had previously purchased from the parent Thomson-Houston Electric Company, at exceedingly high prices, the apparatus, machinery and appliances used by them in the prosecution of their business, and had obtained full and exclusive license to its use in that territory; and that said allied companies in many cases used apparatus which to all intents and purposes was the same as that which they undoubtedly had full, legal, exclusive right to use, and how such infringing apparatus was sold to their competitors at a fraction of the cost which the pioneer company had paid?

Do the station men of this country fail to remember how these allied companies were further used to intimidate, browbeat or cajole their executive officers and stockholders into deals for the purchase of their apparatus, or into combinations with other companies using that apparatus in their territory in direct violation of the rights secured to them under the contracts with the controlling company?

Do the pioneer station men not recall the many terrible struggles for maintaining a bare existence, due largely to the defectively designed and badly constructed apparatus, which was in many cases wholly inadequate to stand the strains or incapable of meeting the requirements of practical use; and, further, how they were mulcted and bilked by the parent companies by grossly unjust and outrageously excessive charges for repairs to and renewals of parts of that apparatus to such an extent as to render it absolutely impossible in many cases to meet even their running expenses?

The time is not far distant since this same management had skilfully drawn and most carefully worded forms of contract, presented to and intended to bind the station men of this country hand and foot, to purchase from them, and them only, for a long period of time, such machinery, apparatus and supplies as they needed in the conduct of their business—whether or not that machinery, apparatus and supplies were equal or vastly inferior to that made by competing concerns. And if they did not accede to these conditions what might they be led to expect at the hands of the management of a 60,000,000-dollar parent company!

We believe that the dangerous fangs of that management may possibly be temporarily sheathed, but not destroyed, and there is no certainty but that, by some *new alliance*, the dangers threatening the station men of this country will be re-developed and appear with even greater virulence than ever.

If the dangers referred to, and unquestionably previously threatening all the station men and independent manufacturers of this country, have temporarily passed, it is only because of the inability of the managers of the General Electric Company to *raise the money* with which to pursue and carry out the course they had undoubtedly mapped out.

Full exposure of the rascally methods employed in the conduct of the business by the parent or manufacturing companies is the only real safeguard against the reappearance of these dangers; because it, and it only, will prevent them raising any large amount of money by illegitimate schemes, and moreover it forces them into a position in which they are compelled either to conduct their business as manufacturers of other appliances do, and depend for revenue on returns from actual sales, or it will force them out of the business; or, what is more likely, when the business reaches this condition, they, being no longer able to make money in it by their methods, will therefore desert it and turn their attention to other fields, in which their peculiar methods stand a better chance of yielding the kind of success they strive for. Hence we believe it our duty to the station men, independent manufacturers and others engaged in the equitable conduct of the various branches of the industry to continue the warfare on, and fully expose, the methods employed by these schemers; and we are firmly convinced that at some not far distant time the best men in the enterprise will recognize and concede that we have done a really valuable service to the trade at large.

In 1894 Mr. C. A. Coffin used the following significant language in his second annual report to the stockholders of the General Electric Company:

"The Edison Company to a small extent and the Thomson-Houston Company (the organization of which was mainly adopted by your company) to a greater extent had been in the habit of doing more or less exploiting work, resulting in the acquisition of stocks and bonds of local lighting and railway companies. The Thomson-Houston Company had generally been very successful in marketing these securities at profitable figures. By the facilities which it had thus been able to afford local enterprises it was enabled to expand its business. Your company at the time of its organization assumed a large number of such transactions which were in progress or contracted for. The general policy of your board, however, since the organization of your company, has been to curtail transactions involving the acceptance of stocks or bonds for anything other than license rights, except where for some special reason it has been deemed advisable to accept them, as in settlement of disputed or doubtful accounts.

"Among the most important transactions of the character above referred to were those with newly organized companies, and this class of business had been very extensive in the South and West. The financial and industrial collapse in these sections in the spring and summer of 1893 affected your company very severely, and very many accounts, notes and investments assumed as good a year ago must now be recognized as of diminished value. The same is especially true as to the Northwest, where your company's output was sold through the Northwest General Electric Company, formerly known as the Northwest Thomson-Houston Company."

The guarded admission thus made of the fact that the Edison Company to a *small extent* and the Thomson-Houston Company to a *greater extent* had been in the habit of doing more or less *exploiting work*, resulting in the acquisition of stocks and bonds, is of considerable importance in connection with the subject in hand. But it would have been nearer the truth to have stated that the principal, and indeed by far the larger part, of the Thomson-Houston Company's business was composed of what Mr. Coffin has chosen to term "exploiting work" rather than to designate it by its true name. Indeed, for years and (if strict regard be paid to the naked truth) ever since shortly after the organization of that company, it had mainly devoted its energies to doing an utterly illegitimate business in this so-called "exploiting work;" and in a thoroughly unsafe, unjust and iniquitous way it had indeed been "enabled to expand its business" and thus create an actually *false* and fabulous demand for its electrical apparatus for the purposes of stock-jobbery and fraud, and with the further intention, by resorting to these methods, of working the ruin of every other company or concern in the field, by making it practically impossible for them to sell their apparatus in competition with the Thomson-Houston Electric Company unless the managers of these competing concerns were also willing to adopt the same unsafe, vicious and nefarious policy and means of doing business, and to do so to the same or even a greater extent than did the management of the Thomson-Houston Electric Company.

We find ourselves greatly tempted at this time to go into a most detailed analysis of the statements made by Mr. Coffin in the language quoted from his second annual report to the stockholders of the General Electric Company, and other language used by him in that report and doubtless intended to convey the impression to their minds that *he* was *ignorant* of the actual condition of the properties referred to by him and of the condition of the Northwest Company, and was consequently blameless for their condition and conduct, and to compare these statements with the actual facts. It is, however, better to defer this analysis of his statements and a comparison of them with the facts until we have shown the actual condition of the properties and of the Northwest Company and the methods employed in the conduct of this latter named company.

The cases we discuss in the present series of articles will show how this "exploiting work" was done and upon what sort of a foundation these "local enterprises" were laid and by which the Thomson-Houston Company "was enabled to expand its business."

At the head office of the parent Thomson-Houston Electric Company, and at its sub or district offices, and at the offices of its associated or trading companies, there were a large number of men employed whose principal or sole duty it was to visit the various cities, towns or villages in their respective districts for the purpose of selling plants or endeavoring to erect stations and install local plants, or organize companies to do so, from which local plants electricity was to be publicly supplied for lighting, power and heating purposes.

Whenever a city, town or village was found without a local station for supplying electricity, or, for that matter, already had one in operation, and from which light or power was supplied by any other system or systems than the so-called Thomson-Houston systems, these men were authorized to take all necessary steps and incur whatever expense might be involved in securing a franchise from the municipal or village government, permitting them to establish, erect and maintain the necessary buildings and machinery, erect poles, posts, lamps, line wires, etc., required for the equipment and operation of a plant for the distribution of electricity to be used for the purposes of "illumination, heat and power."

Whenever any other company operating a different system did not already occupy the territory which was to be the field of operation, and whenever it was practicable, the franchise sought to be secured was to be an exclusive one, and was to be obtained for as long a period of time as it was possible to *induce* the city, town or village authorities to grant it. In addition to the franchise these agents, promoters or exploiters were instructed to also *induce* the municipal or village governments to sign an exclusive contract for the furnishing of a certain number (and as many as possible) of arc or incandescent lights, or both, for lighting the streets or roads of the city, town or village, and for as long a time as they could, and at such prices as circumstances determined or policy made necessary.

How the city, town or village authorities were in some cases *induced* to give such franchises and enter into such contracts will appear later.

In a very large number of cases these agents, promoters or exploiters secured the franchises, contracts and rights in their own names, and were expected, at the proper time, to transfer them either to the parent company or to the sub-parent company, or to the local company which was to be subsequently organized to purchase and operate the plant.

In most cases the parent company or the sub-parent company furnished all the money expended in obtaining the franchises and contracts and also all the money paid in purchase of land and erection of buildings and in purchase and erection of engines, boilers, etc., and furnished and erected all the electrical machinery, appliances and appurtenances common to electric lighting and power plants, the parent company or the sub-parent company, or both, charging on its books all actual expenditures, and for all material and machinery furnished to the plant, and carrying them as an asset in their accounts. In a very large number of cases they also paid all the operating and maintenance expenses, and furnished the means needed in effecting changes, or for extensions or improvements, the latter items again being charged on the books of one or both of the companies; and they continued to meet all running expense, and losses arising therefrom, and to carry the plant on their books until such time as it could be sold—if that time ever came, which was by no means always the case.

In the earlier period of the business in the Northwest the plan just outlined was the one generally, if not always, employed. And in pursuing this plan the Northwest Electric Construction Company, already referred to, put into operation a large number of local lighting and power plants in various cities, towns and villages in the States of Minnesota, Montana, North Dakota, South Dakota, Idaho, Wyoming, Washington, Oregon and the northern part of Wisconsin. A large number of these plants having been put into operation during the time the well known Mr. E. R. Gilman was president of the Northwest Electric Construction Company.

When Mr. H. M. Byllesby was sent by Mr. Coffin to St. Paul to take charge of the affairs of the Northwest Construction Company he found a large number of these local electric lighting and power plants carried on the books of that concern, most of which had been running at a heavy loss for a long time. It was, of course, impossible to continue to run them as they had been run, and equally impossible to dispose of them directly, or to realize anything from them in the way of money, or anything which could be used for the purpose of raising money. It was absolutely necessary, therefore, in order to meet the continuous heavy loss incurred in operating these plants, to devise some plan by which they could be put into such shape as to be capable of being utilized for the purpose of raising money. To effect this object a syndicate was organized for forming companies on these properties, and an account was opened on the books of the Northwest Company with this syndicate, and all these properties were transferred to the syndicate account. The syndicate thus became the nominal owners of the properties.

This syndicate then took the necessary steps to found companies on these properties, and as soon as a company was legally chartered the members of the syndicate, who were its only stockholders, met and proceeded to organize the company and to elect from amongst its members the board of directors, and these again elected their officers. The company so organized and constituted issued stock and bonds to the sub-parent Northwest Company in amount sufficient to pay that company for the book value of the plants, and the directors retained in their individual names sufficient stock to legally qualify them to fill their respective positions.

What was the actual value of these plants was indeed a very different thing from their *book value*, as we shall show later on.

Part of the stock and bonds so issued to the Northwest sub-parent company were then used to pay the obligations of that company to the parent Thomson-Houston Electric Company of Boston for the apparatus, machinery and appliances furnished and other items of indebtedness to that company, and were placed by this latter named company for disposal to investors in channels with which our readers are already familiar, or were otherwise used to raise money.

The syndicate referred to was composed entirely of the officers, clerks and other employees of the Northwest Company, and these men remained the virtual managers of the various local companies so organized, subject of course to the control and direction of the one master mind which had inaugurated and followed this same general scheme of financing electric properties in other sections of the country.

The actual running of the plants was turned over to two or more low salaried employees, who resided in or very near to the place where the plant was located, and who reported the results of its operation and made their returns to the sub-parent Northwest companies' head office, in St. Paul, on printed blank forms.

It will be noticed that this plan of "exploiting" local lighting stations, operating them and forming companies to conduct them did not depend, in the least, upon the ability of the company engaged in the scheme to induce the investment of one dollar of *local* capital in what was strictly a local enterprise. Nor did it depend on the direction or assistance in the subsequent management of the plant of a single person who was directly pecuniarily interested in the success or failure of the enterprise. The entire scheme was in fact one in which the whole of the capital necessary for establishing, maintaining and operating the plants was to be obtained from another and far distant section of the country, and the entire management and responsibility for the conduct of the enterprise was virtually absolutely in the hands of the employees of the promoting or exploiting foreign corporation engaged in *selling* electrical machinery and apparatus, which corporation was practically and actually under the control and subject to the supervision of the parent manufacturing company, the former company being legitimately mainly dependent for any material returns from its business on the profits due to the commissions on its value, and the latter named company being legitimately dependent upon the profits derived from the manufacture and sale of the machinery, apparatus and material made and sold by it.

As might be expected, such "exploiting" in a country with 3,602,990 square miles, with a population of some 62,622,250, very widely and quite thinly spread over that enormous area, and with some 99,000 cities, towns and villages, the field for operations of this kind was a very broad one indeed, and under these conditions could furnish an outlet for electrical apparatus, machinery and appliances which was truly remarkable and almost illimitable, and also gave unequalled opportunities for that kind of financing which has heretofore been (quite aptly we think) termed "Coffinesque."

THE CAUSE OF DEATH IN ELECTRIC SHOCK.*

BY A. M. BLEILE, M. D.,
Prof. Physiology, Ohio State University.

The work here given was undertaken with a view to elucidating the effects of larger quantities of electricity on the organism. Incidentally the value of artificial respiration after death by electricity was also tested. As this is the minor portion of the work, this part will be given first.

The data bearing on the subject in general are quite meager, especially as to the amount of current which actually passed through in fatal cases.

In all my experiments dogs were used, and in the subjoined table the weight, voltage, amperage and time are given for each case.

In the first experiment 525 volts, 2 amperes, were applied for 8 seconds; in the second, 220 volts, 1.2 amperes; in the third, 106 volts, .4 ampere, 10 seconds; in the fifth, 96 volts, .35 ampere, 2 seconds; in the sixth, 52 volts, .3 ampere, for 1, 2 and 4 seconds; in the seventh, 70 volts, .32 ampere, ½, 1 and 2 seconds, were used.

Before the application of the current a cannula was put into the trachea, so arranged that it could at once be connected with a bellows for the purpose of giving very complete artificial respiration. Respiration was set up as soon as the current was off, and this was continued for periods varying from 20 minutes in the first case to 2½ hours in the last, and in no instance was resuscitation accomplished.

Further work was carried on for the sole object of studying the effect of the current.

Our electrodes consisted of oval copper plates 3 by 2 inches, covered with sponges moistened with salt water. One electrode was applied at the base of the skull, and the other over the middle of the back, the hair of the animal having been previously well moistened with the salt solution. The current used was the alternating current of 130 periods per second. While the details of each experiment are given in the tables subjoined, a few are selected for special presentation. The larger voltages were abandoned for 100 volts, 70 and 50, as near as could be reached.

Ninety-eight volts with .32 ampere were applied first ½ second, then 1 second with recovery, but in two seconds produced death. Fifty-two volts with .3 ampere were applied 1 second, later 2 seconds, with recovery, then 4 seconds, producing death. Fifty-two volts, .24 ampere, applied 3 seconds, produced death. Fifty-one volts, .12 ampere, 4 seconds; 51 volts, .18 ampere, 4 seconds, were not fatal. Fifty-one volts, 2 ampere, 4 seconds, produced death. From these figures and similar ones to be obtained from the table, it is evident that the result depends, somewhat independently of the weight of the animal, on three factors: on the voltage, on the amperage and upon the time of application. A variation of either one of these factors may change the result—that is, a lower voltage with lesser amperage applied for a longer time will have the same effect as a current of higher voltage or more amperage applied for a shorter time. In this connection it was suggested by Prof. Thomas that the joules necessary would be found the same in each case, and calculations show that this is approximately true. To prove this absolutely it would, of course, be necessary to work with the minimum quantities as to voltage, amperage and time in each case, and no doubt one or another of these factors will be found in excess in most cases. In these experiments it is of great interest to point out this approximate relation between the results and the absolute amount of mechanical energy used. The results found on post-mortem examination of the animals were so uniform that they can be very briefly described. In all cases this examination was made immediately after death, and at first we wished to study the changes produced upon the heart, so that the incision was made through the chest walls and the heart exposed as rapidly as possible. This organ presented the following peculiar conditions. The left side was completely relaxed, the right side was intensely gorged with blood, as were also the large veins in the immediate vicinity of the heart, and the little appendages of the upper portion of the heart were found beating regularly, strongly and synchronously. Pressure on the heart caused a contraction of the other parts, and from this it was evident the death was not due primarily to the destruction of the heart fibers. In addition it was noted that the deep and extensive cuts made in the tissues were free from blood, and that the arteries were quite small and contracted.

This excluded a direct effect upon the heart, and, having shown by artificial respiration that the stoppage of this function was not the cause of death, other causes were to be looked for.

It was supposed that the current immediately struck the pneumogastric nerve stimulating those fibers which control the heart in that they have the power of arresting its beat when strongly stimulated. To test this view, resort was had to the hypodermic injection of atropine, the action of which drug is to paralyze the nerve fibers and thus prevent their action on the heart when stimulated. In one case $1\frac{1}{30}$ grains of atropine were given, 52 volts with .25 ampere were applied first for 2 seconds, then for 4 seconds, and this resulted in death. In a second case $\frac{1}{10}$ grain of atropine was given, 52 volts with .29 ampere were applied first 2 seconds, then 4 seconds, again resulting in death. These animals were not therefore rendered more resistant by the drug, and the theory as to the role of the pneumogastric nerve was abandoned.

I now recall the fact already mentioned that after death incisions into the animal are not followed by bleeding, that the arteries are contracted down to a very small caliber, and that the blood is crowded into the very large veins in the trunk. Taking these facts, it was suggested that the current acted upon the arteries through the nervous center which controls their diameter. It is well known that the arteries are supplied with a middle muscular coat in which the fibers are circular, and their contraction would of course cause a narrowing of the artery, rise of the blood pressure, and a consequent impediment of the heart's action; in fact it has been experimentally demonstrated that the arteries can be constricted to such an extent as to produce a rise of blood pressure which the heart is unable to overcome and that the circulation will stop from this cause. It is further known that we have in the brain most of the nerve matter whose function it is to control the vaso-motor nerves, the arteries at one time and in one place contracting and thus decreasing the amount of blood, at another time and in another place dilating and thus increasing the amount of blood getting to another particular part. To test this view, that the action of the vascular nervous system was the cause of death, we resorted to the hypodermic use of nitroglycerine. It is known of this drug that it powerfully affects the arterial system, causing, when given in larger doses, an extreme dilation of the arteries, and a consequent great lowering of the blood pressure.

The first animal received $\frac{1}{25}$ of a grain of nitroglycerine and, when the facts were fully established, a current, which was known to be fatal, was thrown in, namely 50 volts, .24 ampere, for 4 seconds, but the effects produced by this current soon passed off and there was complete recovery. Then 97 volts with .54 ampere were thrown in for 1 second but this caused death. In another case $\frac{3}{25}$ of a grain of nitroglycerine was used; here 25 volts, .22 ampere, a fatal dose, were thrown in for 4 seconds with recovery. One hundred and four volts, .6 ampere, were thrown in for 4 seconds producing death, but after the current was taken off there was noted 8 deep although irregular respirations. In other cases where the nitroglycerine was used, there was no apparent effect, but some investigation led me to attribute this to the unreliability of the tablets of nitroglycerine used, and this drug was thus abandoned for nitrite of amyl, a substance which has the same physiological effects as nitroglycerine but which can be always obtained pure, and the effects of which can be more accurately regulated because it is given by inhalation. In the first case the animal was brought moderately under the influence of the nitrate of amyl; 52 volts with .24 ampere were thrown in for 3 seconds (this by the way being a fatal dose ordinarily) without producing death. Fifty-two volts, .25 of an ampere, for 4 seconds, also a fatal dose, failed to produce death. Fifty-two volts, .3 of an ampere, for 6 seconds, produced death, but after the current was taken off, the animal made 22 deep, regular respirations though not a trace of the heartbeat could be made out, this incidentally proving that stoppage of the respiration is not the primary cause of death.

Three more experiments may be selected. Numbers 24, 26 and 27 of the table.

No. 24 was a pointer dog in excellent condition, weighing 34 lbs. Nitrite of amyl was given until the effects were fully marked. Fifty and five-tenths volts with .2 ampere were given for 3 seconds; after a pause the same quantity was given for 6 seconds, followed by recovery. Three days later the same dog, who showed no effects at all of the previous treatment, was given—without the nitrite of amyl—51 volts, .2 ampere, 4 seconds, producing death.

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*A paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

In the last case a dog weighing only 12 lbs. and of such general condition of weakness that the assistants protested against his use as not being competent to demonstrate anything, was given a full dose of nitrite, then 50 volts with .6 ampere were applied for 4 seconds and followed by recovery. The dose applied for 6 seconds produced death, and here again several respirations were noted.

The statements made in regard to the cause of death by electricity are so at variance with one another that it is unnecessary to review them here. Among other plausible reasons it has been stated that the current has a direct disintegrating effect on the brain and nerve tissues and that herein is to be found the cause of the fatality. The disintegrating effects of the current on the brain and nerve tissue said to follow are not to be seen microscopically and the microscopic examination of these organs so far as made by us failed to reveal any change in their structure. It would appear therefore that death in electric shock is entirely due to the fact that the current produces a contraction of the arteries through an influence on the nervous system, and that this constriction of the arteries throws in such a mechanical impediment to the flow of the blood as the heart is unable to overcome, and that, where drugs are given to counteract this effect, much larger doses of electricity than the ordinary can be borne. While artificial respiration may be of value in simple stunning, when larger doses have been taken, no rational means of resuscitation have as yet been suggested.

I was enabled to carry out the above experiments by the loan of apparatus kindly furnished by Prof. Thomas and was greatly assisted in the work by Mr. Boyd, of the Physical Department, who was present at every experiment and who made the measurements for us.

The current was obtained from a surface wound alternator giving an approximate sine-curve. For potentials of 100 volts or less, connection was made with the secondary of a suitable transformer. Potentials of over 100 volts were taken direct from the primary circuit, adjustment being made by varying the generator field.

No.	Weight (lbs.).	Volts.	Amperes.	Time (seconds).	
1	21	325	2	8	Artificial respiration 40 min.—Death
2	15	220	1.22	8	Artificial respiration 25 min.—Death.
3	30	106	.6	10	Artificial respiration 1 hr 15 min.—Death.
4	40	98	.4	4	Artificial respiration 2 hrs. 30 min.—Death.
5	27	96	.3	2	Artificial respiration 1 hour—Death
6	21½	52	.3	1 2 4	Recovery Recovery Death
7	20	70	.30	.5 1 1 2	Recovery Recovery Recovery Recovery
8	40	47.5	.25	4	Death.
9	35	96	.35	1	Death.
10	30	57	.25	2 4	1-30 grain atropine { Recovery Death
11	28	52	.29	2 4	3-60 grain atropine { Recovery Death.
12	26	50 97	.24 .54	4 1	1-25 grain nitroglycerine { Recovery Death
13	30	48	.22	4	1-20 grain nitroglycerine—Death.
14	33	52 104	.20 .6	4 4	4-50 grain nitroglycerine { Recovery. Death.
15	20	51	.34	4	6-50 grain nitroglycerine.—Death.
16	22	47	.2	4	1-10 grain nitroglycerine.—Death.
17	27	52 106	.2 .55	4 1	1-10 grain nitroglycerine { Recovery. Death
18	36	51	.25	4	80 grains chloral 1-50 grain atropine } Death
19	30	52	.24	3	Death.
20	52	52	.24 .25 .30	3 4 6	Recovery. Recovery. Death. (22 deep respirations.)
21	25	50.5	.2	3	Death.
22	29	51	.2	3	Small dose nitrite of amyl.—Death
23	17	51	.2	3	Small dose nitrite—Death.
24	34	50.5	.2	3 6	Full dose nitrite { Recovery. Recovery.
25	38	50.5 101	.2 .2 .5	4 6 2	Full dose nitrite { Recovery. Recovery. Death.
26	34	52	.12 .18 .2	4 4 4	Recovery. Recovery. Death.
27	22	50	.2	4 6	Full dose nitrite { Recovery. Death.

Voltages were measured by means of a Weston A. C. voltmeter. The mains supplying the current were of low resistance, so that the drop when the circuit was closed was found to be negligible. The figures given are the actual potential differences of the electrodes while the current was flowing through the animal, correct to within one-half volt. A Siemens dynamometer was used for measuring the current when the time of contact was less than four seconds. It was somewhat difficult to make a setting, so that readings for those short times can not be taken as correct within five per cent.

The Electric Light and Power Installation for the Railway Stations and Workshops at Dresden, Germany.*

The plant of the Dresden railway stations, the general features of which were briefly described by the writer (Dr. Ulbricht) in the *Elektrotechnische Zeitschrift* in 1893, began working on April 24, 1894, although at that time the plant was not provided with its full complement of machines. It has now four large alternators at work, of about 300 H. P. each, and room is left for the introduction of another if required, which will probably be of 600 H. P.

The object of the plant was to supply a number of railway stations for passengers and freight with light, as well as to supply power for a large number of motors used for driving machinery of all sorts in the construction and workshops about the stations.

The electrical machinery is the work of the Siemens & Halske Company of Berlin and is of the most advanced order.

The three rotary current or drehstrom dynamos are coupled each direct to the spindle of the engine that drives it. The armature is a fixed structure, and the field magnet system revolves inside the former. The armature windings consist of copper rods that are passed through the fixed iron ring of the armature, and this as well as the field magnet cores are built up of laminated iron and bolted together in sections. The normal voltage of these machines is about 150 and the maximum output is 220 K. W. There are 60 field magnets on the revolving ring, so that at 100 revolutions a minute the frequency of alternation will be 100 pulsations or reversals a second.

As seen from the picture of the drehstrom dynamo, Fig. 1, the exciter is an ordinary direct current machine of the Siemens & Halske make, the revolving part of which is carried upon the prolonged axis of the main dynamo. These exciters can give about 180 amperes at 110 volts. As the exciting current for each of the three dynamos is about 50 amperes, one of these exciters is about equal to the task of supplying, if need be, the fields of all four dynamos. However, to enable the ready substitution of one of these for the other in any field, their separate circuits are led to a special switchboard from which emanate the field circuits of the main dynamos and where any desired system of connections can be made at will. Usually two of these exciters are connected for the field excitation of two machines each, and the remaining two are used for lighting about the power house so as not to disturb the external circuits with this changing load.

The electric system finally chosen for this work is a modified drehstrom or multiphase current one. The various demands upon the different circuits, with so many motors everywhere in operation, at first suggested the use of the Drehstrom plan pure and simple, but the well-known difficulty of balancing the currents in the three different circuits under such varying conditions of load led the projector of this plant, Dr. Ulbricht, to consider seriously some other system than the drehstrom, with a view to obtaining a more efficient and reliable regulation; and upon his recommendation extensive experiments were conducted under his supervision at the Siemens & Halske Works to determine whether the system he had proposed was better adapted to a suitable regulation than the well known drehstrom. These experiments gave such gratifying results that the adoption of the modified drehstrom or "Ulbricht" system was decided upon, which in plain terms is one in which a single alternating current is used in the ordinary way to supply the entire lighting circuit, while a third or auxiliary circuit, having an

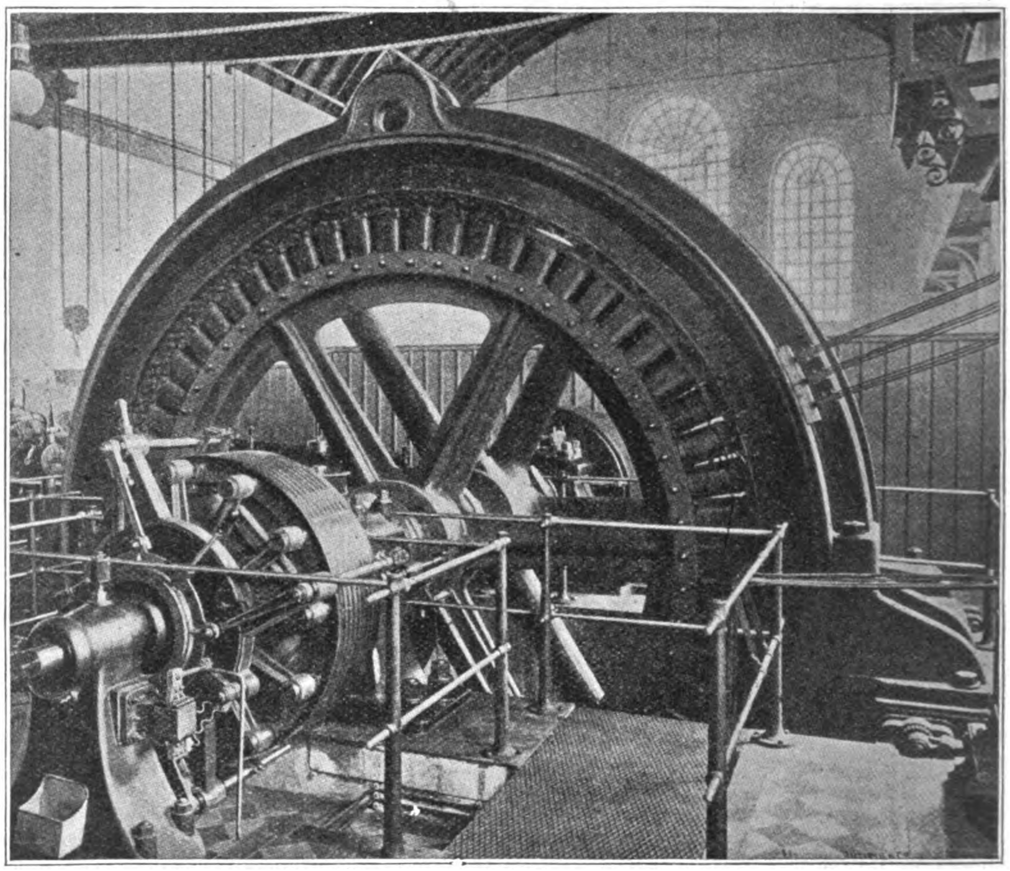

FIG. 1.—DREHSTROM DYNAMO.

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* Abstracted from the "Elektrotechnische Zeitschrift" of July 4 and 11, 1895.

independent armature or generator winding, is connected one end to the middle of the other or principal armature winding, and its outer or free end through the usual sliding ring contact to the external auxiliary circuit. If now a circuit is connected from this auxiliary external line across to both the other lines of the main or light circuit, these circuits will have currents of different phase in them, and they will both differ generally by unlike amounts of phase difference from a circuit connected across the light leads. When, therefore, we connect an ordinary three-phase motor to the three external leads in the manner just described, it will be supplied with three currents not exactly in triphase relation, but nearly so, whence we see that so far as the power supply is concerned the system is nothing more nor less than a modification of a triphase system in which one circuit alone is used for the light supply and all three for power. It is also evidently identical in every particular with the much discussed "monocyclic system" of the General Electric Company, which is thus clearly shown to have been in use on a commercial basis in Europe nearly a year before any mention was made of it in the United States.

Since November last the practice has been to run a single drehstrom machine during the daytime for power service only and such lights as might be under immediate control of the works. At the beginning of twilight, first one machine is started up as a single phaser for the light supply, and as the load increases others are successively connected in the same way. So far as tried, the mixed service of light and power in the same circuits has given satisfaction, but the final test and proof of the system will have to wait for the completion and operation of the 40 H. P. lifting cranes in the harbor which will be put to work in a few months. So far, however, the plant has worked without interruption since first starting up, and the light and power loads have been constantly increasing until the monthly output now is 34,000 kilowatt hours for light service and 11,000 for motors. During the present month, however, the light service will be increased to 60,000 K. W. hours per month by adding the service for the passenger station at Dresden Altstadt, where seventy more arcs, a great many glow lamps and five motors for elevators will require current.

In this plant the extensive motor service is of special interest by reason of the great variety of work performed, as well as by the scattered nature of this service over a large territory.

In the circuit belonging to the workshops there are now forty-four motors, from 1 to 20 H. P. each, and aggregating a total output of 183 H. P.

These motors are the regular Siemens & Halske three-phase motors as built for ordinary Drehstrom service, and are all provided with a starting resistance which is introduced into the armature circuit until the machine has acquired its normal speed under load.

One of the many uses that electricity has been put to is for thief catching, and it has just served to relieve the employees of a large factory on the west side of Chicago of much uneasiness in regard to the missing of articles of raiment and money from the dressing room of the girls' department. A trustworthy girl was taken into the confidence of the management, and a double wire was sewn into the lining of her cloak, connecting a spring jaw in the pocket with the two hooks on which the cloak hung. From these connecting wires were carried under a molding through the floor to a single cell battery, and a bell placed in series was hidden in the room where the girls were at work, 50 feet away. A purse was put at the bottom of the pocket, which could not be molested without sounding an alarm, and the trap was set. In about three hours the bell rang and the owner of the cloak, hurrying to the dressing room, found one of the factory girls in the act of rifling her purse.

LOCATION OF GROUNDS IN ARMATURES, FIELDS, ETC.*

BY CLARENCE E. GIFFORD.

This paper presents no novel scientific principles. The methods herein described are but simple adaptations of the principle of the Wheatstone bridge. They have been in use by the writer for several years, and he, having devised them for his own use, and found them very rapid, accurate and simple, is led to believe that they may be of considerable service to others. The *Electrical World* "Digest" of March 16 notices a slightly similar, but evidently less perfect method, published by Mr. Bronsson in the London *Electrical Review*. The insufficiency of Mr. Bronsson's method in cases where two grounds at some distance apart exist is admitted. The methods herein described deal successfully with such cases.

If the work can be performed in a very quiet room, two or three cells of battery, a telephone receiver and connecting wires comprise the necessary apparatus. In some cases two "table binding posts" and a foot or two of No. 18 or No. 20 bright iron wire will be a convenient addition. Where noise will not permit the use of a telephone, a dead-beat reflecting galvanometer, a millivoltmeter, or some other form of delicate and rapid working visual indicator must be used instead. If an armature is to be tested without removing it from the machine, connection with the battery may be made through the brushes, first making certain that the short-circuiting switch is opened, if dealing with an arc machine. The points of connection with the battery need not be diametrically opposite, and may be made by the wires being firmly pressed against the commutator by an assistant, if more convenient.

Good electrical contact between metallic surfaces can better be secured by cleaning the same thoroughly with kerosene, which removes foreign matter, and is so fluid that it will in no way interfere with perfect contact when moderate pressure is applied. Especially when making measurement of resistance of armature sections, it is even advisable to have the surface of the commutator quite wet with kerosene during the operation, as this avoids trouble from grease or dirt which might get on the surface from handling subsequent to cleaning, and it also prevents the contact points becoming oxidized by any sparks which may occur at the moment of breaking contact. True, the oil is an insulator, but we use it in this case as a detergent simply.

Returning to the armature: connection being made between battery and commutator, first determine whether the armature circuit is complete throughout. If the circuit is complete, a click will be heard in the telephone when the two terminals of the same are brought in contact with any two contiguous bars of the commutator, or when contact is broken. If an open circuit exists on either side of the circuit, of course no sound will be heard in the telephone when used on that side, except when connection is made or broken by it between the bars lying on opposite sides of the break. See Fig. 1.

Close any open circuit temporarily by bridging between the two bars with a drop of solder. Two or more breaks can evidently be located by suitably shifting the battery contacts and searching as before. Open circuits will, of course, when an armature continues in work, soon cause burns between the bars that will indicate unmistakably their location. Having closed any open circuits, and the battery being connected to two points of the commutator approximately opposite each other, one terminal of the telephone is connected to the armature shaft, or frame of the machine, and the other terminal is drawn completely around over the surface of the commutator, while the telephone is held to the ear. If only one ground exists, two balancing points, or points giving the least noise in the telephone, will be found.

In an armature of ordinary construction, one of the points so found will be on the bar nearest the real ground, while the other balancing point bears what might be termed a "bridge relation" to the first, being at practically the same potential; the armature itself forming in reality a veritable Wheatstone bridge.

Now, shift the points of battery contact a few bars either way and the true ground, if but one exists, will be indicated in precisely the same position as before, while the other balancing point will shift every time the battery contacts are shifted. See Fig. 2.

If two grounds exist, two balancing points will be found, as before, but both points will shift more or less when the battery contacts are shifted, provided the grounds lie on opposite sides of the same battery contact. This case will be considered later.

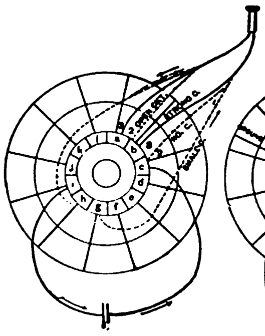

FIG. 1.

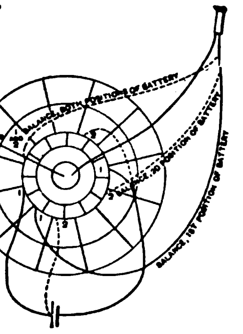
BALANCE, BOTH POSITIONS OF BATTERY
BALANCE, 2D POSITION OF BATTERY
BALANCE, 1ST POSITION OF BATTERY
1
2

FIG. 2.

In the case of one ground, having determined its location approximately, fix it as closely as may be by making and breaking contact with the telephone terminal on each of the more quiet bars, separately, until by comparison the two giving the faintest clicks are determined. If your hearing has served you correctly, these two bars lie nearest the trouble, the fainter one being the nearer. Prove the non-existence of a second ground by placing one of the battery contacts on the first bar to the right of the apparently permanent balancing point just found, and then on the first bar to the left of said point, the other contact being nearly diametrically opposite. This balancing point should still remain unchanged if no other ground exists.

The next step is to connect the battery to these two bars just fixed upon as lying nearest the trouble. The armature still forms a "bridge," the portion included between the two continuous bars to which the battery is now connected forming the one side, and the remainder of the armature the other side. See Fig. 3.

One of the telephone terminals is now connected to the shaft as before, and the other terminal again drawn around the commutator. If the balancing point is found, say one-sixth to one-half the long way around from one battery contact to the other (these contacts being on two contiguous bars), the trouble lies in the coil between those two bars, and the point of trouble divides the coil in the same ratio as the balancing point divides the remainder of the armature, the ground and the balancing point being respectively nearest the same battery contact. If the balancing point falls on the same bar as one of the battery contacts, the ground is located on that bar or on the lead between it and the armature, provided the balancing point is found to be upon the same bar when the battery con-

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[*] A paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 25, 1895.

tacts are both shifted one bar to the right or left of their original position. See Fig. 4.

If the balancing point appears to be found within three or four bars from one of the contacts, the precaution should be taken to test its correctness by moving both battery contacts one bar toward the balancing point. If the trouble was between the battery contacts when in their previous position, this shifting of the contacts will now throw the balancing point clear around onto the contact which was in the previous position farthest away from the balancing point. If, on the contrary, the balancing point remains unmoved by this shifting of the battery contacts, it shows that this balancing point is the point nearest the real ground, and that the ear was deceived in its first supposed approximation, which, with due care, however, is not likely to occur.

If such error has been made, the new point, as indicated, together with first the bar on one side of it and then on the other, must be tried as points of battery contact; or, much better, make a new start with the contacts nearly at opposite sides of the commutator, and proceed as before. A single 20,000 ohm ground on a one ohm armature should be located accurately in not over three minutes, in a quiet room. Higher resistance grounds require more battery and more care. Armatures of very low resistance also offer greater difficulty.

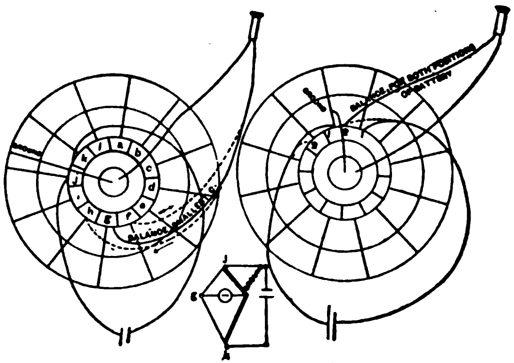

FIG. 3. FIG. 4.

Where two grounds are found to exist, as indicated by the change of location of both balancing points, under the conditions before stated, when the battery contacts are shifted, the following mode of procedure will answer the purpose well, and is simple. Fix the battery contacts at any two points of the commutator nearly opposite each other, preferably at points to be determined by trial, that will cause the balancing points to fall nearly diametrically opposite to each other, and determine and mark the two balancing points, as then shown. Now place the battery contacts on the balancing points just found. If only one ground exists, the two balancing points and one battery contact will all be coincident in one point. If two grounds exist, both balancing points will be shifted from their former position. Open the armature circuit by unsoldering one of the ends of a coil connecting with the lead of the bar that is marked in the first part of this test as one of the balancing points. Place one of the battery contacts on the armature shaft, and the other on the marked balancing point that is farthest from the point where the circuit has been opened. Next place one telephone terminal on the first bar to the right of the opened wire, and draw the other terminal from the same point, toward the right, over the surface of the commutator. The telephone will be absolutely silent until the moving terminal has just passed the ground nearest to it, and strikes the first bar beyond the same, when it will click. This ground lies in the coil between this first bar giving a click and the one passed just previously, or else in the said previous bar.

The other ground is obviously to be located in a similar manner, by placing one telephone terminal on the bar just to the left of the open wire, and from that point searching toward the left with the other terminal. Only in places where one ground is of very low and one of very high resistance will any difficulty be experienced in locating both accurately before either is removed.

The coils thus indicated may have their terminals unsoldered, when it can be readily ascertained with each, whether the ground be in the coil or in the bar just preceding it.

If scientifically inclined, or if otherwise preferable, the circuit may be opened at a point somewhere midway between the two indicated coils instead of disconnecting those coils, and the exact location of each ground determined as follows: Take a piece of "broom wire" about 18 inches long, new and clean, screw the ends firmly into two clean, brass table binding posts, and into the other holes of the same posts screw the battery terminals. Have an assistant press the corners of the bases of the binding posts into very firm contact with the two bars that lie at the ends of the indicated coil, observing the directions previously given for securing clean contact. Place one telephone terminal in contact with the shaft, and with the other find the balancing point on the wire. This point will indicate the relative position of the ground in the coil, or commutator bar, as the case may be. If more than two grounds were suspected, the two lying the farthest apart would be approximately located by the first part of the two-ground process, and if these coils were not disconnected before proceeding farther, it would be well to make two openings in the circuit, close to and lying between these outer grounds, then locate definitely these two extreme grounds, and proceed with the remaining section somewhat as with a complete armature, except that you would commence by connecting the battery to the terminals of this section, and would then bridge the telephone from the shaft to the different portions of the section, and would complete the process by applying the remainder of the two-ground test.

In dealing with a cross connected gramme ring, an obvious change would be made in the points of application of the battery, and as many points of apparent trouble would be indicated as there were series of cross-connections.

After location of these points it would be necessary to use the auxiliary wire loop as before described, between these points, to determine which is nearest the trouble. This fact being determined, it would in case of a single ground (indicated by the permanency of the balancing point) become necessary to remove the cross-connections from two bars before proceeding farther. The auxiliary wire loop would properly be used to complete the process.

The ordinary "closed coil" ring or drum armatures are types to which these methods are directly applicable.

The sections of open coil armatures would receive the same treatment as field coils.

Familiarity with any special forms of armature will doubtless suggest to the ingenious mind modifications of these methods suited to those forms, but it would be improper to attempt here to deal with specialties whose names are legion.

Where wet grounds exist it will always be better, when practicable, to dry them out before making the final test, as certain sections may show faults which will not be permanent. Wet grounds will of course give a click in the telephone when bridged from the commutator to the shaft when no battery is attached, owing to galvanic action of the water on the copper winding and iron core.

Whenever necessary to deal with wet grounds in testing, it is better to make at least four tests, reversing the battery after each test, and taking the mean of the four determinations.

Field coils, also any wires of uniform cross-section, the extremities of which are accessible and within a reasonable distance of each other, can of course be easily tested for grounds by soldering or firmly clamping a bare wire of suitable size between the extremities of the conductor to be tested, applying a battery to the junctions, and bridging with a telephone between the bare wire and the object upon which the conductor is grounded This will give only the location of a single ground, or the "resultant" of two grounds. A "T. H." rheostat should have the battery connected to the two extremities, and the point of apparent ground determined by bridging with a telephone between the frame and the several contact plates. Then apply the battery to the frame and point of apparent ground, connect one terminal of the telephone with each extremity successively, and search from it toward the center with the other terminal, as in the case of searching for two grounds in an armature.

In determining the location of grounds that are of very low resistance, a good induction coil similar to that used in the Blake transmitter may be used with advantage in connection with the telephone receiver. The receiver is placed in circuit with the secondary of the coil, and the "bridging" is done with the primary. With high resistance grounds the best results are obtained by using the receiver only.

EARTH CURRENTS AND THE EARTH DYNAMO.*

BY JAMES S. LANG.

With the advent of modern electrical transmission, there has come to inventors and scientists in general a partial realization at least of the tremendous waste of energy continually going on around us. Those more sanguine and less practical would harness the tides which roll against our coasts and compel the moon herself as she swings on in her path, a corpse among worlds, to drive our factories and light our streets.

And yet such visions are not wholly illusions, but are capable of being developed to a certain degree, by careful study of the conditions, with proper discrimination between the practical and the impractical.

One class of phenomena worthy of more attention than it has received is that relating to earth currents. This is not to be wondered at, as investigation flows in well defined streams, and the attention of investigators has been turned to subjects of more immediate pecuniary value.

The theory of their cause which I present here, and which is a result of the action of what I designate as the Earth Dynamo, appears to be borne out by the facts and phenomena observed.

It has been known for many years that there was an intimate connection between the sun spots, the magnetic needle and earth currents. This connection is so well marked, and its action is so certain, that it would indicate conclusively that magnetic polarity is possessed to an intense degree by the sun That the magnetic poles of the sun coincide very nearly with its geographical poles is shown by the fact that in the absence of spots no changes in the terrestrial magnetic state occur which have a periodicity equal to the time of solar rotation. The sun, then, we are forced to conclude, may be considered as a magnet, in the same way that we look upon the earth as one, and as such possesses its lines of force, which after having passed from pole to pole inside the sun, envelop and pass the earth at a distance of 91,000,000 miles on their return course. Far beyond our farthest planet these lines spread out in gigantic ellipses, bringing planet and asteroid alike into magnetic touch with the seething monitor of our solar system. And our planetary system is again and again permeated with weaker lines of force having their origin in other suns than ours, and our sun himself as he whirls ceaselessly onward, feels with his magnetic nerves the influence of the sidereal system of which he is a single atom. The milky way stretching across our sky points to our minds the direction of lines of force which have hurled together suns, stars and systems. Multiply the range of our telescopes by infinity and you would see other galactic belts, around, beyond and parallel to our own, stretching away into endless space—indices of lines of force—the handiwork of an infinite creator, the harmony of whose productions exceeds our wildest flights of imagination.

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* From the Year Book of the Society of Engineers, University of Minnesota.

Thus we see that one factor of the magnetism of the earth is due to the lines of force passing through the sun, which penetrate the earth on account of its superior permeability.

That the magnetic poles of the earth are not stationary is shown by the constant diurnal variation of the magnetic needle. Their virtual traces on the earth's surface revolve in small circles around the traces of the main pole, and the angle between the two tangents to these circles drawn to a magnetic needle gives the amplitude of diurnal variation of that needle under normal circumstances.

It is plain that if a wire be suitably placed[*] on the surface of the earth, it cuts this revolving component of the earth's magnetism and we have earth currents as a result. We may consider the earth as a typical spherical armature, familiar to all, in the conductors of which, at times when the equatorial component grows large, we have high voltages.

We see, then, that earth currents may be due to the revolution of this earth armature in a magnetic field of which the sun is the immediate inducer. We are, then, led farther—why not wrap our earth with a suitable system of conductors and wrest from our mother earth an amount of power equal to that wasting at every tide on every sea.

It is easy to determine its feasibility, for we know that the intensity of the revolving equatorial component is equal to the sine of half the angle of the diurnal variation of the compass, times the intensity of the earth's magnetism. A difference of potential of one volt being produced in every conductor which cuts 100,000,000 lines of force per second, if we surround the earth with a coil of 100 wires, it may easily be shown that a difference of potential of upwards of 60,000 volts would be produced under normal conditions.

For wires extending both above and below the equator with turns connected in series, the following method of application will apply. Selecting such a position on the earth's surface that data applicable to that place will be approximately a mean for the whole surface, we may say that the actual intensity of the earth's magnetism is equal to the horizontal component times the secant of the angle of inclination of the dipping needle.

Taking horizontal component equal to .20 of a line per sq. cm. and inclination equal to 60°, we have for the intensity of the earth's magnetism .40 of a line per sq. cm.

The revolving equatorial component of this will be equal to .40 times sine 7′, when diurnal variation is 14′, which equals .0008144 of a line per sq. cm. The area swept over by a single wire placed as designated will be 2 × 48,375,360,000 sq. ft. or 2 × 44,940,709,440,000 sq. cm.

Therefore the voltage induced will be $\frac{44940709440000\text{x}2\text{x}0008144}{100000000}$ which equals 742. This multiplied by 100, the number of turns of wire used, equals 74,200 volts.

If the difference of potential was 60,000 volts in round numbers, and No. 0000 wire used, one-eleventh of an ampere would flow, and the total power produced would be 5,454 watts or less than 8 H. P. Although the amount would rise into hundreds of horse-power at those times when earth currents become abnormal, the enormous cost of the plant would forbid its practical application.

Thermo-electric Properties of Pure Metals.

Herr K. Noll, in *Ann. Phys. Chem.*, states that owing to considerable differences between the observations of different workers on the thermo-electric properties of metals, he redetermined the E. M. F. for various combinations, employing metals in as high a state of purity as was obtainable. In the first series of experiments the second metal was in all cases mercury and the temperatures of the junctions 100 deg. and 0 deg. The E. M. F. was determined by Du Bois Raymond's modification of Poggendorf's methods, Clark cells being employed as the source of the constant E. M. F. The results of these researches (expressed in microvolts) are contained in the following table, + values indicating a current from mercury to metal at the hot junction :

Bismuth	— 6,705.4
Nickel	— 1,664.2
Cobalt	— 1,522.2
Nickel silver	— 1,035.2
Platinum	+ 4.59
Aluminium	+ 362.4
Magnesium	+ 391.84
Tin	+ 396.03
Lead	+ 402.5
Brass	+ 433.3
Carbon rod	+ 662.88
Silver	+ 710.25
Gold	+ 713.35
Copper	+ 725.58
Zinc	+ 692.71
Cadmium	+ 875.09
Carbon filament	+ 1,452.
Iron	+ 1,601.4
Piano wire	+ 1,732.8
Antimony	+ 3,379.6

In many cases the effect of small quantities of impurities was very great. Thus platinum gave values as high as + 593.88 and copper as low as + 684.29 when the metals were not chemically pure. The state of aggregation had also a marked effect in some cases—for instance, silver (710.25; 671.51), zinc (692.71; 735.2), iron, brass, nickel. The second series of experiments was performed at various temperatures between 217 deg. and 0 deg., a number of experiments being made in each case. From the results the value for 100—0 deg. was calculated, good agreement with the observed value being in all cases obtained. The junctions were in some cases formed with mercury, in others with copper. The E. M. F. is given according to Gaugain by formula $\varepsilon = (t_1 - t_2) \{ b \pm c (t_1 + t_2) \}$. The values for b and c are deduced from two experiments, and the results calculated by their aid compared with the observations. The agreement is perfectly satisfactory. The value $\frac{d\varepsilon}{dt} = b \pm ct$ is then calculated, and as this can be expressed as $b \pm (k_2 - k_1)\, t$, where k_2 and k_1 are the constants for the different metals of the junctions, the numbers are referred to lead for which $k = 0$. The values thus obtained for the thermo-electric power $\frac{d\varepsilon}{dt}$ are compared with those of other observers. The difference in the result may be explained by the effect of impurities which, as is evident from the numbers, produce considerable variations.

Effects of a Recent Lightning Flash in Ben Nevis Observatory.

The following are some of the particulars sent to *Nature* by Mr. William S. Bruce, with regard to the effects of the recent lightning flash which struck Ben Nevis Observatory :

"Whenever a thunderstorm passes the summit of the Ben, there occurs almost invariably a discharge from metallic bodies in the Observatory as the cloud is passing away. A flash of greater or less extent is given off the stoves, accompanied by a sharp crack. In January, 1890, there was an exceptionally severe flash ; 'one of the observers was almost knocked down when sitting writing, and the telegraph wire was fused and all communication stopped for five days.' But more destructive than any previous flash was that which occurred this year on June 19, when the Observatory narrowly escaped being destroyed by fire. Between two and three o'clock that afternoon, repeated clicks on the telegraph instrument were heard by one of the assistants who was sitting in the office ; he had been carefully noting the times at which the clicks occurred, when suddenly the whole office was filled with a brilliant flash and deafening roar. A pillar of smoke was discharged from the telegraph instrument and from the stove-pipe, filling the room. A second slighter discharge took place immediately after, when the writer had entered the office to commence the 15 hours' observations. The discharge hurled two boxes and a small picture, that were in the vicinity of the lightning protector, across the kitchen, and blew off the button and outer casement of the electric bell in the visitors' room. The solder on the kitchen chimney outside, a copper fastening of the lightning conductor, and many portions of the telegraphic wire and apparatus were fused, and the woodwork of the Observatory was scorched in several places. The great flash occurred at 14h. 57½min., and the hourly barometric reading was taken at 15 hours, as usual. There was a very heavy fall of snow at the time, equivalent to 0·470 in. of rainfall for the hour, but in the confusion the writer omitted to take the rain gauge with him, and had to return for it. This was a fortunate incident; for it was only on leaving the office for a second time that he observed smoke and flame issuing from behind the panelling between the kitchen and the office. Assistance was secured, and the fire—which was in a very awkward and dangerous place—was overcome in good time, and the damage done was very slight. The damage done to the telegraphic apparatus, however, was serious. The lightning protector was badly fused, the plates showing a patch of fusion as large as a sixpence. All connecting wires within the building were rendered useless. The majority were so heated as to melt the insulation off, and in one or two cases the copper conductors were melted by the discharge. In one case the fusion set fire to the woodwork. The coils of Neale's sounder were fused and rendered useless. The keys suffered worst of all. The vacuum protector at Aslimtee, the base of the cable, also the plate protector in Fort William post office, were fused, but only slightly, the main discharge having expended itself on the summit. The low level Observatory instrument and protector were unimpaired, and communication between there and Fort William postoffice was carried on as usual after the removal of the fault in the post office protector. The registering aneroid shows a slight upward kick at the time, but the curve is otherwise fairly steady; the temperature was 31·7° F., the wind south-south-east and light. Heavy snow was falling at the time, which, with a fall on the 17th, made a total depth of nine inches on the summit. St. Elmo's Fire was very strongly felt and heard until after seventeen hours"

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[*] Ganot's Physics, Sec. 894. Faraday's Researches in Electricity, Secs. 187 and 192. Mascart & Joubert, Elect. and Mag. Vol. I, Sec. 531.

London Notes.

(From our Special London Correspondent.)

LIVERPOOL ELECTRIC LIGHTING SYSTEM TO BE BOUGHT BY THE CORPORATION.

From time to time controversies are carried on in the technical press as to whether local governing bodies or private individuals are the better able to carry on electric lighting installations. So far as practical experience goes, there has not yet been sufficient opportunity to judge from actual working which of the two parties can do the work more profitably. Most of our electric lighting concerns are even now too young for such comparisons to be fairly made. There have been instances in different parts of England of corporations and limited companies which have after a year or two realized excellent profits.

In some towns municipal bodies who let the electric lighting powers drift into the hands of private individuals are regretting the step and conducting negotiations for purchasing the systems; the experience of the companies has led to a decided move among local authorities to keep the work in their own hands.

The Liverpool Electric Supply Company Limited, which has for a few years supplied a certain area in Liverpool, has worked very successfully. Some months ago the Corporation began to consider whether it would not be worth its while to buy up the concern and run it itself before the value became greater than it then was. The result of these considerations was that negotiations were entered into with the company, Parliament's sanction was obtained, and £400,000 is to be paid by the Corporation for the entire undertaking. These terms will pay the company very well.

THE LIGHTING OF ECCLESIASTICAL BUILDINGS.

A short time ago I reported that experiments for the electric lighting of St. Paul's Cathedral had been carried out by Major-General Webber, and that the detailed results of these experiments were to be published in a paper by the Major before the Society of Arts. Owing to pressure of other work the paper has not yet been read, but will doubtless come on early in the next session. I now learn that similar experiments are to be carried out at Westminster Abbey. The organ-loft, which at best is a dismal place, is to be first treated. The organ-loft is situated within the screen and is at present lighted by gas. If the experiments in the loft are successful, it is probable that the interior of the entire building will be so lighted.

ISLE OF MAN ELECTRIC TRAMWAYS.

Twelve months ago there was opened in the Isle of Man a line of electric tramways running from Douglas to Laxey, a distance of a little under seven miles. There was a power station at either end and an accumulator station containing about 240 chloride cells about two and one half miles down the line.

This line has been worked so satisfactorily in every way (particularly financially, as this is a tourists' resort) that extensions were soon decided upon and have now been completed. The line was extended from Laxey to Mount Snaefell. Messrs. Mather & Platt have supplied five pairs of 150 H. P. compound engines and four boilers for the generating station. The line was opened for traffic on August 17th.

The Trolley in Suburban Traffic.

The Philadelphia *Press* predicts that the trolley or electrical street railway will eventually become more of a help than a hindrance to the prosperity of the main railroad lines. It says:

> Thus far the trolley has been the rival of the railroad in suburban traffic. In five years and after it will be its feeder. Thus far it is reducing railroad revenue. In five years it will increase it.
>
> Hitherto, after six miles or so from a city center is reached, for fifteen miles further suburban traffic has been necessarily drawn from a strip two miles wide each side of the track from station to station. Practically no one who takes a train over six miles from the city cares to live more than a mile from it. A few do, not many. This limits suburban traffic to a strip of residence territory two miles wide and fifteen miles long—say from six miles out to twenty one—or thirty square miles.
>
> The rural trolley, when it is developed, is going to make it possible to live five miles from a station and still make a train as easily as one once could a mile off with no trolley. The strip which feeds suburban traffic will be as before, from six to twenty one miles out, fifteen miles long; but it will be ten miles broad instead of two. It will be 150 square miles instead of thirty square miles.
>
> The area from which a railroad will draw its great flood of suburban traffic will be as large as the area of all Philadelphia. The railroad will carry it in mass. The trolley will collect it in detail.

Personal.

The many friends of Mr. L. Levy, of the Anthony Company, Cincinnati, have learned with deepest regret of the sudden death of Mrs. Levy.

Mr. J. J. Gates, general manager of the Perkins Electric Switch Manufacturing Company, Hartford, Conn., visited New York this week.

Tidings from Europe bring the information that J. W. Godfrey is thoroughly enjoying his sojourn there. When last heard from he was with his family at Baden-Baden, the Saratoga of Germany. During the east-bound passage of the Atlantic, Mr. Godfrey was, as is his custom, hail fellow well met with Hon. C. F. Crisp, Murat Halstead and other distinguished fellow-voyagers. At a concert given aboard the New York, Mr. Godfrey's abilities as an entertainer were brought into use, he having had the honor of starting the entertainment with an exhilarating overture, "Throw Him Down McCloskey," the rendition of which was received with hearty manifestations of approval.

General News.

What is Going on in the Electrical World.

Laurel, Md.—The electric light plant at the Keeley Institute in this place was destroyed by fire on the 16th.

Escanaba, Mich.—At the special election held here on the 17th, the people voted in favor of purchasing the electric light plant for $70,000.

Dallas, Tex.—The Rapid Transit Railway Company will issue $150,000 bonds, the proceeds to be applied to the improvement of their road.

Wilmington, Del.—The indications are that the Elsmere and Wilmington Electric Railway will shortly be built; the route has been surveyed.

Medford, Mass.—The International Lard and Oil Refining Company of New York intends, it is said, to erect a factory here and will put in an electric plant.

Dawson, Ga.—$10,000 of the $35,000 bonds authorized by the voters of the city have been sold in New York and that amount will be expended for electric lights.

Lynchburg, Va.—The Bedford City electric plant was sold on the 15th, under a decree of the court, to J. A. Clarke, for $10,050. The original cost of the plant was $33,000.

Hicksville, O.—A gentleman from Washington, D. C., representing Eastern capitalists, has been looking over the route for an electric road from Bryan, O., to Fort Wayne, Ind.

Greenbush, N. Y.—The trustees have granted a franchise to the Albany, Greenbush and Bath Railway Company to build and operate an electric street railway line in Greenbush.

Marion, O.—The project of building an electric railroad from Marion to Marysville by Prospect, Richwood, Magnetic Springs and Pharisburg is meeting with favor all along the line.

Frederick, Md.—The directors of the proposed Frederick and Middletown electric railway state that they now have only $5,000 to raise and expect to begin work on the road at once.

Newburg, N. Y.—The Homer Ramsdell Transportation Company are said to be behind the syndicate which proposes to build an electric railroad from this city to New Paltz via the Orange Lake road.

Niagara Falls.—Both of the 5,000 horse-power dynamos were tested a few days ago to full capacity in the presence of a number of experts who expressed themselves well pleased with the performance of the machines.

Van Buren, Ark.—It is stated that Colonel Sheldon is organizing a company to establish an electric light plant, and also that H. J. Isbell, of Parsons, Kan., is making preparations for erecting an electric plant in Van Buren.

Scranton, Pa.—The West Side board of trade have given favorable consideration to the plan of erecting an electric light plant in the operation of which the culm piles at the Oxford or Mt. Pleasant mines could be utilized as fuel.

Fort Wayne, Ind.—The electric railroad from this city to Lake Everett is now assured, as the commissioners have granted Mr. Everett a franchise; work on the road must begin within ninety days and the road be in operation within a year.

Shamokin, Pa.—The Schuylkill Traction Company and the Shamokin and Mount Carmel Electric Railway Company will build a connecting line from Ashland to Centralia, and then there will be a complete line from Shamokin to Mahanoy City.

Los Angeles, Cal.—The injunction against the sale of the Consolidated Electric Railroad was dissolved on the 17th inst. and the property was immediately bought by a syndicate representing the majority of bondholders. The bid was $1,500,000.

New Brunswick, N. J.—It is reported here that the Pennsylvania Railroad Company intends to convert its branch road from New Brunswick to Millstone into an electric railroad, on the plan of the branch road from Mount Holly to Burlington, N. J.

Peoria, Ill.—Congressman J. Frank Aldrich, of Chicago, has accepted the franchises granted by the council and will begin work at once on his new gas and electric light plant in this city. Mr. Aldrich is backed by a syndicate of which the leading member is John R. Walsh.

Lee, Mass.—Lee capitalists and mill owners are considering the project of establishing an electric plant to furnish power to various mills on the river from Lake May which depend on water and steam power. A stock company may be formed to push the thing through.

Eaton Rapids, Mich.—At the special election on the 19th, to consider the proposition of bonding the city in the sum of $35,000 to erect and maintain waterworks and an electric light plant, the waterworks was defeated while the electric light branch was carried by 151 majority.

Mifflintown, Pa.—The ordinance granting the Patterson Electric Light Company the right to erect a plant and furnish light in the borough of Patterson, Pa., has been published. The borough authorities have entered into a contract with the company for five years' public lighting.

Brooklyn, N. Y.—After a test of naphtha and electric lighting on about a mile and a half of Ocean Parkway for a month past, Mayor Schieren has decided on lighting the Parkway with electricity. Ninety large arc lights are to be erected and bids will be opened on the 31st inst.

Foxboro, Mass.—The Van Choate Electric Company's plant in this town is nearing completion. The gentleman who gives its name to the company promises to introduce to the world some electrical productions of a startling character—something as startling probably as the Keely motor.

Portland, Me.—It is not yet decided when work on the Portland and Yarmouth Electric Railroad will begin, but efforts are being made towards getting grants of location in Deering, Falmouth and Yarmouth and also in this city. If these result favorably, no time will be lost in constructing the road.

Youngstown, O.—The Park and Falls Company, which is building an electric railroad from this city to the southern part of Mahoning county, will increase the capital stock from $50,000 to $200.000 and will run the road into the North Lima coal field. The company also intends to do a general freight business.

Washington, D. C.—The next convention of the National Brotherhood of Electrical Workers will be held in this city October 11 to 17, inclusive. The leading men of the order throughout the country are discussing the topics of general interest which will be brought up for consideration during the convention.

Knoxville, Tenn.—The Citizens' Railway Company, which has filed an application for a charter, proposes to build and operate an electric line in Knoxville, West Knoxville, North Knoxville and Knox county. The incorporators are: W. G. McAdoo, Jr., F. K Huger, Geo. W. Henderson, R. H. Sanson, E. T. Sanford and T. H. Heald.

Wooster, O.—The Wadsworth Electric Railroad Company has been chartered to build a road from Wooster to Cleveland. It is privileged to carry passengers, baggage, express goods, United States mail and freight, and at proper distances spurs will be thrown out where cars can be left for farmers, dairymen, and others to load their products.

Syracuse, N. Y.—The Consolidated Street Railway was sold on the 17th inst., under foreclosure proceedings, to Frederick Strauss, of New York, for $865,000. Mr. Strauss bought the property for the majority bondholders. The only other bidder was H. Clark Ford, of Cleveland, who bid for the Syracuse Street Railroad Company $864,000.

Baltimore, Md.—Mayor Latrobe is in favor of an independent lighting plant for the parks. —The rumor that the Baltimore Traction Company and the City and Suburban Company are to consolidate seems to have some basis in the fact that representatives of the two systems have been in conference recently, and have, it is understood, agreed upon some of the details.

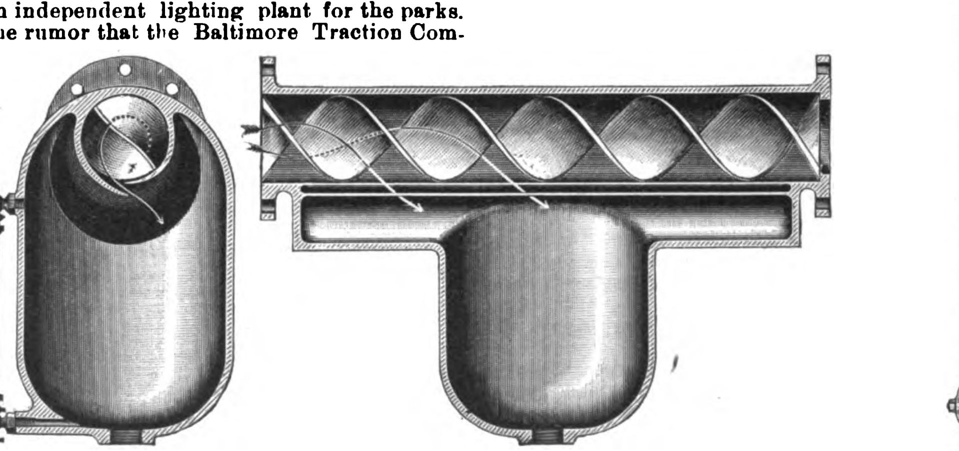

FIG. 1.—MOSHER SEPARATOR, LARGE COLLECTING CHAMBER.

Millbury, Mass.—Millbury and Sutton have granted a franchise in their limits to the Blackstone Valley Electric Railroad and Grafton will probably do likewise. Northbridge declines to let the road in, but the people are said to be in favor of the road and at the next election will choose a board of selectmen more favorable to progress than the present board.

Louisville, Ky.—It is now almost certain that the electric railroad between Louisville and Fairfield will be built. The $9,000 necessary to secure a charter has been subscribed, and articles will be prepared without delay. Among those interested are Judge W. H. Ellaby and F. H. Carrithers of Mt. Washington; Judge W. B. Hoke, L. De Witt, Stephen Lloyd, James McKenna and Robert Mills of Louisville.

St. Joseph, Mo.—The property of the St. Joseph Lighting and Traction Company, including all the street railway lines in the city and the electric light plant, was sold at auction on the 21st inst., to satisfy a mortgage of the Central Loan and Trust Company of New York. The property was bid in by A. Harriman, of Portland, Me., and O. P. Harriman, of New York, acting as trustees for the stockholders.

Boston, Mass.—It is possible to go by electric cars from Boston now as far north as Marblehead, Beverly, Wenham, Danvers, Reading and North Woburn; as far west as Waltham, West Newton, and Newton Upper Falls; and as far south as Dedham, Stoughton, Brockton, Whitman, Rockland and Weymouth. The Gloucester, Essex and Beverly Street Railroad was opened last week, and a line is running to Ashland from Newton Lower Falls.

Alton, Ill.—The stockholders of the Alton Electric Street Railway Company have authorized the directors to sell and dispose of all franchises whatsoever belonging to that company to the Alton Railway and Illuminating Company in consideration of the latter assuming all indebtedness of the company, and issuing stock to the stockholders of the old concern to the amount of $100,000. This completes the transfers incidental to the consolidation of the lighting and street railway companies.

Staten Island, N. Y.—The Staten Island Midland Railroad has been sold. The new purchasers are experienced electric railroad men, who will proceed at once to rebuild and electrify the present lines and make extensions. The company has been reorganized with the following officers: James C. Hincliffe of Paterson, N. J., president; Benjamin E. Throop of Scranton, Pa., vice-president; W. B. Rockwell of Scranton, treasurer and general manager; E. G. Wightman of Middletown, N. Y., secretary, and M. J. Wightman of Scranton, electrical engineer.

Richmond, Va.—A long and bitter fight for a franchise has just come to an end through the common council's voting to give the Richmond Traction Company, a new corporation, the right of way for an electric line in Broad street. The Richmond City Railway Company had for weeks been making extraordinary efforts to obtain the franchise, and the committee on streets had reported in their favor, but they were defeated in council by two votes. The winning company agrees to give the city five per cent. of the gross receipts, to sell six tickets for 25 cents, and to let school children and working people (during certain hours) ride for half fare.

Tonawanda, N. Y.—The Ely Railroad between Buffalo and Niagara Falls is about completed. In length the new line is 16 miles. The date for the formal opening of the road has not yet been set, but it is thought by the middle of September cars will be running regularly over the line.—The location for the test of electricity as a motive power on the canals has been fixed within the limits of this city; the date is September 25. The cable or traction system will be used and both preliminary and official tests will be made. The experiments will be made with eight or ten canalboats lashed together, which it is expected to move at a rate of about six miles an hour.

Albany, N. Y.—The promoters of the proposed Albany, Helderberg and Schoharie Electric Railway have elected the following officers: President, John W. Van Valkenburg; vice-president, Jonas S. Brooks; treasurer, Theodore Little; secretary, W. H. Erwin. Directors: Jonas H. Brooks, Benjamin M. Secor, L. C. Warner and John W. Van Valkenburg, of Albany; Dr. O. C. Snyder and Jacob Kelsch, of Gallupville; C. E. Dietz and T. J. Wood, of Berne; J. M. Ervin, of New Salem; Dr. C. J. Crounse, of Clarksville; Harrison Tinkle, of Greenbush; E. Twichell and C. Kromer, of Schoharie. The capital stock of the company will be $350,000. According to the articles of incorporation the road may be operated by compressed air, electricity or steam.

Milwaukee, Wis.—The stock of the Milwaukee Arc Light Company has been bought up by the parties interested in the Milwaukee Street Railway Company, it is said, and if this is the case the latter company gets control of all the lighting plants in the city with the exception of the Pabst plant The Arc Light Company is capitalized for $100,000 and its service is confined to residences and business establishments.—The Calumet Club gave a trolley party here on the night of the 15th, and caused as much excitement and enthusiasm as the "Greatest Show on Earth" ever did by its flaming pageants. There were ten trolley cars in the procession carrying 400 persons including a band of music, and the streets through which they passed were made radiant by incandesent lights and crimson fires. After the trolley ride, which occupied about two hours, lunch was served at the clubhouse and this was followed by a dance.

The Mosher Steam Separator.

In the Mosher Steam Separator, illustrated in the accompanying cuts, it will be observed that the utilization of centrifugal force is the principle of operation, acknowledged to be the only successful method of separation. The construction of the Separator is extremely simple. The steam conduit consists of a slightly enlarged section of the main steam pipe in which is located a worm or twisted plate. The wall of this conduit is of spiral form with one lip below the other, thus forming a slot through which all moisture is thrown to the collecting chamber below. Thus the steam is acted on many times in its passage around the twisted plate, and the heavier particles being thrown outwardly by centrifugal force are shaved off and deposited in the isolated chamber below from which it may be returned to the boiler.

The Separator is also made with small collecting chamber, rendering it more compact and adapted to places where other styles would be excluded on account of limited space. This style is peculiarly adapted to the extraction of oil from exhaust steam, rendering a considerable saving in oil and preventing destruction of roofs; on exhaust pipes when steam is used for heating purposes, to keep pipes and radiators from becoming clogged with oil; between cylinders of compound engines to extract water of condensation; between low pressure cylinder and condenser to avoid the clogging up of condenser by oil from cylinders; also in ice and refrigeration plants to extract the oil from ammonia gas, thus providing against the pipes becoming coated on the inside by oil. In the last-named capacity the Mosher Separator is the only device that has successfully accomplished this extremely difficult problem of separation.

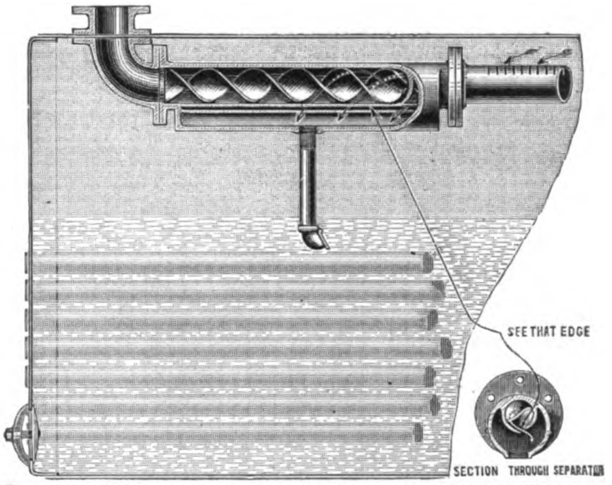

FIG. 2.—MOSHER SEPARATOR APPLIED INSIDE OF BOILER.

Many boilers are subject to violent priming or foaming during which a considerable amount of water is carried out of the boiler. In such cases the trouble may be entirely avoided by the introduction of a Mosher Separator inside the boiler, as shown in Fig. 2. The Separator, which by reason of its small size may be introduced through the ordinary manhole and connected between throttle and a perforated dry pipe, will prevent any possibility of wet steam leaving the boiler due to primage and therefore furnish dry steam at all times regardless of how severe the boiler may "foam" or "prime."

The Mosher Separator is built in sizes from one and one-half inches to any size required. Separators are tested for 200 pounds working pressure per square inch. These re built by Charles D. Mosher, 1 Broadway, rho will be pleased to send his "Treatise on eparator" to all who desire it.

Large Sales of Beacon Lamps.

n Lamp Company has closed a contract with lectric Light Company for 9,000 lamps, to be eek in the Knight Templar decorations in so for 1,000 special lamps for Keith's Theater purpose. Another good award is a Governt for 10,600 lamps to be used at the Boston

Westinghouse Engine Sales.

ghouse Machine Company reports business e outlook very flattering. Orders for Comes the past month include one 250 h. p. to Manufacturing Company, Taunton, Mass.; and one 125 h p. to American Hydraulic pany, East Douglas, Mass; one 80 h. p. and to Sioux Consolidated Mining Company, tah; one 200 h. p. to Wendell & Smith, Overwo 80 h. p. to Upper Peninsula Hospital for Newberry, Mich.; four 250 h. p. to United d Building, Washington, D. C.; one 150 h. p. lle Electric Light Company, Connellsville, h. p. to Belvidere (Ill.) Electric Company; . to Carnegie Library Building, Pittsburg, h. p. to Hackensack (N. J.) Gas and Electric ne 300 h. p. to Wilkinsburg (Pa) Electric ne 250 h. p. to Sing Sing (N. Y.) Electric Com h. p. to Gloversville (N. Y.) Electric Comition to the above, the increased number of andard" and "Junior" Automatic Engines eneral revival in all branches of manufactur-

Good Work Brings Good Prices.

board of Ontonagon, Mich., has awarded the he construction and equipment of the vil- light plant to the Electrical Engineering Minneapolis, representing the Siemens & ic Company. The contractors are to furnish ected dynamo of 1,100 lights capacity and nps and 47 street incandescent lamps of 32 ts for 200 private residences for the sum of rk to be completed by October 1. The bid st, but the board took into consideration nd world-wide reputation of the manufac superiority of the apparatus and materials he contract for the engine was let to A. L. Springfield, Ill., for an Ideal direct-connected . P. for $1,429.

HT SCHEDULE FOR THE UNITED STATES.

by the Washington Carbon Company.)

AUGUST, 1895.

LIGHT.	DATE.	EXTING.
11.40 P. M.	2	4.00 A. M.
......	..	....
12.40 A. M.	3	4.00 "
1.40 "	4	4.00 "
No light.	5	No light.
"	6	"
"	7	"
7.20 P. M.	8	9.30 P. M
7.30 "	9	9.50 "
7.30 "	10	10.10 "
7.30 "	11	10.30 "
7.30 "	12	11.00 "
7.30 "	13	11.30 "
7.30 "	15	12.20 A. M.
7.30 "	16	1.00 "
7.30 "	17	1.10 "
7.30 "	18	2.10 "
7.30 "	19	3.30 "
7.20 "	20	4.30 "
7.20 "	21	4.30 "
7.20 "	22	4.30 "
7.20 "	23	4.30 "
7.00 "	24	4.30 "
7.00 "	25	4.30 "
8.00 "	26	4.30 "
9.00 "	27	4.30 "
10.40 "	28	4.30 "
10.40 "	29	4.30 "
1.00 "	30	4.30 "
11.30 "	31	4.30 "
......	..	....

MERCIAL PARAGRAPHS.

l Lead Company, 1 Broadway, New York, amphlet entitled "Concerning Babbit and Metals," which the users of these metals will resting.

Conduit and Insulation Company of New e that they have secured the services of Noll, late of the firm of Noll & Sibley. Mr. been well known in the electrical trade of y for the last fifteen years, will manage the ior Conduit, Motors, Dynamos, Fans, etc., politan district of the Interior Conduit and mpany.

INCORPORATIONS.

The Buena Vista Light and Power Company, Buena Vista, Va.—to manufacture light, power and heat. Capital stock, $25 000. Promoters: S. E. Egolf, R. B. Embree, H N. Egoff, E. L. Embree, Buena Vista, Va. Thos. Bohman, Philadelphia, Pa.

The McGregor Electric Light and Power Company (incorporated in Iowa), La Crosse, Wis.—to construct, maintain and operate a plant for the generation and distribution of electric light, etc. Capital stock, $10,000. Promoters: Clark W. Thompson, H. W. Thompson, Charles F. Speed.

The Texas Telephone and Telegraph Company, Galveston, Texas. Capital stock, $100 000. Incorporators: M. M. Levy, J. Lobet and S. Blum.

The Spirit Lake Telephone Company, Spirit Lake, Ia.—to operate a telephone exchange. Capital stock, $10,000. W. W. Pritchard is president; L. H. Farnham, vice-president; H. E. St. Clair, secretary, and F. W. Barren, treasurer.

The American Signal and Power Company, Minneapolis, Minn.—to manufacture electrical and other instruments, devices, apparatus, appliances, novelties, etc. Capital stock, $100,000. Promoters: Henry B. Higgins, Charles M. Wilkinson, Charles J. Traxler, Minneapolis.

Mineral Point Telephone Company, Mineral Point, Wis. Capital stock, $1,500. Incorporators: N. H. Snow, W. R. Smith, Phil Allen, Jr., and others.

The Richmond Standard Telephone Company, Richmond, Va.—to promote, establish and maintain the business of a telephone company. Capital stock to be not less than $100,000, nor more than $300,000. The following officers have been elected: John C. Robertson, of Chesterfield County, president: R. H. Smith, of Richmond, secretary and treasurer. The above with the following form the board of directors: A. B. Guigon and Thomas R. Marshall, of Richmond; James F. Bradley, of Manchester, and George W. Cross, of New York.

The Ohio Automatic Telephone and Switch Company has filed articles of incorporation. The company will begin business with a capital of $250,000, and will have its start in Elizabeth, N. J., with an office in Cleveland, O. The incorporators are Col. William K. Fogg and William S. Thyng, of Roselle, N. J.; John W. Lovell, of New York, and Lewis H. Allen, of New Rochelle, N. Y.

The California Light and Fuel Company, Los Angeles, Cal.—to acquire, construct, lease, sell gas works, gas, electric light, fuel and power works, etc. Capital stock, $3 0,000. Promoters: Thaddeus S. C. Lowe, Leon P. Lowe, H. C. Brown, all of Pasadena, Cal.; G. W. Cochran, J. M. C. Marble, Los Angeles.

The Portland and Western Railway Company, Portland, Ore—to build and construct numerous electric and cable street railroads in the suburbs of Portland and other cities, and do numerous other things. Capital stock, $25,000. Promoters: S. Z. Mitchell, W. F. Nelson, Frederick V. Holman, all of Portland.

A charter has been applied for by a number of citizens of Jefferson, Ga., who desire to be incorporated as the Jefferson Telephone and Telegraph Company. They will build a telephone system from Jefferson to Harmony Grove, Athens, Winder, Mayesville, Pendergrass and Hoschton.

Articles of incorporation have been filed for the Saugatuck and Ganges Telephone Company, Saugatuck, Mich. The incorporators are: E. E. Brunton, Fred Wade, H. H. Hutchins, Charles E. Bird and H. Bird, Jr. The capital stock of the company is $10,000. It is proposed to build and operate about one hundred miles of line, connecting some dozen or more towns. Work on the first section, to extend from Holland to South Haven, has already begun.

The Western Union Telephone Company, Chicago, Ill.—to manufacture telephones and apparatus. Capital stock, $100 000. Incorporators: Arthur Dixon, Wilfred Massey and Samuel B. Foster.

Articles of incorporation of the Standard Telephone Company, Lansing, Ia., have been filed at Waukon. The capital stock is $25,000. The company intends to first build a local county system and then extend to Southern Minnesota points and La Crosse, Wis.

An application is to be made to the Governor of Pennsylvania by M. R. Thomas, Robert Augustine, Dr. T. J. Jacobs, G. W. Umbel, Wm. A. Frey and others, for the charter of the Somerfield Telephone Company, the lines of which will connect Petersburg, Somerfield, Harnedsville, Confluence, Ursina, Listenburg and other towns in Somerset County, and Markleysburg, Uniontown and other towns in Fayette County, Pa.

The Allegheny and Chartiers Railroad Company—to build an electric railway to connect Carnegie, Idlewood, Crafton, Ingram, Sheraden and Beltzer with Allegheny, Pa. Capital stock, $150,000. Directors: George H. Browne, T. W. Seimen and W. D. Uptegraff.

The Franklin and Oil City Rapid Transit Company, Venango County, Pa.—to operate an electric road between Franklin and Oil City. Capital stock, $70,000. William J. Welsh, of Franklin, is president of the company, and the principal stockholder is Charles W. Mackey.

The City Electric Light Company, Danville, Ill. Capital stock, $15,000. Incorporators: Frank Lindley, Daniel Gregg and Robert Holes.

The Wooster, Medina and Cleveland Street Railway Company, Wooster, Ohio—to operate an electric railway through counties of Wayne, Medina, Summit and Cuyahoga, Ohio. Capital stock, $10,000. Promoters: L. P. Ohlinger, F. H. Harding, J. R. Zimmerman, C. W. Kenke, A. Cunningham, C. V. Hard, W. J. Mullins, Chas. W. Fawcett, A. D. Metz, A. M. Parish.

The International Electric Company, St. Louis, Mo.—to manufacture incandescent lamps, etc. Capital stock, $25,000. Promoters: J. M. Davey, H. B. Russell, H. E. Chandler, H. C. Ferguson, St. Louis; Geo. De Lisle, St. Charles, Mo.

The Leroy Hydraulic Electric Company—to manufacture and supply electricity in Leroy, N. Y. Capital stock, $65,000. Directors: Charles F. Prentice, D. Howard Prentice, Calvin N. Keeney, John P. Sampson and Wm. F. Huyck, of Leroy.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 20, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

544,677. Trolley-Arm and Attachment Therefor. George Maag, Newark, N. J.; Joseph Ayers administrator of said Maag, deceased. Filed Dec. 12, 1894.
544,6?5. Electric Locomotive. Edwin H. Porter, Radford, Va. Filed June 22, 1894.
544,7 4. Automatic Safety Trolley. James B. Scranton, New Haven, Conn. Filed March 10, 1895.
544,794. Trolley-Arm and Wire-Finder. Frederick W. Riess, Philadelphia, Pa. Filed June 10, 1895.
544,862. Electric-Railway. James F. McLaughlin, Philadelphia, Pa. Filed April 18, 1895.
544,863. Electric Railway. James F. McLaughlin, Philadelphia, Pa. Filed May 3, 1895.
545,009 Trolley. George W. Biddle, Chattanooga, Tenn. Filed Feb. 2, 1895.

DYNAMO ELECTRIC MACHINERY.

544,654. Plant for Generating Electricity. George R. Bowen, San Antonio, Tex., assignor of one-half to William Warren Gibbs, Philadelphia, Pa. Filed Feb. 21, 1895.
544,696. Dynamometric Governor. William N. Smith, Chicago, Ill. Filed Aug. 16, 1894.
544,749. Electric Motor. Benjamin P. Remy, Peru, Ind. Filed Nov. 24, 1894.
544,768. Electric Elevator. Nils O. Lindstrom, Union Course, assignor to the A. B. See Manufacturing Company, Brooklyn, N. Y. Filed May 4, 1895.
544,780. Electric Elevator. John C. Winters, Mount Morris, N. Y. Filed Dec. 3, 1894.
544,844. Carbon-Brush Holder for Dynamo-Electric Machines. Alexander J. Churchward, Brooklyn, N. Y. Filed May 14, 1894.
544,861. Applying Power at a Distance by Means of Electricity. James F. McLaughlin, Philadelphia, Pa. Filed Oct 8, 1891.
545,005. Multiple Electric Circuit and Mechanism for Maintaining Same. Timothy K. Ames and Elbert A. Parker, Peterborough, N. H. Filed Oct. 10, 1894.

BATTERIES.

544,6?2. Secondary Battery. Frank King, London, England. Filed April 5, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

.41,711. Telephone Switch and System. Ernest C. Wilcox, Meriden, Conn. Filed May 13, 1895.
541,876. Ship's Telegraphic Apparatus. Johannes K. Adelsberg, Liverpool, England, assignor to the Walker's Engine Speed Indicator and Recorder Company, Limited, Durban, Natal. Filed March 16, 189 .
544,890. Magneto-Electrical Telephone. Max Frank, Munich, Germany. Filed June 30, 1894.
544,901. Telephone-Exchange Apparatus. Joseph J. O'Connell, Chicago, Ill., assignor, by mesne assignments, to the American Bell Telephone Company, Boston, Mass. Filed April 29, 1893.

SIGNALS AND SIGNALING APPARATUS.

544,617. Automatic Electrical Railway-Signal. Charles R. Alsop, Middletown, Conn. Filed Oct. 22, 1894.
544 802. Railway-Signal. William B. Vansize, New York, N. Y. Filed July 18, 1895.
544,937. Electric Train-Signal. Francis C. E. von Sternberg, Brooklyn, N. Y. Filed April 13, 1895.

MISCELLANEOUS.

544,745. Electrically-Controlled Weighing Apparatus. Lorenzo H. Nutting, Davenport, Iowa. Filed Nov. 13, 1894.
544,747. Manhole for Electric-Cable or Other Subways. Ernest L. Ransome, Chicago, Ill. Filed Jan. 11, 1895.
544,778. Insulator for Electric or Other Wires. Clinton Sproat and Edward N. Tarr, Taunton, Mass. Filed Jan. 2, 1895.
544 781. Electric Switch. Thomas H. Brady, New Britain, Conn. Filed May 8, 1895.
544,847. Apparatus for Insulating Electrical Conductors. Louis W. Downes, Providence, R. I. Filed April 6, 1895.
544,868. Apparatus for Training Horses or Other Animals. Albert H. Simpson, Leeds, England. Filed April 11, 1895.
544,894. Fire-Extinguisher William Harkness, New York, N. Y., assignor to the General Fire Extinguishing Company of New York. Filed Aug. 13, 188 .
544,959. Insulator. Reuben G. Collins and Frank W. Foley, Dollar Bay, Mich. Filed Feb 25, 1895.
545,020. Electrically-Controlled Winding Mechanism for Time-Locks. William H. Hollar, Philadelphia, Pa.; George L. Weaver, Boston, Mass., and Anthony Kennedy, Charlestown, W. Va.; said Weaver and Kennedy assignors to said Hollar. Filed April 1, 1895.
545,021. Electric Winder for Time-Locks. William H. Hollar, Philadelphia, Pa.; George L. Weaver, Boston, Mass., and Anthony Kennedy, Charlestown, W. Va.; said Weaver and Kennedy assignors to said Hollar. Filed April 17, 1895.

THE TELEPHONE WORLD.

Telephone Litigation.

Text of Bill of Complaint in Bell vs. National Telephone Manufacturing Company.

The following is the full text of the bill of complaint in the suit of the American Bell Telephone Company vs. the National Telephone Manufacturing Company:

I.

1. On or about June 4, 1877, Emile Berliner, then of Washington, in the District of Columbia, being theretofore the original and first inventor of certain new and useful improvements in electric telephony (sometimes known and herein spoken of as the variable-pressure contact telephone or microphone), made application, in due form of law, to the Commissioner of Patents of the United States for the grant of a patent securing to him the exclusive property in his said improvements, which had not been known or used by others in this country, nor patented or described in any printed publication in this or any foreign country before his invention thereof, and which had not been in public use or on sale for more than two years prior to his said application. And subsequently, and before the grant of the patent herein sued on, the said Berliner, by an instrument in writing, duly assigned unto the American Bell Telephone Company the said invention and the said application, and the patent to be issued thereon, which assignment was duly entered of record in the Patent Office before the grant of the patent herein sued on.

2. Thereupon, after due proceedings in all respects according to the requisitions of the statutes in such case made and provided, letters patent of the United States numbered 463,569, dated the 17th day of November in the year 1891, signed by the Secretary of the Interior and countersigned by the Commissioner of Patents, were issued under the seal of the Patent Office and delivered unto the said American Bell Telephone Company, as assignee of said Emile Berliner; whereby was granted to it, its successors or assigns, for the term of seventeen years from the said date of the same, the exclusive right to make, use and vend the said invention throughout the United States and the Territories thereof; as will more fully appear by the said patent, or by a copy of the same duly certified from the records of the Patent Office, and in this court to be produced. And your orator avers that it has given sufficient notice to the public that any article patented in and by said letters patent, and made or vended by your orator, is patented, either by fixing thereon the word "patented" together with the day and year the patent was granted, or, when from the character of the article this could not be done, by fixing to it, or to the package wherein one or more of them was enclosed, a label containing the like notice.

3. Ever since the grant of said patent the sole and exclusive right to make, to sell, and to authorise others to use telephones embracing the invention of said patent, has been and it still is invested in your orator, the American Bell Telephone Company. The only rights possessed by other persons thereunder have been licenses limited as to territory or use, or both, to use telephones procured from your orator, the American Bell Telephone Company, upon payment of stated royalties according to the nature and duration of the use. By means of which the American Bell Telephone Company and its various licensees as aforesaid long have been and are now engaged in the business of furnishing such telephones to the public within that territory, and are at all times ready so to furnish them to all persons upon the terms, conditions and price uniformly established for all users. Extensive lines and plants have been established by them for that purpose; and any infringement of your orator's rights in the premises is a cause of great, serious and irreparable injury and interference with the said business and business interests so established as aforesaid.

II.

4. The art of electric speaking telephony was first known to the public in the spring of the year 1876, Alexander Graham Bell's first speaking telephone patent being dated March 7, 1876; and electric speaking telephones first went into commercial use in the spring of the year 1877, in the form of the magneto telephone invented and patented by said Bell by his patents of March 7, 1876, and January 30, 1877. Emile Berliner's said application of June 4, 187, was preceded by a caveat filed by him in the Patent Office on April 14, 1877, which described the invention on which this suit is brought.

5. As early as the year 1878 it was publicly and generally known, especially to those interested in the art and business of telephony in connection with the American Bell Telephone Company or its predecessors in interest, and to those interested adversely to them, that Emile Berliner claimed that he was the true, first and original inventor of the variable-pressure contact telephone, that he had filed an application for a broad patent thereon, and that the American Bell Telephone Company or its predecessors had become the assignees and owners of his said invention and rights growing out of it or resting upon it, and were prosecuting his application. In and before the year 1879 speaking telephone transmitters embodying and known to embody that invention went into extensive and general public and commercial use throughout the United States and in other parts of the world; and the great superiority of transmitters which embodied this invention over those which did not embody it was known and recognized; and at said time and ever since, it was known and recognized that the patent sought for by the American Bell Telephone Company, as assignee of Emile Berliner as aforesaid, if granted with the broad claims asked for, and which are contained in the patent as granted, would, so far as could be seen, if valid, practically control commercial telephony. The effect and importance of the patent so sought by the American Bell Telephone Company, as assignee of Berliner, and on his said application, were thus generally and publicly known and understood both to the officials of the Patent Office and to all persons interested in telephony, and to and by the general public, in 1880 and before.

The invention of the speaking telephone and the principal forms of it, including the variable-pressure contact telephone, were also the subject of much controversy both in public discussions, in the Patent Office, and in the courts.

6 The controversy and litigation which thus began in the year 1878 or before, was of such a nature as to lead and induce all persons who had, who thought they had, or pretended to have, any claims or pretensions to be original inventors of the electric speaking telephone or its principal members, including the microphone as one form of it, to make them publicly known and to assert them; and to induce and lead persons interested adversely to the American Bell Telephone Company to search for publications which, and for persons whose work, could be supposed to embody any early important inventions in telephony. Thus for many years before the issue of the Berliner patent in suit, in 1891, the history of the art and the work of all those by or on behalf of whom any pretensions were made in respect of telephonic discoveries earlier than Berliner's said caveat, had been thoroughly explored and studied by those whose interests were adverse to the American Bell Telephone Company.

7. In the legal controversies which arose in the Patent Office and in the courts under the said Bell patents and otherwise, all the publications and alleged work of such persons were set up for judicial investigation, and such of them as were thought by their advocates to offer any possibility of success were made the subject of earnest and protracted litigation, so that the early history of speaking telephony and the scientific principles upon which that art depends were litigiously and thoroughly investigated with great and extraordinary fulness.

8. The persons and publications so investigated and considered, for the most part claimed and pretended, or it was on their behalf claimed and pretended, that their early instruments and those on which they relied were speaking microphones. And thus the decision of the Patent Office and the courts in said controversies involved and adversely disposed of the pretensions of the alleged inventors of the microphone other than Berliner, as, for example, the pretensions of Daniel Drawbaugh, James W. McDonough, William L. Voelker, Philip Reis and others. The principal of these suits were before the Supreme Court of the United States in 1887, and are reported in Vol. 126 of the United States Supreme Court reports, to which report, and the reports of the same cases in the various circuit courts, in this court to be produced, reference is hereby made for fuller and greater certainty.

9. In the year 1892, the attention of the Attorney-General of the United States was specifically called to the importance and controlling effect of the variable-pressure telephone invention described and covered by the said Berliner patent 463,569, and particularly by claims 1, 2, 4 and 6 thereof, and it was alleged to him that the said patent, and especially said claims, granted to the American Bell Telephone Company the sole and exclusive right to an invention which in fact and in law the whole people of the United States had a right freely to use; and that said patent was unlawful, illegal and void. Thereupon, with the aid of special counsel and experts and persons skilled in the art, the Attorney-General and his associates examined and caused to be examined the subject, and on February 9, 1893, filed a bill in equity in the name of the United States of America, in the Circuit Court of the United States for the First Circuit, in the District of Massachusetts, against the American Bell Telephone Company and Emile Berliner. In and by said bill he alleged that the said patent was an illegal grant; that it was void; that it unlawfully abridged the rights of the citizens of the United States; that it ought of right to be annulled; and he prayed the Court to repeal and cancel the same, in whole or in part.

10. In and by said bill he averred that the American Bell Telephone Company gave out and claimed that the exclusive right vested in it by said patent, if valid, would secure to it the practical control of commercial telephony in the United States. He also in said bill described the invention in question as operating upon the principle of variations of pressure between electrodes in constant contact, and averred that the said patent, particularly by the said claims, which he styled "broad claims," covered "the feature of constant contact during operation between the electrodes." He said of it that "the feature of constant contact between the electrodes in a telephonic transmitter proved immediately, upon the practical introduction of the art of telephony, to be of great value; that so far as is now known, while other forms of transmitter are practicable for use on very short lines, the constant contact transmitter, or microphone, as it is sometimes called, is the only instrument capable of successful use in the transmission of articulate speech by electricity over such distances and in such situations as those for which the telephone is practically most useful and has hitherto been chiefly used."

11. It further appeared, partly from said bill and more fully from the testimony on both sides, that the transmitters so referred to as the successful and usual transmitters in commercial use, were chiefly or entirely of the forms, styles and specific structures known as the "Blake" or single-contact microphone, in which the contact is composed of two electrodes; and the multiple contact transmitter, in which carbon powder is employed to produce a multitude of contacts as in some forms of the "Edison" style in public use in 1878, and with the powder in a granular form in the "Hunnings" or "Long Distance" style, the latter of which was at and before the filing of the Attorney-General's bill in universal use by the American Bell Telephone Company for the transmission of speech over long distances. Thereupon the Attorney-General's bill averred that "the broad claims of said patent 463,569 cover in their scope every form of constant contact telephonic transmitter which it is possible to make."

12. Among the alleged reasons for the alleged invalidity of the patent the said bill averred that Berliner had never made the invention therein described and claimed by said broad claims; that if he had made it, he was not the first to make it; that neither the instruments of the application nor of the patent were operative for the purposes set forth, or for any useful purpose; that the description in the application was insufficient; that the description in the patent was insufficient; that the right to a patent had been abandoned and lost; and that the proceedings in the Patent Office, and the conduct, both of Berliner and the Bell Co., relative thereto, were of such a character, particularly as regards the length of pendency of the application and the making of amendments thereto, that the Commissioner had no right to issue the patent and should not have done so, and that the grant of it was an illegal, unlawful and void grant. And he also alleged that the patent 238,969, issued on November 2, 1880, to Emile Berliner, and by him assigned to the American Bell Telephone Company, was in fact and in law a patent for the same invention as that for which the patent in suit 463,569 was issued, and exhausted the power of the Commissioner and made the patent 463,569 here in suit unlawful and void.

13. For all which and other reasons more fully set out in said bill a copy of which is here in court to be produced, he prayed for a repeal of the said patent 463,569 in whole or in part.

14. To said bill the American Bell Telephone Company and Emile Berliner duly filed answers declaring the scope of the said Berliner patent to be as in said bill was alleged, denying the alleged invalidity of the patent and the allegations set forth as the grounds thereof, and asserting that Berliner was in fact and in law the true, first and original inventor of said invention, and that the patent was a good and valid grant in the hands of the American Bell Telephone Company and ought to be respected as such.

15. Thereupon evidence was taken at length on both sides and the case was argued and was finally decided against the United States and in favor of the American Bell Telephone Company and Emile Berliner by the Circuit Court of Appeals of the United States for the first circuit, by a decision on the merits, made on May 18, 1895, directing that the bill be dismissed; as will more fully appear from the opinion of said court bearing that date, here in court to be produced.

16. It is a fact and it also appeared by the record in said suit that the attorney-general or his representatives were, when said bill was filed and before the evidence was concluded, fully aware of all the grounds of attack against said patent which in the course of many years of conflict have ever been seriously suggested, and with the preten-

sions of all those who have ever been suggested or alleged as having invented the variable-pressure speaking telephone prior to Berliner. They duly investigated the same, and such of them as were not specifically alleged in said bill nor attempted to be proved in the evidence were so omitted because upon investigation it was believed, concluded and judged by him or his representatives in the case, in the exercise of their official functions and under their official responsibility, that the same were false and unfounded and not worthy of further attention.

17. In said suit (among other matters) it appeared and was either expressly found by the court or admitted by the attorney-general's special counsel at the argument to be matter too clearly proved to be capable of dispute, that Berliner made the invention in controversy before he filed his application; that he was the first to make it; that the description in his original application and the description in the patent were, each of them, sufficient both as regards the structure and the operation of the variable-pressure telephone; that the American Bell Telephone Company and Berliner were lacking in no duty and guilty of no fault in the prosecution of the application; that the invention of the contact transmitter and the invention of the contact receiver were two inventions each capable of supporting a patent; and that said patent either in whole or in part ought not to be cancelled or repealed.

18. It also appeared and was found by the Court that the question of the effect of patent 233,969 on patent 463,569 (the patent in suit) was duly, carefully and elaborately considered by the proper superior officers of the Patent Office, and that, after argument pro and con it was by them adjudged that the patent 233,969 did not destroy or impair the right to the patent 463,569 here in suit.

19. And so the complainant says that the Berliner patent here in suit is and must be taken to be, for the purposes of a preliminary injunction and for all other purposes, a patent the validity of which has been sustained upon a full judicial investigation of its merits.

III.

20. It is a fact, and is stated in the attorney-general's said bill, that down to the date of the filing of said bill no electric speaking telephones of any kind had been used to any considerable extent by any person in the United States except under license from the American Bell Telephone Company and its predecessors in interest, because all other users had been enjoined by the courts in suits brought under the two Bell patents, herein before mentioned, both of which were in force at that date. Subsequently to the expiration of said Bell patents, the defendants herein jointly made, used, offered for sale and sold to others for use variable-pressure constant contact telephone transmitters, embodying the invention, the sole and exclusive use of which was granted to the American Bell Telephone Company by the Berliner patent 463,569 here in suit. They did this, knowing the existence and the said scope of the said Berliner patent, and the pendency of the attorney-general's said suit, but asserting to their customers that they believed that no suit would be brought by the American Bell Telephone Company on the Berliner patent until there had been a decision in the attorney-general's suit, and that, in their opinion, the attorney-general's suit would result in the defeat of the Berliner patent.

21. But since the decision of said suit as aforesaid they still continue to make, use and sell to others to be used such transmitters as aforesaid, falsely giving out and pretending that the result of said suit decides nothing, and asserting that they will not respect said patent and that it ought not to be respected.

22. The defendants, well knowing the premises, but designing and contriving to injure your orator and to deprive your orator of the benefits and advantages arising and accruing from the exclusive possession, exercise and control of the invention and improvements patented in and by the patent No. 463,569, to which your orator has been and is justly and lawfully entitled, have jointly, without the consent and against the will and protest of your orator, within this district and elsewhere within the United States, since the seventeenth day of November, 1891, unlawfully and wrongfully used and furnished to others for use, and caused to be used and to be furnished to others for use, electric speaking telephones, each of which embraces and embodies the inventions and improvements or substantial and material parts thereof described and claimed in the said Berliner patent No. 463,569, and particularly those claimed in each of the claims designated 1, 2, 3, 6, respectively, in the specification of that patent; and still are using and furnishing to others for use such electric speaking telephones, and are causing the same to be used and to be furnished to others for use, in violation and infringement of your orator's exclusive rights in the premises, and threaten and offer to the public to continue so to do; but precisely how long the defendants have used or furnished to others for use such infringing telephones, or caused the same to be used or furnished to others for use, or what number of said infringing electric speaking telephones the defendants have so used or furnished to others for use, or caused to be used or furnished to others for use, your orators are ignorant or want of a discovery, and pray that the defendants be required to disclose and set forth these matters in their answer hereto.

23. Your orator further shows that the telephones so made and sold by the defendants in violation of your orator's rights in the premises, are sold by them to go into all parts of the United States, and into the territory of several and of all of your orator's licensees; that they are small instruments and easily used in private, usually only a few by one person, and easily transferred from one person tô another; that unless the defendants shall be enjoined from further infringements it will be exceedingly difficult and practically impossible for your orator to prevent their infringing use; and further, infringements by the defendants will irreparably damage and injure your orator, and depreciate or destroy the value of the exclusive franchise to which your orator is entitled under the patent aforesaid, and will grievously injure both your orator and its licensees in their said business and will deprive each of them of benefits and advantages for the loss of which there exists no adequate legal remedy.

24. Your orator further shows that, in addition to the relief herein sought against the defendants, they are likewise entitled to restrain each and every user of any infringing telephone or telephones which have been or shall be furnished or disposed of by the defendants in violation of your orator's exclusive rights in the premises, and to recover and collect from each user thereof a suitable sum of money, as and for damages and profits in consequence and growing out of such use; and your orator, notwithstanding any proceedings in this cause, does not waive any rights or remedies which it may have against each and every person who has or shall have used any of the said infringing telephones, but wholly insists upon its said rights and remedies, and avers and asserts that it intends to pursue and enforce the same against every such user; but your orator further avers that the defendants are also liable to pay to your orator other sums of money as and for profits by them actually realized, and as and for damages by them directly caused to your orator by reason of their said infringements and unlawful acts.

25. The principal and substantially the entire business of the defendant corporation since March 7, 1893, has been the manufacture and sale of telephones which embody the said Berliner invention patented by the patent in suit, and it is pecuniarily irresponsible and unable to respond to a decree for damages in favor of the complainant in this suit.

During all the time of the infringements herein complained of, the defendant Emery has been and now is the president and a director of said company, and the defendant Leatherbee has been and now is the treasurer and a director of said company, and the said two defendants during all said time have been and now constitute a majority of the directors of said corporation and have been and are its managing and controlling officers; said Roberts has also been and is a director thereof. Said Boardman has been and now is the "electrician" of said company, and has personally devised some of the details of said infringing instruments, and has personally constructed them or supervised and directed their construction.

Each of them is also largely interested in the infringing business carried on by said National Telephone Manufacturing Corporation, and in the profits thereof, and has personally and actively committed, caused, promoted, maintained and participated in the said infringements upon the exclusive rights secured to your orator by said Berliner patent as aforesaid, and has shared and intended to share in the profits and benefits arising and accruing therefrom.

IV.

26. To the end, therefore, that the defendants may, if they can, show why your orator should not have the relief herein prayed, and may, according to their best and utmost knowledge, remembrance, information and belief, but not under oath, which is hereby expressly waived, full, true, direct and perfect answer make to the matters hereinbefore stated and charged, and more especially may answer, discover, and set forth whether during any and what period of time, and whether within this district or elsewhere, and when and where they or either of them used the said improvements or either of them, and how the said telephones made or used or sold by them and the several parts of the same are constructed and used.

And that the defendants may be decreed to account for and pay over to your orator all such gains and profits as have, and shall have, resulted and accrued to them from the said unlawful using or furnishing to others for use of electric speaking telephones embracing or embodying the invention and improvements or any material and substantial part thereof, set forth and claimed in said patent No. 463,569; and that, in addition to the said profits to be so accounted for, the defendants may also be decreed to pay your orator the damages which your orator has sustained by reason of the said violation and infringement of its exclusive rights aforesaid, and which this Honorable Court may assess or cause to be assessed, together with such increase thereof as your Honors may see fit to adjudge.

And that the defendants, their attorneys, agents, workmen, servants and confederates may be perpetually enjoined and restrained by the decree of this Honorable Court from directly or indirectly making, using, furnishing to others for use, or selling any electric speaking telephones or telephonic apparatus whatsoever embracing and embodying the invention and improvements, or any material and substantial part thereof, set forth and claimed in said patent No. 463,569.

And that the defendants may likewise be restrained and enjoined to the same effect while this cause is proceeding to final order and decree.

And that the defendants may be further decreed to pay the costs of this suit.

And that your orator may have such other relief as the equity of this case may require, and as your Honors may deem to be just and right.

27. May it please your Honors to grant unto your orator a writ of injunction conformable to the prayer of this bill, and an injunction *pendente lite* to the same effect, until further order, and also a writ of *subpœna* directed to the said defendants, the National Telephone Manufacturing Company, at Boston, Massachusetts, James D. Leatherbee, of South Braintree, Massachusetts, Woodward Emery, of Cambridge, Massachusetts, Stillman K. Roberts, of Malden, Massachusetts, and Arthur F. Boardman, of Somerville, Massachusetts, commanding them and each of them to appear and answer unto this bill of complaint, and to do and to receive what to your Honors shall seem meet in the premises.

THE AMERICAN BELL TELEPHONE COMPANY,
By JOHN E. HUDSON, President.

James J. Storrow; Fish, Richardson & Storrow, Solicitors and of Counsel for Complainant.

The Citizens' Telephone and Electric Company, recently organized at Hoboken, N. J., with William H. Ellis president, John Ryan secretary, has applied for permission to construct subways and conduits in certain streets. If the franchise is granted, the company will reduce telephone rates to less than one-half the present charges.

A telephone line is being put up between Atlanta and Rome, Ga., which when completed will connect that city with nearly all the large cities in that State, among them Macon, Columbus and Augusta. The line will be completed by September 1. It is probable that it will be extended to Chattanooga very soon.

The Pennsylvania Telephone Company has been granted a franchise at West Bethlehem, Pa., conditioned upon the maintenance by the company of a fire alarm system and free telephones for the borough's use.

The Spartanburg Telephone Company, a local company which has been organized at Spartanburg, S. C., to compete with the Bell Company, is now arranging to put up poles and wires. The capital stock is placed at $10,000. The company has already secured 165 subscribers on five-year contracts.

The Central Bell Company has been notified to remove its telephones from the county offices in Toledo, Ohio. A contract has been made with the Harrison Company for local exchange service.

State Senator Rourke, of Rawson County, N. D., is interested in the proposed constructon of a telephone line from Lisbon to Fargo, that State, to make connection with the Fargo and Grand Rapids line of the Northwestern Telephone Exchange.

The Rahway Telephone Company, lately granted franchise at Norfolk, Va., is canvassing for subscribers.

Fred Kraus, of Milwaukee, has asked for a telephone franchise at Menasha, Wis.

The Southern New England Telephone Company has applied for underground privileges at Willimantic, Conn.

A telephone line is to be constructed between Morrison and Sterling, Ill.

The telephone line between Galesville, Wis., and Winona, Minn., will be extended to Ettrick, Wis., at an early date.

Fairfield and Mount Erie, Ill., are to be connected by a new telephone line eighteen miles long.

Underground rights have been granted to the Southeastern Telephone Company at Brockton, Mass.

The Phœnix Interior Telephone Company, 131 Liberty street, New York, has closed contracts during the past week for upwards of 400 telephones.

A company with a capital stock of $10,000 is being organized at Scranton Pa., to install a telephone exchange system in that city.

Herman de Laguna has applied for a telephone franchise in Los Angeles, Cal., offering to build underground conduit system in a restricted district; to pay 1 per cent. of his gross receipts to city annually and to furnish to the city departments fifty telephones free of charge during the life of his franchise.

ELECTRICITY.

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EDITORIAL NOTES.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—" ELECTRICITY," June 5, 1895.

The Problem of the Brake Upon the Trolley Car. Our esteemed contemporary, the *American Machinist*, in reply to an editorial in a recent issue of this paper, says that the question at issue is *not* whether the electrical journals have published anything on "brakes," but "the perplexing problem of *how to operate* the brake upon the electric car so that an electrically propelled car shall be as safe as any other so far as the stopping of it is concerned." . . . "It would be a great relief to our minds, and a great assurance of safety to the general public, if any one would assert and prove that it is not true, as we asserted, that an electrically driven car upon a street railway, a trolley car. either an overhead trolley or an underground trolley, and especially and for an additional reason, a car operated by a storage battery, cannot either of them, *with safety to itself*, be stopped as quickly as any other car of the same capacity, and running at the same speed."

The burden of our contemporary's argument seems to be that the brake on an electric car is purposely made slow to avoid injury to the car; and after making the assertion that it is, asks us to disprove the assertion. This is indeed begging the question, for the burden of proof certainly lies with the "allegator." It has never occurred to us, nor do we believe that it has ever occurred to any of the manufacturers of electric cars, that the brakes were made slow-acting to save the machinery of the cars. Such an idea is to us absurd in the extreme, and if the *American Machinist* has any valid reason for thinking that this is true it seems to us high time that it should declare its reasons. They are necessarily somewhat slow of action for the same reason that the old hand brakes on the steam roads were and are slow acting—solely and simply because they are hand brakes, and not for the purpose of saving the machinery. The air brake has largely supplanted the hand brake on steam roads, and was also employed on the Intramural, but has not found favor on street cars, either cable or electric, for various reasons—but the one suggested is certainly not one of them.

One of the chief virtues of the air brake is that it can be applied almost simultaneously to all the wheels of a long train. Where there are but four wheels, as in the ordinary street car, and these can be braked simultaneously from one point, the requirements are fairly well met by the present hand brake. Not very long ago a paper was read by Mr. Elmer Sperry before the Institute on an electric brake. This and other electric brakes have been assiduously exploited in the market but have failed of general favor—not so much because they failed to accomplish what was claimed for them as because there has not yet arisen any apparent need for them. We believe that it has been very fairly demonstrated that a four-wheeled car, for instance, can be brought to a standstill within a space so short by the hand brake that neither the air brake nor the electric brake could do much better. and that the difference in favor of the two latter is more than counterbalanced by certain disadvantages inherent in them. A cable car is by no means as heavy as a motor car, nor is there a cable line anywhere in the country running at as great a speed as electric cars are habitually driven. We think also that there is no question at all but that an electric car, notwithstanding its greater weight, can be stopped more quickly than can a cable car, and that all it requires with its present braking facilities is that those facilities should be applied intelligently. A cable car cannot back out, nor rely upon anything to stop its course but the adhesion of the wheels on the track. With the electric car as with the steam locomotive the wheels may be reversed as soon as the speed is reduced so that this may be done without skidding. The storage battery car is more difficult to stop than the trolley if both are at the same speed, simply because the storage battery car weighs just about twice as much as the heaviest cable car.

The greatest trouble, in our opinion, with the braking facilities of our electric cars is that the motorman has too much to do already. He has the controlling lever in one hand, the brake lever in the other, a reversing switch, which we suppose he is expected to control with his teeth while he blows a whistle with his mouth, a bell push to occupy one of his feet and the pawl on the brake ratchet which his other foot is in, tended to control and a sand valve thot must be operated somehow. There is a canopy switch also which, if he be very tall and sprightly, he might work with the top of his head. Now, supposing we add an emergency brake or two, as the *American Machinist* would have us do, that would have to be controlled in the same way that the one-armed fifer held his fife while passing his hat for alms, and this, we think, would not be an effective method of control.

* * *

Grand Transmission Scheme at Goose Pond. High among the forest-crowned hills of western Massachusetts lies a pretty sheet of water of about 250 acres area, bearing the romantic appellation of Goose Pond. It feeds a little trout-stream which tumbles somewhat precipitately over a stony bed for a distance of three or four miles, and finds its way into the Housatonic in the town of Lee, furnishing along its course somewhat uncertain water power to half-a-dozen small manufacturing establishments. A few days since the local newspaper of the vicinity came out with startling headlines, followed by a column article containing many interesting particulars respecting "a great scheme" which was on foot for developing the almost limitless resources of Goose Pond in the way of power, to be distributed by electric motors to the manufacturers of Lee. "The plan," says the local reporter, "was suggested by a Mr. Upton, who was here in the interest of the Standard Thermometer Company which manufactures arc lamps. In conversation with the manufacturers on the Goose Pond stream he suggested the advantages of the above plan." The water, we are told, is to be carried three miles in a pipe and then delivered through an inch-and-a-half nozzle to a 15-inch Pelton wheel, under a head of 600 feet, "furnishing at a low estimate 2,000 horse power night and day during the entire year." Mr. Upton estimates that a plant of 2,000 horse power capacity might be furnished for about $75,000, or of half that power for $50,000, and that it could be operated at an expense of about $10,000 per annum, including fixed charges. As steam power is estimated to be worth $40 per horse power per year in Lee, "it can easily be seen," says the reporter, "that the scheme, if successfully carried out, would prove enormously profitable"—possibly as profitable as the local electric light plant established by the Thomson-Houston Company, respecting which Electricity gave some interesting statistics a few weeks since. "To those who know what has been accomplished in harnessing the mighty forces of Niagara, and what science is doing in other directions," continues the reporter, "this can hardly appear incredible. If the statements above can be relied upon, and they undoubtedly can, as Mr. Upton is thoroughly conversant with the subject, there is certainly no apparent reason why the plan cannot be carried out."

Some account of this project having been published in the *Springfield Republican*, Mr. F. L. Pope, who appears to be familiar with the topography of the Goose Pond district, in a letter to that journal calls attention to the fact that the water-shed of Goose Pond has an area of only some four square miles, and says that if all the water that falls on that area during the year were stored and utilized (a thing which is probably impracticable), the utmost amount that could be utilized for consumption in a dry year would be about 261 horse power, instead of the 2,000 reported to have been figured out by Mr. Upton. The manufacturers of Lee, it appears, have held a meeting and have appointed a committee to consider the matter. They had better go slow; if they should decide to invest $75,000 in a transmission plant and then find that they could only get 261 horse power, they might, after due consideration, be disposed to think that the time-honored appellation of their storage reservoir had not been bestowed wholly without prophetic significance.

Under the Searchlight.

Views and Opinions on Timely Topics.

Lost, Strayed, Stolen or Skedaddled—A Street Railway Company.

While in the Northwest recently, a member of the staff of Electricity made some effort to find the St. Cloud Street Car Company, but learned at once that the search was not likely to be successful, as several other interested parties have been looking for it since January last. The affairs of this company were recently reviewed in Electricity. There was $100,000 stock and $100,000 bonds issued, but out of the proceeds no power house was provided, the power having been rented from the local lighting company. One of the stockholders of the latter company, a substantial citizen of St. Paul, Chas. S. Benson, has been manager of the street railway property, being engaged by Mr. Byllesby. The street railway company now owes the lighting company upwards of $4,000 for power. In January of this year, when the General Electric interests fled from St. Paul in the night, Mr. Benson was told to apply the receipts to operating expenses, and to go ahead and run the system, as there was no one to remit to. The receipts have been just about enough to pay the wages account. In June the main part of the property of the company, located in St. Cloud, Stearns Co., was sold for taxes, and was purchased by interests friendly to Benson. A director of the lighting company has visited the East, and been informed by Messrs. Coffin, Byllesby, Levis and others that they do not know who owns the stock of the company. This stock was all issued originally to the Northwest General Electric Company. Early this month the St. Paul Title Insurance and Trust Company, as trustee of the bonds, applied for a receiver, and asked that Mr. A. S. Huey be appointed. They refused to give up the names of the owners of the bonds. Mr. Huey, being an employee of the General Electric Company, was not acceptable to the lighting company in St. Cloud. They, therefore, asked the Court to appoint Mr. E. E. Clarke, Assistant Cashier of the First National Bank of St. Cloud. The Court granted their request on August 9. So far Mr. Clarke has received nothing, and it is doubtful if he ever will. The lighting company refused to turn over the property until their claim is paid, and the man who bought it in for taxes also thinks he has a pretty good claim on it, but either of these parties would willingly give up the system if they could get their pay. In fact, if they do not find the owners, they are likely to run the cars into the river and sell the track as junk, because the ownership of the system, if it also entails the expense of operation, would be a positive misfortune to anyone. The company owns six cars, three of which are sick. If this notice shall attract the attention of the actual owners of the system, we hope they will come forward and claim their property.

* * *

The Fort Clark Street Railway (Peoria, Ill.) Company's property has just been sold by the receiver to the Central Railway Company of the same place. The city of Peoria has a population of 41,024. The aggregate capitalization of the two systems was $1,550,000, as against $615,000, the limit allowable according to the ordinary rules of honesty. The Ft. Clark property was entirely a General Electric enterprise. There was an authorized issue of $500,000 stock, of which $177,750 is held by the General Electric Company as an asset. Of the $250,000 bonds, $50,000 were turned over to the Street Railway and Illuminating Properties and the remainder sold to other investors.

* * *

Financial News.

The *Electrical World* sustains the reputation it has made in discussing electrical finances from week to week. A few months ago, it will be remembered, the *World* announced in behalf of its master, the General Electric Company, that the loss of the Edison feeder and main patent was offset by a great victory over the Universal Electric Company of Cleveland on incandescent lamps about two weeks before the Edison lamp patent was declared to be expired by the United States Supreme Court.

Last week our abject and servile contemporary said:

> Electric Storage Battery continues strong and active; on Thursday the stock reached its highest point this year, selling up to 46. Later on, however, selling to realize profits, by those who had previously picked up some of the stock at low figures, caused a reaction to 45. The stock appears to have come into marked favor on the Philadelphia Exchange for both speculative and investment purposes, probably owing to the rather advantageous position of the company as regards volume of business and control of patents.

Will Mr. W. J. Johnston, the proprietor and editor of the *Electrical World*, explain just what is meant by the last sentence in the above paragraph?

Does he know—

1. That the capital stock of this concern is $13,500,000?

2. That about half of this amount is represented by "patents"?

3. That there has not been, in the history of the storage battery business, one year in which the gross business done in America amounted to $200,000?

4. That the best informed storage battery men in this country state with positiveness that the gross annual output can scarcely reach $250,000 in the next five years?

This is just about one-fiftieth part of the business the company need to do to pay dividends on their stock, unless, indeed, they pay dividends out of the proceeds of the sale of more stock—a plan not entirely unknown to the promoters of the Electric Storage Battery Company.

Would Mr. W. J. Johnston invest one dollar of his own money in this scheme?

If not, does he consider himself an honest man, or his paper an honest paper when it assists the promoters to gather in the money of investors not so well informed?

* * *

On August 25 a meeting of various heads of departments, etc., was held at the Harrison lamp works, to glorify Lieut. Ayres for his magnificent conduct of that establishment. The general tone of the comment was that the Lieutenant had dropped down at Harrison as a special dispensation of Providence. Especially was his great "system" praised. The next day an order came in for a few thousand lamps of a certain voltage, which could not be filled though the Lieutenant had reported that there were 300,000 of them in stock.

* * *

News comes from Washington that the law officers of the Government have decided to prosecute further the case of the Government against the Bell Telephone Company, recently decided in favor of the Bell Company. So far as we can learn, the only telephone company in America which wants the Government to continue this litigation is the American Bell Telephone Company.

* * *

Another Fixture Combine.

Not satisfied with the knockout he received two years ago in a similar attempt, Mr. C. M. Biddle, of Philadelphia, is trying to form another combination in the fixture business. The corporate name is the Gas and Electric Light Manufacturers' Association, and the officers are: President, John H. Selmes, of the Mitchell-Vance Company; vice-president, H. C. Beck, of the Vosburg Manufacturing Company, of Brooklyn; secretary, A. M. Thackara, of the Thackara Manufacturing Company, of Philadelphia; treasurer, J. A. Cunningham, of the Brooklyn Gas Fixture Company.

* * *

"*As a voltage of* 10,000 *has proved to be entirely practicable, a territory within a circle of* 100 *miles diameter can be as easily served from a central point as can one town from its own plant employing the usual voltage.*"—Electrical World.

* * *

An Appreciative Contemporary.

"Electricity's" Special Merits as an Advertising Medium.

(From the Electrical Engineer.)

ELECTRICITY has been called upon in innumerable ways by the enterprising advertiser to catch the eye of the public, and invariably with success.

* * *

A ST. LOUIS paper tells of a horseless vehicle which has been seen on the streets of that city "in the still hours of the night." It is the invention of a 21-year-old boy named Perry Lewis. "It flew up Lucas avenue at the rate of 15 miles an hour, and when it struck a big hill it climbed it with ease."

The contrivance is a high two-seated rig. Under the seats are 30 storage batteries, which are loaded through a chloride accumulator. The motor is an invention of Lewis's. He calls it a quadrupler. It consists of a big armature surrounded by four secondary coils. With this is connected a ratchet wheel that fits into a large cogged wheel, built solid with the axle. It takes 10 hours to store the batteries and they are then capable of running the vehicle at a speed of 12 miles an hour for 4 hours.

* * *

Who Knows Anything About This?

To the Editor of ELECTRICITY.

DEAR SIR: Why don't you make inquiries about the collections made of poor working people at Schenectady to pay for the street which the General Electric Company wants? Poor working girls are told to give so that they may not lose a chance to make a living. It's rotten.

* * *

THE *Electrical World* had last week 32 pages of advertising matter, exclusive of its own, 15 per cent. of which was from concerns unable to pay their bills. The *Electrical Engineer* had 23 pages. This is an average drop for both papers of 50 per cent. from the time when they were called upon to do their duty by the trade which they falsely claim to represent.

* * *

What Mr. Coffin Never Forgot.

(From the Washington Star.)

"Now, John," said Mrs. Porque to the new gardener, "I hope you will remember all that I have told you. And whatever you do, don't forget to water the electric light plant."

The Electropoise.

Methods of the Promoters Abroad.

(From Science Siftings, London.)

On December 14, 1893, an auspicious visit was paid to the office of *Science Siftings* by a person who expressed the desire to interview the editor, and whose business card described him as being "Mr. R. Bourne," the representative of the Electropoise Company, of London and Brighton. Bourne was forthwith gratified, inasmuch as he stated that he called at the suggestion of Mr. T. E. Gatehouse of the *Electrical Review*—a gentleman who, as our readers well know, has rendered yeoman's service in the exposure of "electric" quackery.

Bourne explained that his mission was to obtain a thoroughly reliable scientific opinion upon what he described, with unfeigned zeal, as a most marvellous appliance (not electrical) for the cure of disease—to wit, the "Electropoise." Curiosity is largely ascribed to the gentler sex, but be it confessed that the editorial chair immediately became vacant when a small box was produced by Bourne containing the latest candidate for public favor in the field of quackery.

The "Electropoise," which is priced to the public at five guineas, was produced for inspection, and its appearance is thus described without color or disparagement: A nickeled metal cylinder about three inches in length by one inch in diameter. The head of the cylinder has alength of about twelve feet of scarlet cord (the color is sometimes varied), through which run some strands of tinsel. At the end of the cord is a piece of elastic webbing, and attached to this is a small metallic buckle, so that the webbing may be utilized as a wristlet or anklet. The patient is to recline in a reposing position and place the webbing round the wrist or ankle and thus attain perfect health.

The most elementary knowledge of science makes it apparent that such a construction could not permit of the generation of any known force, be it electrical or otherwise, there being but *one* attachment to the cylinder.

It would be puerile to detail the testimony volunteered by Bourne as to the "efficacy" of his appliance, even when it was pointed out that his assertions could not possibly be well founded. It was patent, however, that the agent of the Electropoise Company had been gulled by his principals, and that Bourne was simply an ignorant, enthusiastic subordinate—at once a dupe and an instrument. He admitted that he had no knowledge of either science or pathology, although his duty was to see and examine patients. When further questioned he stated that he obtained from the patients the diagnosis of their doctor, failing which he expressed himself as possessing the knack of arriving at the nature of the diseases or disorders with which the patrons of the "Electropoise" were affected. Bourne handed over the "Electropoise" for inspection, together with a pamphlet and a book of directions for using it, for perusal, and departed, observing that *Science Siftings* would receive a further communication from his principals.

This is the story of the man whose functions are to advertise and sell the "Electropoise" in this country and advises upon the treatment of cancer, Bright's disease, cholera, diphtheria, ovarian tumors and a host of other fearful and often fatal maladies. The wickedness and fraud of the employers of Bourne have no bounds, for in plain type the intervention of a medical man is inhibited. The "Electropoise" alone is to decide the issue of life or death Forsooth it *cures without medication*. This fraudulent instrument bears everything on its surface save the contents of the cylinder; clearly the cord and webbing are pure negations. The cylinder has been broken and examined—its contents analyzed. It is loaded with plumbago mixed with sulphur. This combination has been chosen probably because it is one of the cheapest forms of ballast that could be poured into the cylinder when in liquid or molten form. Observe the language of "Electropoise" charlatans, who thus describe their crude and impertinent imposition: "It consists of a cylinder, called a 'Polarizer,' filled with imperishable materials, combined, after *years of study and experiment*, to produce the best possible results."

A scarlet pamphlet expatiates on this device vended at £5 5s. 0d., and which has been thus assessed by a well-known fancy goods dealer in the City of London: "If this article were *amusing* or *useful* I would price it in my establishments as a shilling line." The pamphlet referred to on its blushing cover thus announces the utility and capability of the "Electropoise":

THE NEW ERA.

The
ELECTROPOISE
CURES

Bright's disease,
Chronic catarrh,
Constipation,
Consumption,
Diphtheria,
Dropsy,
Dyspepsia,
Heart disease,
Insomnia,
Locomotor Ataxia,
Nervous prostration
Paralysis,
Rheumatism,
Varicose veins,

And all other Curable Diseases,
Without Medicine or Electricity.

Electropoise offices, 263 Oxford St., W. (close to Oxford Circus), *4 North St., Quadrant, Brighton.*

What we assert is that these are tissues of deliberately and wickedly false representations. The "Electropoise" never has cured nor will it ever cure or affect any ailment which has ever befallen mankind; and no one is better aware of the fact than its scheming promoters that it is an impudent juggle of expert American sharpers, who imagine that the English Press has its price for aught and everything. Interleafed in this pamphlet containing a variety of Press notices is a lithograph of a letter written on four sheets, bearing a crest and purporting to emanate from the Rev. J. Edmond Long, Incumbent of Holy Trinity, New Charlton, S.E.

Are those responsible for the Press notices to which we refer or is the reverend gentleman we name aware that puffing a fraudulent quack remedy of the vilest description even innocently, or rather ignorantly, is conduct which cannot commend itself to any thoughtful man? Think of perchance a poor cancer-stricken woman with slender purse being led by her paper or the reference of the man of God to visit 263 Oxford street. We know where the responsibility begins, but the question is where does it end.

The most efficacious manner of unmasking the authors of the "Electropoise" fraud is to publish the following extract from a letter received by *Science Siftings*, headed "1405 New York Avenue, Washington, D. C." (we commend this address to the American Police), and dated January 4, 1894. . . . "The past seven years of my life have been devoted to the introduction and sale of the Electropoise. . . *Not being a scientific man*, I have been content heretofore, having my hands full of business, to know that the thing would cure disease, and with it to effect cures heretofore unknown to men. The time has arrived that we are anxious to know the scientific basis for this action. . . I shall be glad to give you all the information in my power and am sure that a *fair* investigation will show you that it is what we claim and open the way to an arrangement by which both of us can make some money.—Awaiting your favors, I am, yours truly, JOHN N. WEBB, President."

What does this letter of grammatical gaps mean? Can there be any doubt whatever about the fact of John N. Webb's barefaced attempt to bribe *Science Siftings*, knowing the part it has taken in the unveiling of Quacks. *Science Siftings* replies not by letter but by this article, respectfully declining to make some or any money in conjunction with a man who seems to be a candidate ripe for the felon's dock.

To pretend that diphtheria, cancer, or heart disease can be cured by wearing an elastic wristlet attached by a cord to a piece of metal is surely criminal, when the pretence is made with intent to obtain money. Further than this, can a parallel be found to the heartless villany that suggests that this device will resuscitate a drowning man, when the precious moments thus lost would certainly render recovery impossible? One can readily appreciate the existence of lynch law in the Far West, but the astute Mr. Webb spins his web in Washington, where we sincerely trust he may remain and cure snake bites and small-pox, as set forth on page 232 of his interesting literary production, bearing the title of "Plain Directions for Using the Electropoise." John N. Webb has at least played one meritorious part in his life story, for he has contributed a moral lesson of no mean value as a weapon in the Quack Crusade.

WATER-POWER APPLIED BY ELECTRICITY TO GOLD-DREDGING.*

BY ROBERT HAY.

In many mining districts there are deposits of gold which cannot be worked owing to the difficulties of transport and the dearth of fuel. The application of water-power transmitted to a distance by electricity is, therefore, a subject which may well command attention in well-watered countries like New Zealand, where a plentiful supply of power is obtainable, for intervening hills and valleys form no obstacle to its transmission, there being few districts through which light wires and poles cannot be easily carried.

The plant described in this paper is the first of its kind constructed in New Zealand. It was designed by the author for gold-dredging on the River Shotover, at a point about 30 miles from its confluence with Kawarau River and 2 miles from Queenstown, a small town situated on Lake Wakatipu, which lies about 1,000 feet above sea-level. The Shotover runs through rugged and inhospitable country, generally in precipitous rocky gorges, and is only accessible by tracks cut down the leading spurs and gullies. Since the dredge commenced operations, however, a mountain road has been constructed at a considerable elevation above the river, and extends some 20 miles towards the Upper Shotover dredging-ground, opening up to some extent the interior of that part of the country.

All the bucket-grab and suction dredges hitherto employed in New Zealand have been actuated by steam power; bituminous coal, lignite or firewood usually being fairly plentiful, and accordingly moderate in cost. In the case referred to, however, fuel could only be obtained at prohibitive prices, as it would have been necessary to transport it to the dredge for long distances over the mountain tracks on the backs of horses. Water power in a convenient form was found to be available at a branch creek, but for many reasons it could not be applied directly to dredging. It was therefore decided to transmit the water-power by electricity to the dredge in whatever part of the river it might be working.

The water was obtained from a creek 1½ miles distant, and was brought, by a race cut in the side of the hill, or, through places where the ground was too precipitous or loose to carry the race, by a timber flume, to a pressure-tank situated at a point 524 ft. above the generator-house. The race is 2 ft. 6 in. deep, and 3 ft. wide at the bottom, and the sides are cut with slopes of 2 in 1. The flume is rectangular in cross-section, 2 ft. deep and 3 ft. wide, and in places where it could not be wholly set in a cutting along the side of the hill, is carried upon trestles standing about 6 ft. apart. The pressure-tank is 20 ft. long and 12 ft. wide at the bottom, and has sides with slopes of 1 in 1 and 2 in 1. The water passes from the pressure tank through a bell-mouth covered by a wrought-iron grid, and is carried in steel pipes to the generator-house.

The pipes are of rolled steel of 16 and 11 B. W. G., with double-riveted longitudinal seams and single-riveted circular seams with 1½ inch lap. The pipes are each 19 ft. 6 in. long over all, and are jointed with wrought angle-iron flanges riveted to the pipes. The internal diameter of the main pipe is 14½ inches.

The quantity of water available in ordinary seasons is 240 cubic feet per minute; but in dry weather, after a fine winter, when the snowfall has been light, the supply falls to about half that quantity. This, however, is sufficient to develop the necessary power.

The generator-house is situated about midway between the ends of the portion of the river to be worked, which is about 4 miles long. The prime mover at the generator house is a 4-foot Pelton water wheel, on the buckets of which the water impinges from a 1½ inch nozzle at a pressure, in the pipes outside the station, of 228 lbs. per square inch. The Pelton wheel drives by belt two Brush-Victoria series wound dynamos which, when working at their normal speed of 700 revolutions per minute, give each an electromotive force of 650 volts and a current of 40 amperes, or together a total electrical output of nearly 70 H. P. The two dynamos are coupled in series. A Buss-Sombart tachometer, driven from the armature shaft of one of the dynamos, indicates their speed, while a Soames-Nalder amperemeter and a Cardew voltmeter (the latter reading up to 1,400 volts) indicate the current and electromotive force respectively. The Pelton wheel has no automatic regulator, as the work required of it is fairly constant. It was necessary, however, to provide against the possibility of an abnormal increase of current, due either to accidental short-circuiting of the line wired or to the sudden arrest of one of the motors, which might result in damage to the generator armatures, and to provide also against racing of the Pelton wheel and dynamo, which would take place if the circuit was broken or the load suddenly thrown off one of the motors by a belt leaving the pulley. This has been accomplished in the following manner. Two electro-magnetic switches are placed in circuit with the dynamos and motors, and are so adjusted that, in the event of the current increasing to three amperes above its normal amount, one of them, and in the event of it decreasing to three amperes below it, the other one, disconnects the line and motors from the circuit and throws into it in their place a set of iron-wire resistance coils, constituting an artificial load of the normal amount. If anything occurs to the line or motors to cause an abnormal increase or decrease of current, the dynamos are therefore automatically protected, and continue to work as if nothing unusual had occurred. When either of the switches comes into action, an electric bell calls the attention of the attendant. The contrivance has been found to answer well in practice, and has on several occasions saved the dynamos from the risk of damage.

The conductors between the station and the dredge form a completely metallic circuit, and consist of bare copper wire of No. 4 S. W. G., supported upon Johnson-Phillip fluid insulators. The supports are old 40 lb. rails, with a short hard-wood cross-arm bolted to each about 2 ft. from the top. This arm carried the insulators for the conductors, while a third insulator, bolted to the top of the rail, carried a telephone wire connecting the generator-house with the dredge, the length of line being about two miles. Between the ends of the conductors on the bank and the motors in the dredge, the two cables consist of seven No. 16 copper wires, and are heavily insulated with vulcanized indiarubber. The shore ends are clamped to the conductors near to one of the poles, a supplementary pole having to be used occasionally when the river bed is too wide to admit of a single span to the dredge. The other ends of the cable pass over insulated pulley-blocks, and are coiled upon a drum so that they can be drawn in or slacked out as the dredge moves towards or from the shore.

The electric motors, of which there are two, are also arranged in series, and are exact duplicates of the dynamos; the object being to make the various parts of the machinery interchangeable and to avoid a multiplicity of spare apparatus. A spare armature and field magnet are provided which will fit any one of the machines. One motor drives directly, through a belt, a centrifugal pump, whilst the other, geared to an intermediate shaft, drives the buckets, winches, and revolving cylinder of the dredge. As it is sometimes necessary to vary the speed or to stop the motor that works the buckets, a variable iron-wire resistance is provided by which its field-magnet coils can be shunted. The motor that drives the pump acts as a current regulator, for, when the bucket motor is switched off, or its speed varied, the pump motor absorbs the surplus electrical energy—revolving faster and causing the pump to throw more water, which, however, does not cause inconvenience. By this means great simplification in the working of the plant is attained—an important factor when electrical apparatus is placed in the charge of unskilled hands.

The frames and plating of the dredge, which is 80 ft. long and 20 ft. wide, are entirely of steel, and where possible all the framing, ladders, buckets, etc., are made of the same material. The buckets, which have each a capacity of 3½ cubic feet, are filled and discharged at the rate of about twelve a minute. This gives a lifting capacity while dredging to depth of 20 ft. of more than 90 cubic yards per hour, which is as large a quantity as can be economically treated on the tables for gold-saving purposes. The winches have separate barrels for the quarter, head, and hoisting lines, which are of steel wire, and each barrel is driven by a large worm-wheel. A vertical shaft carrying a worm-wheel is connected with bevel-wheels below the neck, which are provided with friction clutches so arranged that the barrels can be thrown in or out of gear by moving the winch handle to one side or the other, all the winches being driven by a shaft below the deck. The dredgings, boulders and gravel are delivered into a revolving cylinder 10 ft. long, constructed of bars set ½ in. apart. Through these bars the gold and finer sand pass on to the tables, the stones and debris being retained and afterwards discharged direct into the river through the stone-shoot. The tables are set at an inclination of 1 in 12, and are covered with baize upon which the gold is caught. The cloths are washed in tubs at intervals of eight hours, and are then replaced on the tables. A 16½ in. centrifugal pump, driven at a speed of 600 revolutions per minute, and with a lift of 16 ft. from the water-level, supplies about 2,000 gallons of water per minute to the revolving cylinder.

The dredger is lighted by two 10-ampere Brush arc-lamps, included in the power circuit in multiple series with the motors. They are controlled from a small switchboard on the vessel. A resistance-coil to take 20 amperes is arranged as a shunt on the lamps, while the remaining 20 amperes are divided equally between two circuits, in each of which an arc-lamp is placed. The switches are arranged so that if one of the lamps is switched off an equivalent resistance is thrown into the circuit in its place, the current in the circuit of the other lamp remaining unaltered. When the lamp is switched off it is entirely disconnected from the power circuit, so that it may be touched without danger of unpleasant shock. A third switch disconnects the resistances and lamps from the power circuit during the daytime, when the lamps are not required.

The full available output of the plant is not utilized, and a reserve of power is always maintained. The working duties of the plant as observed are:

Pressure of water in the pipes	228 lbs. per sq. inch.
" " at the valve	195 lbs. " " "
" " at the nozzle	188 lbs. " " "
Speed of the Pelton wheel	447 revs. per minute.
Water used per minute	108 cubic feet.
Power of the Pelton wheel	81 H. P.
Total electromotive force of the dynamos	1,170 volts.
Total current	30 amperes.
Total electrical output	47 H. P.
Loss of power transmitted through two miles of line	5·2 H. P.

The cost of the entire installation was:

	£
Dredger	2,600
Race and flume	500
Intake, pipes and valves	600
Electrical plant	2,500
Cartage of material to the site of the works	800
Total	£7,000

The cost of working the machinery with three shifts of eight hours each, as obtained from the results of three years' work, has been:

	Per Week. £	s.	d.
Wages, including dredge-master and electrician	25	0	0
Renewals, maintenance, oils, brushes, etc.	5	0	0
Management, office, rates and taxes	5	0	0
Total cost	£35	0	0

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* Proceedings of the Institute of Civil Engineers.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER IX.

The Mitchell Plant and the Mitchell Electric Company.

It seems almost needless to remark that in working the stock-and-bond scheme in connection with electric lighting stations in small towns the sums involved were, in general, of necessity much smaller than in those cases in which electric railways were exploited. The amount of money involved in the case we are about to discuss is trifling compared with the instances we have already dealt with in the street railway swindles. If, however, the Mitchell operation is somewhat lacking in interest from want of magnitude of the financial part of the scheme, we believe it will be conceded that it justifies giving enough space and time to its consideration to fully exhibit and demonstrate the amount of depravity and dishonesty these exploiters were capable of even in comparatively little things.

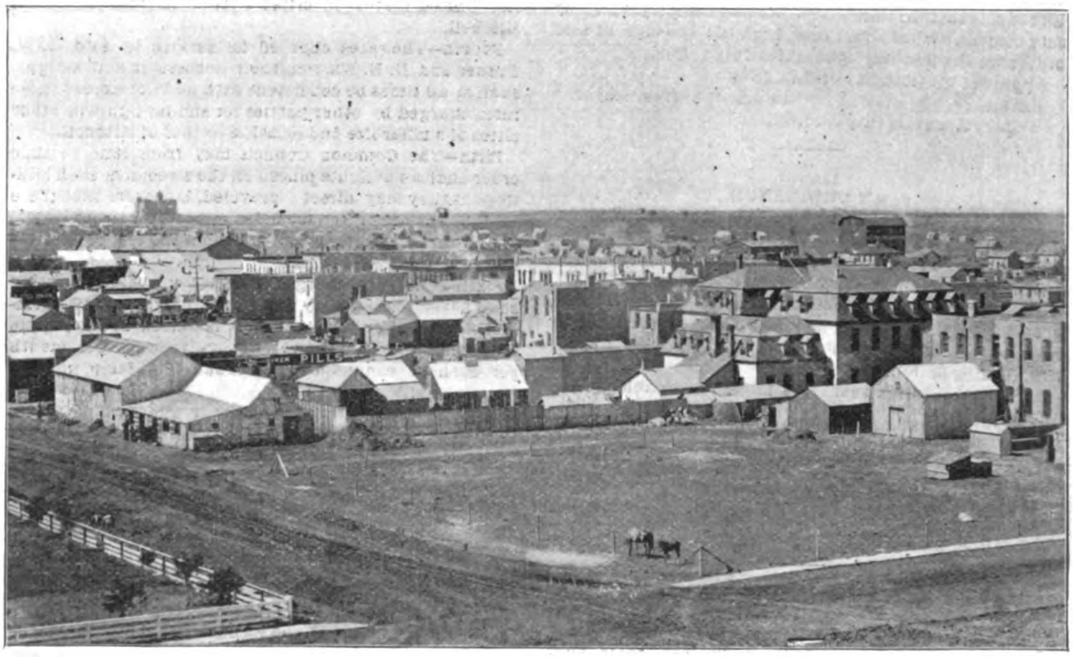
In the introductory chapter to this series of articles, published in last week's issue, we presented a general outline of the plan of conducting what Mr. Coffin has termed "exploiting work" in connection with establishing and operating local electric lighting stations, and we briefly described by what means and in what manner the Thomson-Houston Electric Company "was enabled to expand its business" by the aid of its thrice-christened, thrice-organized and thrice-capitalized sub or sub-parent company in the Northwest. It is now our duty to furnish conclusive evidence of the correctness of the statements made in the introductory chapter; and this we propose to do by citing many specific instances of local electric lighting plants which were established and run under the conditions described, and upon which plants companies were subsequently founded for taking them over and operating them in precisely the manner set forth.

One of the number of properties referred to as being carried as an asset upon the books of the Northwest Electric Construction Company at the time Mr. Byllesby was sent by Mr. Coffin to St. Paul, with instructions to re-christen, re-capitalize, re-organize and conduct the business of the re-organized Northwest sub-company, was known as the "Mitchell plant," and was located in the little town of Mitchell, Davison County, South Dakota.

For the benefit of those of our readers who are unfamiliar with the character of that section of South Dakota, and with its climate, population and resources, and who may not have conveniently at hand the means of obtaining such information, we shall give a few facts bearing on these points.

Davison County, of which Mitchell is the county seat, has a total area of 435 square miles, and its entire population at that time was only 5,449. The density of the population was therefore very low, being only 1.25 per square mile, and it has changed but very slightly since. The soil of the region it includes is quite rich and is very fertile in good seasons, but the frequent, long-continued droughts make the raising of crops and cattle extremely uncertain, and the financial condition of the principal part of the population equally uncertain, and, at times, very precarious. During seasons unfavorable to raising fair crops the inhabitants become, of necessity, relatively quite heavy borrowers. Very bad seasons are not infrequent, and when they occur the demand for money becomes relatively very great, it not being at all unusual, under such circumstances, for money to command interest at the rate of 2[illegible] per cent. per annum, the great risk of making loans on farming property in a country in which the climate is so uncertain justifying this extremely high rate of interest.

The whole State of South Dakota covers an area of 77,650 square miles, and the total population in 1890 was 328 808. The density of the population of the entire State is therefore only 4.28 per square mile. The frequency and severity of the droughts, the intensity of the heat in summer, accompanied with the extreme dryness of the atmosphere, often make the summer climate of this section of the country suggestive of the interior of a baker's oven, and the destructiveness of the intensely dry heat on vegetation can only be fully appreciated by those who have been in the country during a period of long-continued dry weather. The intensity of the heat in summer is more than equalled by the severity of the cold in winter, and the change in temperature in a few weeks is often something very startling, the difference in temperature being frequently as much as 140° F., the changes ranging from 40° below zero in winter to over 100° above in summer. To add to the discomfort and dangers of the inhabitants, the plains are often swept by the most frightful hurricanes and cyclones, which destroy everything in their path.



TOWN OF MITCHELL, S. D. (POP. 2.205.)

The town of Mitchell is located on the line of two railroads—the Chicago, Milwaukee and St. Paul, and the Chicago, St. Paul, Minneapolis and Omaha. At the time the plant was installed it had a population of 2,205. It has one main business street upon which there are a few brick buildings, but most of the structures are of wood. Almost the entire business section of the town is confined within the limits of about 1,400 feet of this street, and very nearly equidistant from the two ends of the street. There are a few side or residence streets, in which are a number of cheap frame buildings, a goodly portion of these being single-story structures. The town has no manufacturing or other industrial enterprises of any kind, except a small steam grist-mill. The town is situated in a prairie district, and its inhabitants are dependent for their trade and support almost entirely upon the agricultural pursuits of the very small population of the surrounding country; and its prosperity and prospective growth rest entirely on the prosperity and growth of the farming interests of the outlying district, and upon the degree of success the farmers meet with in raising their staple crops of corn and wheat, and in cattle raising.

A fair estimate of the very limited capital and business resources of the town and outlying district can be formed from the fact that the combined capital of the three banks in Mitchell is only $125,000, made up as follows:

First National Bank capital	$50,000
Mitchell National Bank capital	0,000
Security Bank capital	25,000

Such was the character, population and condition of what was to be the scene of the operations of some of Mr. Coffin's *exploiters*. We will now devote our attention to the details of how this "exploiting" work was carried on, and to a study of the methods employed in doing it, and to the final results of it so far as it relates to this "Mitchell plant."

At the time we are now dealing with, Mr. E. R. Gilman was the president of the Northwest Electric Construction and Supply Company, and the company had in its employ a Mr. H. W. Turner and a Mr. H. B. Warren. The latter named persons were deputed to make the customary overtures to the town authorities for obtaining a franchise for establishing an electric lighting plant and for securing a contract for furnishing the town with a certain number of lights for lighting the streets. In this they were successful. The nature and terms of this franchise and of the contract can be fully understood from the following transcript of copies of the official documents:

[COPY.]

ELECTRIC LIGHT ORDINANCE.

An ordinance granting to H. W. Turner and H. B. Warren the right to erect and maintain electric works.

Be it ordained by the City Council of Mitchell:

SEC. 1. That there is hereby granted to H. W. Turner and H. B. Warren and their successors and assigns, the right to establish, erect and maintain the necessary buildings, erect poles, posts, lamps, lines, wires, conductors and cables or other appliances or apparatus that may be necessary for the proper generation, conveyance and distribution of electricity for the purpose of illumination, heat and power.

Sec. 2. That for said purposes they may enter upon any of the streets, alleys or public grounds of said city, and make such excavations therein as may be necessary for erecting said posts or poles, or for laying said conductors, wires or cables, provided that such excavations shall be properly protected while open, shall remain open no longer than necessary, and shall be so filled and repaired as to leave the street or alley in as good condition as before the excavation was made. All main lines of wires or conductors shall be erected or laid upon the alleys as far as practicable, and no main line shall be constructed upon any streets except to make connections with some lamp or consumer, or to cross said street, from alley to alley, without a special permit from the City Council, and in no event shall any wire or conductor be allowed to extend over or be attached to the roof of any building.

Sec. 3. That said parties shall begin the construction of said works and lines within two months, and shall have the principal line ready for operation within six months from the passage of this ordinance, unless prevented from doing so by legal proceedings, and in case the provisions of this section are not strictly complied with, all rights of said parties, their successors or assigns, hereunder shall cease.

Sec. 4. That nothing herein shall be construed as exempting said parties, their successors or assigns, from any liability arising from the erection or maintenance of said works or lines, or from negligence of said parties or their employees, or imposing any responsibility upon said city therefor.

Sec. 5. That no exclusive right or privilege is granted hereby to said parties.

Sec. 6. That the privilege herein granted shall continue and be in force for the term of twenty years from the passage of this ordinance.

Sec. 7. This ordinance shall take effect and be in force from and after its publication, which publication shall be without expense to the city.

Sec. 8. If after six years it is found practicable, and is directed by ordinance by the City Council, all lines, wires and cables shall be taken down and laid underground by said company within one year from the passage of said ordinance so directing. [Repealed July 1, 1889.]

Approved this 15th day of May, 1889.

Attest: GEO. A. JOHNSTON, Mayor.

J. F. KIMBALL, City Auditor.

[COPY.]

AN ORDINANCE

To repeal certain portions of an ordinance entitled "Ordinance granting to H. W. Turner and H. B. Warren the right to erect and maintain electric light works."

Be it ordained by the City Council:

That the portion of the ordinance entitled an ordinance granting to H. W. Turner and H. B. Warren the right to erect and maintain electric works, and approved May 15, 1889, reading as follows—

"Sec. 8. If after six years it is found practicable, and is directed by ordinance and the City Council, all lines, wires, cables shall be taken down and laid underground by said company within one year from the passage of said ordinance so directing,"

is hereby repealed.

Approved this 1st day of July, 1889.

Attest: GEO. A. JOHNSTON, Mayor.

J. F. KIMBALL, Auditor.

[COPY.]

AN ORDINANCE

Containing the contract between the city of Mitchell and H. W. Turner and H. B. Warren, their successors and assigns, for the lighting of the streets of said city by electricity, and defining the rights and privileges of said H. W. Turner and H. B. Warren, their successors and assigns, upon the public streets and highways of said city.

Be it ordained by the Common Council of the City of Mitchell:

Sec. 1. That in consideration of the benefits to be derived by the inhabitants of the city by the establishment of a system of electric works, and for the purpose of lighting the streets, alleys, public grounds and buildings of said city by electricity, there is hereby granted to H. W. Turner and H. B. Warren, their successors and assigns, the exclusive right to establish, erect, maintain and operate a system or systems of arc and incandescent lighting, power and heating circuits in the city of Mitchell, for a period of twenty years from and after the passage of this ordinance.

Sec. 2. That for the purpose of erecting the necessary poles, posts, lamps, lines, conductors and cables, they may enter upon any of the streets, alleys or public grounds of said city, and make such excavations therein as may be necessary for the erection of said posts or poles, or for laying said conductors, wires or cables, provided that such excavations shall be properly protected while open, shall remain open no longer than necessary, and shall be so filled and repaired as to leave the street or alley in as good condition as before the excavation was made.

Sec. 3. That nothing herein contained shall be construed as exempting said parties their successors and assigns, from any liability arising from the erection or maintenance of said system, or from negligence of said parties or their employees, or imposing any responsibility upon said city therefor.

Sec. 4. In consideration of the sum of eighty-eight dollars per month, to be paid to said H. W. Turner and H. B. Warren, their successors and assigns, by the city of Mitchell, on the first day of each and every month, for a period of twenty years from and after the date of starting said electric system, the said H. W. Turner and H. B. Warren, their successors and assigns, shall furnish to the said city, upon its public streets, in such locations as the Common Council may direct, eight (8) arc lamps of twelve hundred (1,200) nominal candle-power each, and said lamps shall be kept in operation from the hour of starting the lights of said system until the hour of midnight each and every night in the year; provided, however, that should said lights be out during lighting hours, owing to accidents to the machinery or apparatus of the said H. W. Turner and H. B. Warren, their successors and assigns, then, and in that case, they shall be liable for no damages other than a reduction of the revenue for the period the lights remain so out.

Sec. 5. The rights and privileges granted to the said H. W. Turner and H. B. Warren, their successors and assigns, are granted upon the following condition, a violation of, or a failure to perform, any of which will forfeit all the exclusive privileges contained in this ordinance:

First—The electric system shall be in operation on or before the first day of January, A. D. 18[illegible]0.

Second—That said H. W. Turner and H. B. Warren, their successors and assigns, within two weeks from and after the date of the passage of the ordinance, file with the City Clerk of Mitchell their written acceptance of the ordinance in lieu of one passed May 15, 839, granting them certain privileges.

Third—The said H. W. Turner and H. B. Warren, their successors and assigns, shall at all times during the term of this grant keep their lights in good condition, and furnish at all times as high degree of light as is furnished by the best approved machinery in general use throughout the United States in cities similar in size to that of Mitchell.

Fourth—The rates charged for service by said H. W. Turner and H. B. Warren, their successors and assigns, shall at all times be consistent with and not exceed those rates charged by other parties for similar lights in other cities of similar size and location to that of Mitchell.

Fifth—The Common Council may from time to time order additional lights placed on the streets, in such locations as they may direct; provided, however, that there shall be one arc or ten incandescent lamps, either public or private or both, for every one thousand feet of wire required for such extension.

Sixth—The price charged the city for street lighting shall never exceed forty cents per arc light of 1,200 nominal candle-power per night until 12 o'clock, or sixty cents all night, or one dollar and twenty-five cents per month per each 16 candle-power incandescent lamp until 12 o'clock, or $1.50 all night.

Seventh—That said H. W. Turner and H. B. Warren, their successors and assigns, shall be required to supply the existing demand for electric light at all times.

Sec. 6.—This ordinance shall take effect and be in force from and after its passage and approval by the Mayor and its publication, which publication shall be without expense to the city.

Sec. [illegible]. This ordinance shall have the effect of and be a contract between the city of Mitchell and the said H. W. Turner and H. B. Warren, their successors and assigns, and be the measures of the rights and liabilities of the said H. W. Turner and H. B. Warren, their successors and assigns.

Approved October 8, 1889.

Attest: GEO. A. JOHNSTON, Mayor.

J. F. KIMBALL, Auditor.

Armed with these privileges and the contract, the next step was to make preparations to comply with the conditions imposed, and to make arrangements for erecting and running the plant.

It was decided not to erect a station and not to install an engine and boiler for furnishing power to run the dynamos, but an arrangement was made with the owners of the Monmouth Merchants Mill Company (the steam grist-mill previously referred to) for the rental of sufficient room in which to place the three dynamos which were to be used and for the rental of sufficient power from that company for running them. The three dynamo machines referred to consisted of one 30-light 1,200 candle-power K 12 Thomson-Houston arc dynamo, one 500 sixteen candle power light, old style Thomson-Houston alternating current dynamo, and one D 3 Thomson Houston exciter dynamo, for exciting the field of the alternator.

The plant was erected under these conditions, and poles, circuits and lamps placed in position, and was run at a loss for a number of months. All the apparatus, machinery and supplies used in its construction was charged on the books of the Northwest Electric Construction Company as an asset, and during the existence of that company it owned and operated the plant, making good all losses incurred.

Under the terms of the contract the parties to whom the franchise was granted were bound for a period of 20 years to furnish *eight* arc lights for the sum of $88 per month, which is almost exactly 36 cents per light per night for an all-night arc light. This service was planned to be done with hired power and hired room, and in a town in which the demand for arc lights, both public and private, has never exceeded sixteen, and in which the average price of coal is about $5.50 per ton. All additional lights furnished to the town they were bound to furnish at the rate of 40 cents per light per night up to 12 o'clock, and for 60 cents per light per night for all-night service.

Under these circumstances it was of course impossible to realize any returns from the plant, either by its operation or by its sale, for who wanted to purchase and operate a plant which could not earn enough to pay interest on the investment, to say nothing of providing for its depreciation and continued maintenance?

Trifling as was the actual investment in the three small dynamos, instruments, lines, poles, lamps, etc., comprising the plant, the enterprise was not in such shape as to invite the manifestation of sufficient public spirit on the part of local capitalists, or on the part of the town authorities, to purchase the plant, and thus save to the town whatever benefits, advantages and prestige might be derived from the use of a system of electric illumination.

Some months after starting the plant under the conditions described the owners of the grist-mill notified the Northwest Company that they could no longer continue to furnish room or power for the electric machinery, and it became necessary to make provision to house it elsewhere and to secure steam power from some other source. There was, however, no other source of power in the town, and it was finally decided to purchase a piece of property, erect a building thereon and install an engine and boiler, and to continue the operation of the plant. On the outskirts of the town there was a small plot of land with a very cheaply constructed frame building or shed on it. This land and shed were for sale and were purchased by the Northwest Company for about $350. The wooden shed already on it was remodeled and enlarged to accommodate the proposed plant. In this building was placed one 16′ x 66″ Atlas horizontal tubular boiler with 64 four-inch tubes, the capacity of which was 100 horse power, and the value of it, with fixtures, was about $1,000. The boiler was furnished with an iron smoke-stack, feed pump, etc. The total cost of the steam generating plant, including setting, foundations, piping, heater, feed pump, gauges, etc., should not have exceeded, and ought to be less than $2,100. The engine installed was a second-hand 80 horse power Atlas, and its cost set up, connected to boiler and ready for running should not have exceeded and ought to have been less than $1,500. The building and land cost less than $1,000. Making a total for building, steam generating and power plant, at the highest possible values, $4,600.

The electrical equipment of the station was as follows:

Arc light plant.	Approximate value.	
One 30-light 1,200 c. p. T.-H. dynamo, K 12, with regulator and controller....	$850.00	
20 arc lamps @ $25..........................	500.00	
One buckle switch..........................	10.00	
One lightning arrester....................	7.00	
One arc cut-out..........................	3.00	
		$1,370.00
Incandescent light plant.		
One 500-light T.-H. alternating current dynamo..................................	$1,000.00	
One D 3, 110 volt exciter dynamo........	132.50	
One 34 ampere current indicator........	20.50	
One 64 volt potential indicator..........	30.00	
One S. T. switch..........................	4.50	
One lightning arrester....................	7.00	
One ground detector.......................	15.00	
One rheostat, type 65. D 3, exciter......	20.00	
One station transformer.................	20.00	
Foundations for dynamos, freight and setting..................................	150.00	1,399.50
Belts for transmission of power to dynamos about..............................		130.00
The line equipment consisted of:		
About 6½ miles No.6 wire, worth about	$1,009.00	
" 1¼ " No. 2 wire, "	310.00	
" 110 poles, cross-arms, insulators, set @ $6..................................	660.00	
		1,979.00
Consumers' incandescent light equipment:		
500 lamps and sockets @ 70 cents......	$350.00	
Wiring and connecting @ $1.60..........	800.00	
About 34 transformers @ $2 per light (600 lights)..................................	1,200.00	
About 34 meters at average of $15.......	510.00	
		2,860.00
Consumers' arc light equipment:		
15 hoods and lamps, boards and pole irons..................................	$48.00	
One ceiling board..........................	3.00	
One cut-out box..........................	3.00	
		54.00
Fixtures and tools, about................	$180.00	
Office fixtures, furniture & books, about	75.00	
Extras for small supplies, supervision, engineer, etc..................................	450.00	705.00
Total electric plant......................		$8,497.50
Add:		
Building, steam plant, etc..............		$4,600.00
		$13,097.50

The prices given are in excess of rather than below the actual value.

It needed no trial to convince any competent person that in a town having so few inhabitants, and with so little demand for lights, the property was about as valueless, as an investment, after these changes as it was before. But if trial and absolute proof of this fact were necessary to convince the people who exploited this plant, it came, and we know that the managers of the N. W. Company were notified of the situation by an outsider, through the medium of a document now in our possession, the story of the origin, nature and date of production of which we will now briefly relate.

A little while before Mr. H. M. Byllesby was delegated by Mr. Coffin to take charge of the affairs of the Northwest Company, Mr. J. B. Tarbox, a wealthy stockholder of the Northwest Company and a member of the opulent firm of Tarbox, Schliek & Company, shoe dealers in the city of St. Paul, was induced to take the position of treasurer of that company, and about that time a Mr. Robertson was directed to make a thorough examination of the affairs of that company and its methods of doing business, and to investigate the condition of the local properties owned by it, and to submit the results of his labors in a written report to Mr. Tarbox. This was done and a typewritten report was submitted to Mr. Tarbox in January of 1891, an exact copy of which is in our possession. In this report Mr. Robertson made the following remarks:

"Mitchell Plant. Ordinance issued to H. W Turner and H. B. Warren, their successors and assigns. No record of assignment to this company. Ownership of plant in Northwest Thomson-Houston Electric Company. Hardly pays operating expenses. No prospective increase of business; town losing population, without any possible future. Has been some talk of city purchasing plant, but authorized bonded indebtedness at present beyond limit, and no immediate prospect of sale of plant. Recommend that plant be shut down, which might bring the people to time, and if this will not, advise that the plant be taken out and removed. Investment about $12,000, value about $6,000."

In the paragraph quoted from Mr. Robertson's report there is a most complete confirmation of the substantial correctness of our estimate of the first cost of the plant. The investment he names is, however, quite a little below our estimate, but he *knew* what had actually been expended in *installing* the plant up to that date, and further knew that, owing to a quite serious injury to the boiler, and the unsuitable character of the engine, and depreciation of the property from various causes, the actual value was much below the original cost; and with all these facts before him, he estimates the value of the plant in January, 1891, at $6,000, or considerably less than half of our estimate of its original cost. His report also fully confirms our views as to the worthless character of the plant as an investment.

With Mr. Robertson's report actually on file in the office of the Northwest Company, and easily accessible to, if not actually read by Mr. Byllesby, it might be fairly expected that in this case at least some doubt might have arisen concerning the wisdom of attempting to found a company on such a worthless property as this Mitchell plant had actually proven itself to be, and it might be hoped that no one could be so destitute of honor, so completely devoid of conscience, so thoroughly unscrupulous as to endeavor to capitalize it for $35,000,—$15,000 in stock and $20,000 in bonds—and to finally decide to issue $15,000 of stock and $15,000 of bonds on it.

(*To be continued.*)

Straightening out the Central Station Load Line.

There is nothing which concerns central station men more intimately than the question of levelling out their load line, and suggestions in this line are always read with interest. Practical results expressed in definite figures are still more sought after and harder to find, and whenever we come across them we are glad to give them space. In the issue of *Lightning* for July 23, Mr. C. H. Wordingham, chief engineer of the Manchester Corporation Electricity Works, contributes a letter on this subject which is as follows:

To the Editor of LIGHTNING.

DEAR SIR: We have here two alternative rates, either an ordinary rate of 6d. per unit as measured by meter, or a fixed charge rate. It is this fixed charge rate which provides a sliding scale. In this latter rate we make a charge of £12 per annum for every 1,000 watts in the maximum demand, and in addition to this 2d. per unit as measured by meter. If you work out several cases you will find that this gives a diminished rate per unit as the number of the hours of burning is increased. I enclose two tables which show this very clearly.

Table A shows the average cost to a consumer for different hours of burning during the year. Take the case of a consumer using current about 1,200 hours a year, or rather over three hours per day, the fixed charge is £12, the meter charge £10, a total of £22; the average cost is 4.4d. Take now the case of an underground restaurant where current is consumed for ten hours per day, or 3,500 per annum, the fixed charge remains the same, but meter charge is increased to £29 3s. 4d., and the average cost works out to 2.8d. per unit. Taking the extreme case, which would never, or very rarely, arise, of a consumption extending for twenty-four hours per day throughout the whole year, or 8,760 hours per year, the fixed charge is £12 as before, and the meter charge is £73, giving an average of 2.33d. per unit, which is the lowest price possible with our present fixed charge. It will thus be apparent that our charge for current varies from 6d. per unit down to 2⅓d. per unit, and that it does so absolutely continuously; that is to say, there are no breaks, nor is it possible for a consumer to diminish his account by burning a few more units, as is the case with many systems of discounts.

In the second table, which is practically only a variation of the first, there is shown a number of hours during which the current must be consumed in order to attain a certain average price per unit. Thus, if a consumer would get current at 5d. per unit his hours of consumption must reach 960 per annum, and if he would get it at 3d. his hours must be 2,880.

I do not suppose that this matter would be of sufficient interest to your readers to warrant any lengthy description, but if it would, I should be happy to furnish you with an article on the subject. Yours truly,

C. H. Wordingham, Chief Engineer.

Table A.

Showing the number of hours' burning during which a consumer must consume current in order to obtain it at different average rates.

Price per unit in pence.	No. of hours of burning per year.	Price per unit in pence.	No. of hours of burning per year.
8	480	5	960
7½	523	4½	1,160
7	576	4	1,440
6½	640	3½	1,920
6	720	3	2,880
5½	823	2½	5,760

Table B.

Showing the average cost per unit with the fixed method of charge, the charge being £3 per quarter per unit of maximum demand, and the meter charge being 2d. per unit consumed.

Hours of burning per year	Average price per unit in pence.	Hours of burning per year.	Average price per unit in pence.
100	30.8	2,500	3.15
200	16.4	3,000	2.96
300	11.6	3,500	2.82
400	9.2	4,000	2.72
500	7.8	4,500	2.64
600	6.8	5,000	2.58
700	6.1	5,500	2.52
800	5.6	6,000	2.48
900	5.2	6,500	2.44
1,000	4.9	7,000	2.41
1,200	4.4	7,500	2.38
1,400	4.1	8,000	2.36
1,600	3.8	8,500	2.33
1,800	3.6	8,760	2.33
2,000	3.4		

Note.—One unit of maximum demand signifies that when all lamps are alight one unit is consumed per hour. One unit will maintain fifteen lamps of about 16 c. p. alight for one hour.

London Notes.

(From our Special London Correspondent.)

For some months past there has been in progress a system of electric tramways which is to run between two West of England towns, Kingswood and Bristol. The overhead wire system is to be used.

A central station was opened at Salford, near Manchester, the other day, the cost being just under £35,000. The high pressure alternating current system has been adopted.

The Cost of Niagara Power.

In *Cassier's Magazine* Mr. F. L. Stetson discusses the cost of power from the utilization of Niagara, and arrives at the extraordinary conclusion that in Buffalo, where coal is only $1.50 per ton, it would be cheaper for the good people of that city to employ the electrically transmitted power from the Falls than to use coal even if it were furnished free at the furnace door. If his general deductions are made on such a basis as that which follows, we tremble for those who have invested money in the Niagara scheme: "When in England in 1890, I was told by an eminent gentleman that it was useless to discuss the profitable employment of water-power, for, as he said, 'You can produce steam-power from coal at a cost of a farthing an hour' (1 h. p. hour we presume—Eds. *Electrical Review*), to which I answered: 'Very well, let us work on the problem. Coal, at a farthing an hour, would, in America, represent 5 cents for a day of ten hours, or 12 cents for a day of twenty-four hours, which is, for 300 days in the year, $15 for the short day, and $36 for the long day for fuel only. At Niagara we will gladly furnish continuous 24-hour water-power for $15 a year, in any considerable quantity.'" Of what avail is it to be able to furnish 1 horse-power per year for $15 at Niagara, if to get the same amount in Buffalo it is necessary to pay for more than double that power to make up for losses in transmission. More persuasive arguments than these are necessary, Mr. Stetson, to convince engineers of the economy of electrically transmitted power (even if the source is water) over coal at $1.50 per ton at the furnace door; and so far as the public is concerned, such writing is altogether misleading.—*Electrical Review* (London).

THE CHOICE OF TRANSFORMERS.*

BY D. C. JACKSON.

The public data which are available for forming an opinion of the comparative economy of transformers are very meager. The little which is obtainable is to be found in a great measure in the advertising circulars of manufacturers, and while these results, being tests of their own and of rival makes, are often entirely reliable, such *ex parte* data are unsatisfactory to a careful purchaser. In order to place before you independent data representing all the American transformers of moderate capacities, I will give the results of a long and carefully carried out series of tests made by A. H. Ford in the laboratory of the University of Wisconsin. For these tests transformers of 1,500 watts capacity, as nearly as possible, were procured directly from the manufacturers within about a year from this date, so that the tests may be presumed to represent the latest and best designs which are now supplied. These transformers are from the most prominent makers and in fact include all important makes of American transformers with two or three exceptions.

The results of the tests are given in the attached table :

Number.	Watts capacity.	Open circuit current.		Watts (iron) loss.		Watts (copper) loss at full load.	Total pressure drop.	Efficiencies at full load.		All day efficiency.	
		F = 125	F = 60	F = 125	F = 60			F = 125	F = 60	F = 125	F = 60
1	1250	.043	.066	37	48	30	2.5	95	94	85	83
2	1500	.076	.124	50	71	45	3.5	95	94	85	81
3	1500	.052	.1.0	34	46	38	4.0	96	95	89	85
4	2500	.230	.540	135	230	44	2.5	92	89	77	65
5	1800	.076	.600	53	109	67	5.0	94	92	85	75
6	2000	.055	.091	42	56	55	5.0	95	94	89	86
7	1000	.028	.064	24	28	33	3.0	95	94	87	86
8	1500	.073	.11[illegible]	37	76	31	2.5	94	93	83	79
9	1500	.077	.144	43	55	28	3.0	95	95	86	84

These results, I find, do not differ very widely from those published by the Fort Wayne Electric Corporation in a small blue-printed pamphlet which, however, contains tests made by the company upon only a few of the makes of transformers included in my table.

The data for each transformer are given for tests upon two frequencies, 125 and 60 periods per second respectively. Efficiencies have been calculated and are given in the table for each transformer when operated upon each frequency continuously at full load and also when operated at an assumed load which may be taken as an approximation to the average load found on good stations operating 24 hours. The latter are called "all day" efficiencies and are calculated as though the transformers ran 19 hours out of the 24 on no load and 5 hours on full load.

A comparison of the losses of the different transformers and their efficiencies shows in most cases that the transformers with the smallest iron losses give the highest "all day" efficiencies. The effect of the iron loss on the working efficiency depends upon the length of time the plant runs. The waste of power due to the iron loss in the transformer continues as long as current is fed to the primary circuit, consequently a plant which only runs 6 hours per day will only waste one-quarter of the power by the iron loss of its transformer that it would if operated 24 hours per day. The actual number of watt hours used by the customers of the plant might not differ very greatly in the two cases, yet the output of the station when run 24 hours might be much greater than when run 6, the difference being due to the difference in the amount of power wasted in the transformers. It is therefore evident that extreme care in the selection of the best transformers to be used on an alternating plant which runs all day may be of the greatest advantage. The lower the frequency of the alternating current which is used the greater are the returns coming from this care likely to be.

Let us compare transformers Nos. 3 and 4 as given in the table. These are both made by well known manufacturers. The copper losses at full load do not differ very much, what difference there is being in favor of No. 4; at average loads there being considerably less difference in these two points.

The iron losses, which go on regardless of the load as long as current flows in the primary winding, differ very greatly even if we take three-fifths of the losses in No. 4 as the losses of a 1,500 watt transformer of that type. Let us suppose that these transformers are placed on a plant which supplies current 24 hours each week day and 12 hours on Sunday, which makes a total of 8,136 hours per year that current would flow in the primary winding of the transformers, and the total number of watt hours wasted by the two transformers is shown below.

F = 125

Transformer No. 3.........8,136 × 32 = 260,300
Transformer No. 4.........8,136 × 80 = 651,000

F = 60

Transformer No. 3.........8,136 × 46 = 374.800
Transformer No. 4.........8,136 × 140 = 1,140,000

In a station which turns out a kilowatt hour for each eight pounds of coal burned (and this in Wisconsin requires the station to be well arranged and the use of coal that costs $2.50 or more) transformer No. 4 requires the buying of about a ton and a half of extra coal every year when operated at a frequency of 125; therefore it costs, other things being equal, upwards of $4 per year more to operate than No. 3. It would therefore pay well, if other things were equal to buy transformer No. 3, even if its first cost were many dollars greater than that of No. 4. The difference between the transformers is even greater when the frequency is 60.

For every hundred transformers of the types here compared, the generator plant that supplies current to No. 4 must be of five kilowatts greater capacity than that required for No. 3, which means an increase of 3 per cent. in the generating plant; that is, a plant of a given size which uses transformer No. 4 must have a capacity for supplying current greater by 3 per cent. than if transformer No. 3 were used.

The difference between these two transformers is largely due to differences in the relative amounts and arrangements of the iron and copper in the cores and windings, and the magnetic quality of the iron core. The standing of the manufacturers renders it probable that the transformers are of equal durability and reliability, but the regulation of No. 4 is better. The regulation question, which should be carefully considered, makes a serious deduction from the claims of No. 3 to first place in the comparison.

Differences sometimes occur between transformers of the same size and same make which are not as great as the differences here shown to exist between Nos. 3 and 4, but are sufficiently great to seriously affect their economy. In order to husband the capacity of a plant and to save in operating expenses, it is therefore of importance not only to test transformers of different makes which are presented for sale, but to test each transformer which is put on the line. This may be easily and expeditiously done. To test the iron losses the secondary coil of a transformer should be connected to the regular lighting circuits, with an ordinary wattmeter included, and the circuit of the primary coil should be left open. The reading of the wattmeter shows the number of watts which are wasted by the iron loss.

A wattmeter such as is required for these measurements costs from $40 to $70, and is an instrument that, like the steam engine indicator, pays to have at hand for proper use. However, if the regular wattmeter is too expensive to buy, an ordinary Thomson recording wattmeter, provided a sufficiently sensitive and reliable one is at hand, may be used in place of it, and the record reduced to the basis of one hour. It is needless to say that instruments which are used in such tests as are here proposed must be fairly reliable.

To test the copper losses in a transformer the quickest and easist method, which is approximately accurate, is to connect the primary coil of the transformer in series with some resistance (iron wire or lamp) to the alternating incandescent circuit, and short-circuit the secondary coil of the transformer through an amperemeter. The resistance should be adjusted until the full load current of the transformer flows through the amperemeter. The reading of a wattmeter so connected in circuit with the primary coil gives the copper loss approximately.

The drop in pressure in a transformer may be measured by connecting the transformer to the lighting circuits and reading the primary and secondary pressures by voltmeter. The transformer may then be loaded by lamps and the pressures again read, when the drop is at once seen. One voltmeter may be used for this, but two are more convenient.

For the testing of individual transformers as they are delivered and before they are put on the lines, all the instruments which are required are already in the possession of the electric station, with the exception of a wattmeter, and this is not a serious deficiency since, if necessary, a Thomson recording wattmeter may be used instead. The testing need take but little time and is likely to result, in average stations, in the saving of considerable wastes.

Proper records of his transformer tests enable a station manager to determine at once the amount of saving that he may make by replacing certain small transformers by one large transformer. If tests are not made, such changes may not bring the results expected, since a number of first-rate small transformers may be replaced to no advantage by a large transformer if the latter is not a good one, but usually a large transformer, if one of the best, is more desirable than several small ones, whether they are good or bad.

For your guidance in selecting transformers, I will give you the following data, contained in a table made out by Prof. Ryan. The table gives the largest currents which should flow in the 1,000 volt primary of good transformers when the secondary circuits are open :

Watts capacity.	Leakage current.
1,000	.055
2,000	.080
6,500	.100
17,500	.200

When the low pressure coil is connected to a 100 volt circuit the leakage currents may be expected to be ten times as great.

For intermediate capacities, intermediate values of the open circuit or leakage current may be expected. I shall add to this the values of the iron loss, which should not be exceeded in thoroughly good transformers.

Watts capacity.	Iron loss.
1,000	30
1,500	40
2,000	50
2,500	60
4,000	80
6,500	100
17,500	150

The copper losses in transformers of all sizes should never exceed 3½ per cent. at full load, and ought to be between 1½ and 2½ per cent. The total drop in secondary pressure, due to loading a transformer, if the primary pressure is kept constant, ought not to exceed 3½ per cent.

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* Read before the Northwestern Electrical Association, Chicago, July 19, 1895.

BOOK REVIEWS.

Electrical Engineers and Students' Chart and Handbook of the Brush Arc Light System. By H. C. Reagan, Jr. 8vo, cloth, 48 pp. New York; Norman W. Henley & Co Price $1.00.

The object of this little book is to give to those connected with the Brush system of dynamos a clear and simple explanation, together with illustrations of the different parts of the dynamo, and to afford for students a non-technical description of this well-known machine. A unique feature of the book is a chart by which the Brush commutator is explained. This consists of a heavy card upon which has been engraved the fields with their various connections, and rotating in front of this is a transparent mica disk upon which have been drawn the armature ring and coils together with their connections with the commutator segments. Four mica brushes are also represented, so that as the disk is revolved the courses of the currents are readily traced out for any position of the armature and commutator. By means of ordinary diagrams this tracing of the currents has always been the most difficult part of the machine to explain, but by the means resorted to here it becomes exceedingly simple.

The other illustrations are of the usual kind, embracing both diagrammatic and perspective views of the various parts of the machine, including the Brush regulator, or dial, and are drawn to a sufficient scale to be easily followed.

The method of changing a machine from right hand to left hand is fully explained. Troubles and remedies are given due attention, and a table of dimensions of the various arc-light dynamos is added.

We think the book will be of great interest to all of those having this make of machine in their charge.

American Institute of Electrical Engineers —Applicant's Manual.

Mr. Ralph W. Pope, secretary American Institute of Electrical Engineers, 1,009 Havemeyer Building, New York, has just issued a little pamphlet entitled "Applicant's Manual," prepared to meet the demand for information regarding the work of the Institute and how to join it.

This is a very handy little brochure which should be productive of much good in extending the usefulness of the Institute by spreading more widely the information as to how membership may be acquired. The table of contents includes the following:

1. Instructions for Joining.
2. Fac-simile of Application Blank.
3. Form of Application for Transfer.
4. Rules of the Institute.
5. List of Members (geographical).
6. Classified List of Papers Published.
7. Definition of Electrical Units.

Copies will be supplied *gratis* by the secretary to all who apply to him for the same.

Personal.

Mr. A. S. Terry, of the Sunbeam Lamp Manufacturing Company, has returned to Chicago after a two weeks' vacation in the East.

Col. S. G. Booker, after a long absence, was a welcome visitor in New York and Boston last week.

Mr. L. B. Sherman, for many years connected with the *Railway Review* of Chicago, has been appointed Western manager for "The Official Railway Equipment Guide" and "The Pocket List of Railroad Officials."

According to a London writer the Brussels Electric Railway is an excellent example of international practice. The boilers are English, the engines German, the motors American, the chief engineer Italian and the clerks in the general office French.

General News.

What is Going on in the Electrical World.

Smithville, Tex.—A company is being organized here to put in waterworks and electric lights.

Elizabethtown, Ky.—An effort is being made here to organize a local electric light company.

Cynthiana, Ky—The Cynthiana Electric Light Company has been organized with a capital of $10,000.

Windom, Minn.—The city council has awarded the electric light contract to the Western Electric Company.

Topeka, Kan.—The city council are considering the purchase of new machinery for the city electric light plant.

San Diego, Cal.—George B. Kerper, purchaser of the cable road, will proceed at once to change the road to an electric system.

Dallas, Tex.—E. L. Wood, C. B. Gillespie and others are forming a company to build an electric line to Oak Lawn in the suburbs.

Greenport, L. I.—The stockholders of the Greenport Electric Light and Power Company have voted to sell the entire electric plant.

Allentown, Pa.—Work on the Allentown and Reading trolley road will begin as soon as the awards to the bidding contractors are decided.

Hawkinsville, Ga.—By a unanimous vote the citizens of Hawkinsville have decided in favor of a waterworks system and electric light plant.

Buffalo, N. Y.—The Proctor-Raymond Electric Company of Rochester, manufacturers of electric bells, annunciators, etc., will establish a plant in Buffalo.

McLane, Pa.—Hon. Emmet Wilcox visited this town lately for the purpose of securing right of way for a new electric road to run from Cambridge to Erie.

Saratoga, N. Y.—Proposals will be received until October 12 by James D. McNulty, clerk, for the furnishing of street lights, etc, for one or four years.

Cairo, N. Y.—The Cairo and Windham turnpike has been purchased by a number of capitalists who propose to build an electric railroad from Cairo to Prattsville.

Beeville, Tex—Messrs. Lowery and Wolf, of Temple, Tex., have made a proposition to the citizens of the town to put in an electric light plant and a telephone system.

Flushing, Mich—The contract for the dynamos and electrical equipment of the new electric light plant has been awarded to the Fort Wayne Electric Corporation.

Lockport, N. Y.—After many months of exasperating disappointments and broken promises, this city has an electric street car line that every one is satisfied with.

Petersburg, Va.—The right to build an electric railway between Petersburg and Manchester has been awarded to the company represented by John Robertson of Manchester.

Los Angeles, Cal.—The board of public works recommend that the council grant the franchise for an electric railway in Eighth street to the Los Angeles Traction Company.

New Orleans, La.—An application for a franchise by J. P. Loomis to erect and maintain an electric light plant in the city was referred to the council committee on franchises.

Phœnix, Ariz.—The Phœnix Light and Fuel Company has purchased the Gardiner electric light plant and will combine both plants at the power-house of the Phœnix Company.

Philadelphia, Pa.—The officials of the Southern Passenger Railway have determined to use an electric storage battery system to operate their cars as soon as the road is finished.

Richmond, Va.—The city council has concurred with the board of aldermen in giving to the Richmond Traction Company the right to establish a new street car line on Broad street.

Nevada, Mo.—The electric light and power franchise lately granted to Col. Geo. V. Dudley of St. Louis has been confirmed by a majority vote of 20 to 1 at the special election. The franchise runs for ten years.

St. Paul, Minn.—The business streets of St. Paul are to be electrically lighted if the assembly concurs with the board of aldermen in deciding to abolish the gas lamps and put in 2,000 c.p. arc lights at the street corners.

Hoboken, N. J.—The Hoboken Railroad, Warehouse and Steamship Company, of which Col. E. A. Stevens is president, has applied for a franchise for an electric freight railroad along the water front in Hoboken.

Little Falls, N. Y.—The trustees of Richfield Springs have decided to leave to a vote of the taxpayers the question of permitting the proposed Little Falls and Richfield Springs electric railroad to enter that nobby village.

Rockville, Md.—The Tennallytown and Rockville Electric Railroad Company's franchises, railroad tracks, cars and other equipment, and also the real estate of the company, are to be sold at Bethesda post office on the 25th inst.

Staten Island, N. Y.—The Edgewater trustees have passed a resolution that the Interior Electric Railroad Company must sign its contract with the village, file its bond and deposit $10,000 by September 10 or its franchise will be revoked

Mt. Morris, N. Y.—An electric light and power plant will be put in at Craig Colony for lighting the grounds. Power is obtained from a stream which runs through the Colony property, and an auxiliary steam plant will be put in, all costing about $20,000.

Topeka, Kan.—The city council has under consideration the purchase of new machinery for the city electric light plant. An electric company, it is said, has made the city a proposition to take the old machinery and put in complete new works for $10,000.

Georgetown, Mass.—At a special town meeting held here a few days ago to take action on the petition of the Haverhill, Georgetown and Danvers Electric Railroad Company for a location through this place, it was resolved to welcome the proposed road into town.

New York.—A scheme is in contemplation whereby the Eighth avenue line of horse cars may be superseded by an underground trolley system, to extend from Canal street to the Harlem river. The system in view is similar to but an improvement on that in use at Budapest.

Santa Cruz, Cal.—F. W. Swant n has made terms with Henry Cowell for the purchase of Cowell's water rights in the San Lorenzo River for the purpose of obtaining power with which to operate factories and electric light plants. A company is to be formed for the purpose of utilizing the power.

Keene, N. H.—A charter for an electric street railroad in Keene, N. H., was procured three years ago, and the subject of building is now being agitated. President Elisha Lane, Francis C. Faulkner and C. J. Woodward have been appointed a committee to receive propositions for construction.

Omaha, Neb.—A special election is to be held at Florence on the 17th inst. to get a vote on the proposition to issue $18,000 in bonds to aid the company that proposes to build an electric street railway between Omaha and Florence. V. G. L ntry, Walter G. Clark and Fred Parker are the leading men in the company.

Osborn, O.—Sealed proposals will be received to September 16 for furnishing all labor and material required for the construction of an electric light system and a water works system, according to plans, etc, on file Wm. G. Moler, consulting engineer, Bushnell Building, Springfield, O., can give information

Sea Cliff, L. I.—At a recent meeting of the board of trustees a resolution was adopted to place before the voters a proposition to light the village by electricity, the amount to be expended not to exceed $8.500. The clerk was also ordered to issue notices of the village election, which will take place September 10.

Bowling Green, O.- J. R. McKnight, president of the Bowling Green Electric Lighting Company, has been granted a franchise to build and operate an electric road in this city, and has secured the right of way from Bowling Green to Perrysburg where the road will connect with the Toledo and Maumee Valley belt line.

Detroit, Mich.—It is expected that work will begin very soon on the Detroit, Port Huron and

St. Clair River Railroad. The route of the road is from Detroit to Mt. Clemens, to Chesterfield, to New Baltimore, around Anchor Bay and up the lake and river to Port Huron. Freight as well as passengers will be carried.

Baltimore, Md.—An electric suburban railway is proposed, to extend from Powhatan to Harrisonville, connecting with the Gwynn Oak branch of the Baltimore Traction Company's system at Powhatan. It is understood that the Baltimore Traction Company will construct and equip the road provided the projectors subscribe $15,000 or $18,000.

Jersey City, N. J.--The street and water board has resolved to reorganize the street-lighting system of this city. The city for this purpose has been divided into districts. Some of these—the greater portion—are to be lighted by electricity, while in others gas or oil may be used, as the bids for same may dictate. The board will ask for a series of bids.

Sea Isle City, N. J.—John L. Burk, Wilson Banks, Mayor Frank Smith of Holly Beach, and Councilman George Ent of Anglesea expect to secure a franchise from the borough councils of Holly Beach and Anglesea to build an electric trolley road on Five Mile Beach, connecting Anglesea, Wildwood and Holly Beach. All of the towns will also be lighted by electricity.

Fort Wayne, Ind.—The Fort Wayne, Lake Everett and Columbia City Street Railway Company has completed its organization and the following officers were elected: President, C. E. Everett; vice-president, William Geake; secretary, W. E. Doud. The capital is $800,000 and C. E. Everett and W. E. Doud, of Fort Wayne, own all but three shares of the stock.

St. Helena, Cal.—The town trustees have granted L. Crothwell a franchise to build an electric road along the main streets of St. Helena; also to construct and operate an electric light plant. Mr. Crothwell already has franchises from the county supervisors and the Napa City trustees and proposes soon to begin work on the electric road from Napa to Calistoga.

Peoria, Ill.—The Fort Clark Electric Railroad of this city has passed into the hands of Columbus R. Cummings and Walter Barker, leading stockholders of the Central Railway, and the two systems, the only ones in Peoria, have been consolidated, with the general manager of the Central in charge of both. Both roads recently obtained new franchises from the city council.

Chicopee, Mass.—The commissioners appointed by the Supreme Court to set a value upon the plant of the Chicopee Electric Light Company report that the plant is worth $27,000. The date of transfer to the city was set for October 1. The board consisted of ex-Governor W. E. Russell of Cambridge, James Renfrew of Adams and Theodore C. Bates of North Brookfield.

Rome, N. Y.—Bids for the material and labor required in the erection of a boiler house and dynamo room, building conduits, electric wiring, etc., for the Rome State Custodial Asylum, will be received up to 12 o'clock, Sept. 11. Proposals must be for the whole work and addressed to E. Stuart Williams, president of the board of managers of the Rome State Custodial Asylum, Rome, N. Y.

La Porte City, Ia.—This town was "thrown wide open" when the vote on waterworks and electric lights was announced at the recent election; the majority in favor was overwhelming. The electric light and water plant will cost about $25,000 and will be installed by a local company comprising W. D. Wagoner, president; E. Duke Noven, vice-president, and H. Van Valkenburg, secretary and treasurer.

Syracuse, N. Y.--The Syracuse Street Railway Company has purchased the Consolidated lines from the bondholders, whose representative bid in the property recently for $865,000. The Street Railway Company at that time, it will be remembered, bid $864,000. What they paid in the later transaction has not been made public; the purchase, however, puts them in possession of the whole street railway system of the city.

Logan, Utah.—The Hercules Electric Power Company, at the head of which is Hon. L. L. Nunn, of Colorado, proposes to erect an electric plant on Logan River, a few miles from this town. At that point almost any power may be obtained from the stream. For the purpose of providing light, the company has decided to begin with 1,000 H. P., which may be increased as occasion requires. An electric railway is included in the scheme.

South Framingham, Mass.—The Milford, Holliston and Framingham Electric Railway Company has applied for a franchise to the towns through which it will operate its new road. The South Middlesex Company will furnish power for the new road to operate to Holliston, the Hopedale Electric Company to operate from Holliston to Milford. The Worcester Construction Company will build the line and the company expects to open up before January, 1896.

Washington, D. C.—The Eckington and Soldiers' Home Railway Company are likely to abandon horses in the operation of their line and adopt some other motive power.—The Washington and Great Falls Electric Railway Company has filed a deed of trust conveying its railway property, franchises, etc., to the National Safe Deposit Company to secure 1,300 coupon bonds aggregating $500,000. The purpose of the issue is to provide for the completion and equipment of the road.

Trenton, Ont.—The contract for lighting the town for ten years has been awarded to the Brush Electric Company of Cleveland, O., represented here by Col. W. S. Rogers. The magnificent waterpower, capable of producing 12,000 H. P., north of the town, on which a suitable power house was constructed last year, will be used for the purpose. Besides an incandescent system of lighting, the company will develop the power by putting in large generators, and distribute current through the town for manufacturing purposes.

Hamilton, O.—The city electric light and power plant is to be "dedicated" on the 19th inst. with a splendor calculated to make the event memorable. The programme is an elaborate one, and the celebration will probably last far into the night. "At 6:30 P. M. there will be a festive salute of fifty guns, followed by a grand band concert, dress parade, choral music and a specially arranged display of electrical pyrotechnics. Electrical fountains, similar to those in use at the Columbian Exposition will delight the eye, and the city at large will be lavishly decorated." Arrangements have been made for low rates over all the railroads leading into the city, and a large influx of strangers is expected.

Pittsburg, Pa.—The local papers announce the arrival in this city of R. B. Elwell of Sydney, New South Wales. Mr. Elwell is an electrical engineer in the employ of the New South Wales Government, and came here to study the electrical systems of this country. He is a member of the Society of Civil Engineers of London. He said that the Government in Australia had built and owned almost all the railroads with the exception of a few short lines. There are 2,500 miles of railroad in New South Wales. The freight is handled by Baldwin locomotives, but the passenger traffic is hauled by engines of English make. The Government is about to adopt electricity on the railway lines both for motive, automatic signaling and switching purposes. Mr. Elwell visited the Westinghouse plant at East Pittsburg and pronounced it far ahead of any shops of the same character in the world.--A scheme of electric railway extension involving about 200 miles of road is reported to be under consideration by the Second Avenue Traction Company and others. The road is to be extended along the Ohio River from Pittsburg to Wheeling, touching East Liverpool and Steubenville, and from Wheeling will pass through Washington to Brownsville, thence following the Monongahela to the present terminus near McKeesport, making a complete circuit.—Eugene Ingold has been appointed chief inspector of the new division of inspection in the city bureau of electricity.

Some Big Okonite Cables.

The Okonite Company is making two immense cables for the Metropolitan Telephone Company, to carry wires under the Hudson River. Each of the cables has twenty-four conductors and is over a mile long. The company recently manufactured two similar cables to connect New York with Brooklyn. Another piece of work just finished was a cable three miles long and covered with lead armor made all in one piece. It was shipped to Lenox, Mass., where it will be laid in a subway.

Standard Underground Cables at Buffalo.

The Police Commissioners of Buffalo have contracted with the Standard Underground Cable Company for 14,295 feet of cable to complete the police telegraph system.

International Electric Company.

It would seem that the incandescent lamp trade is improving, for there comes an announcement of the location of another factory in St. Louis. The style of the new company as incorporated under the laws of the State of Missouri is the International Electric Company. The location of their factory is 19th and Olive streets, St. Louis, being within three blocks of that city's new Union Station. Their factory building is modern in every respect, being five stories high and especially adapted to the work to which it is to be put. The manufacture of the incandescent lamps is in the hands of J. M. Davey, who, for some ten years has been identified with the incandescent lamp business. The business management of the company is in the hands of H. G. Ferguson, who has been actively identified with several large central stations in the West, and who is thoroughly familiar with electrical matters both theoretical and practical.

The object of the new company is to furnish a strictly high grade lamp that will appeal for approval alike with the central station, isolated plant and the trade in general. The new lamp, to be put on the market shortly, will be known as the "Davey High Grade."

Beacon Lamps at the Boston Conclave.

The Beacon Lamp Company of Boston met with flattering success with their 11,000 lamps used in the Knight Templar decorations. Mr. J. R. Masury, electrician of B. F. Keith's New Theater, reported that he used three makes of lamps in his Knight Templar decorations, that two-thirds of them were of the Beacon make, and in their four-hour test they lost but one Beacon lamp, and 40 and 200 of the other makes respectively. The conditions under which they were used were very trying, owing to intense heat due to close grouping of the lamps. The Beacon Lamp Company are justly proud of this result.

Catching Up With Orders.

After a continuous run, excluding Sundays, of a thousand hours, the Crocker-Wheeler Electric Company have almost caught up with their orders, which since the fire of last April have been nearly twice as large as ever before. The company have also nearly replaced their stock of parts and are therefore able to serve their customers with greater promptness than has recently been possible.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Albany, N. Y.—It is reported that a hotel and theater building is about to be erected in Albany at a cost of nearly $1,000,000.

Ambler, Pa.—Dr. Mattison will erect a $75,000 house on the Reiff property.

Amesbury, Mass.—The directors and board of auxiliary of the Y. M. C. A. have voted to build a banquet hall at the new gymnasium, with all modern conveniences.

Beloit, Kan.—Sealed proposals will be received at the office of the State Industrial School for Girls, or by the Board of Public Works of the State of Kansas, until Sept. 19, for the completion of a system of electric lighting. Copies of plans will be on file at office of the Board of Public Works, Sol. Miller secretary, Topeka, Kan.

Boston, Mass.—A five story office and store building will be erected at 729-731 Boylston st., for John C. Haynes.... A. D. Puffer will erect a five story mercantile building at 104 Cambridge st.

Brockton, Mass.—At a meeting of the Palace Hall Corporation, it was decided to erect a $30,000 building at once.

Brooklyn, N. Y.—Senator Wm. H. Reynolds is having plans made by Architect J. B. McElfatrick & Sons, 1402 Broadway, New York City, for a $50,000 residence for himself on Vanderbilt ave., near the Eastern Parkway, which will be heated by steam and lighted by electricity.... James Lamb will build 2 four story double apartment houses, north side of Park Place, east of Classon ave.... Louisa Squire will build 2 four story double apartment houses, south side of 8th st., west of 4th ave.

Buffalo, N. Y.—Henry W. Sprague will erect a handsome building on Oakland Place from plans prepared by Architects Babcock & Willard, of New York.

Chicago, Ill.—Architect Charles H. McAfee, 34-36 La Salle st., has prepared plans for a seven story and basement manufacturing building, to be erected on West Van Buren st., near Halstead; heated by steam, lighted by electricity; one passenger and two freight elevators.

Cleveland, O.—H. C. Ford is interested in the erection of a fourteen story building, to be erected cor. Euclid ave. and the Public Square, to cost upwards of a half million dollars

Dobbs Ferry, N. Y.—A syndicate of New York capitalists have purchased the old Manhattan College grounds at Dobbs Ferry, and will erect a hotel and casino building. Colt, Trowbridge & Livingston, 287 4th ave., New

York City, will design the structure and superintend its construction.

Galveston. Tex.—A building, complete in all details, is to be erected here for the Y. M. C. A.

Kansas City, Mo.—The proposed public library building will be lighted by gas and electric lights.

Memphis, Tenn.—Chickasaw Lodge, I. O. O. F. has passed a resolution to erect a seven story lodge and office building at a cost of $100,000.

Milwaukee, Wis.—The plans of Ferry & Clas for the proposed masonic temple have been accepted; they call for a six story building, to cost $60,000.

Morristown, N. J.—The Babbitt Building is being torn down, to be replaced by a five story building with modern improvements.

New York City.—Plans have been drawn for a new playhouse to be erected on the site of the burnt H. R. Jacobs Theatre; Architect Wm. J. Fryer, 19 Broadway....Adam E. Fischer will erect a seven story mercantile building at 70-72 West Houston st ..Robert T. Hotcroft will build a seven story warehouse on east side of West Broadway, north of Grand st., which will be provided with an electric elevator, electric wiring and fittings, etc.; Architects Neville & Bagge, 215 West 125th st....Plans are nearly completed for the new building to be erected for the New York Life Insurance Company, on Broadway near Leonard st.; estimated cost, $1,250,000; Architects McKim, Mead & White, 160 5th ave....Albert Sichel, 209-217 East 22d st., will erect a six story factory, to be occupied by Lehmaier, Schwartz & Co.; Architect W. Wheeler Smith, 7 Wall st....John E. Kaughran will erect at 89 Walker st. a seven story mercantile building, to be equipped with elevators, steam heating appliances, electric wiring, etc.; Architect Richard R. Davis, 247 West 125th st....Architects Harding & Gooch, Postal Telegraph Building, will prepare plans for the eighteen story building to be erected for the Commercial Cable Building Company in Broad st., on the site of the old Delmonico building....It is reported that work on the new Astor-Lenox-Tilden Library Building will be begun November next; the trustees of the library fund have received from the heirs of Samuel J. Tilden $2,000,000 of the $6,000,000 bequeathed for a public library....Wm. W. Astor, 21 West 26th st, will build 4 five story dwellings at 721-723 5th ave., to cost $100,000; Architects Clinton & Russell, 32 Nassau st....Mrs. C. F. Schieffelin, 7 West 36th st., will build a five story dwelling at 5 East 76th st.; Architects Parrish & Schroeder, 1 Madison ave....Charles Buek will erect a row of private dwelling houses on north side of West 72d st., west of the Boulevard; Architect Henry F. Cook, 264 Columbus ave....Pinkus Nathan, 48 East 79th st., will build a four story brick dwelling at 31 West 86th st., to cost $45,000; Architect Albert Wagner, 67 University Place....Robert O. Connell and Edith L. Smith will build a five story brick store and flat cor. of Greenwich and Liberty sts.; Architect Cyrus L. W. Eidlitz, 160 5th ave.

Philadelphia, Pa.—Plans have been completed for the eight story addition to the wholesale department of the Sharpless Bros. stores, at 805 Jayne st.

Portchester, N. Y.—James W. Quintard is having plans drawn for a $100,000 residence in Portchester.

Providence, R. I.—Lloyd Tillinghast, the well-known restaurateur, has purchased the property bounded by Washington, Eddy, Wooster and Cove sts., and will probably erect a four story building, to cost not less than $100,000.

Somerville, Mass.—Designs for a new city hall on Central Hill, cost not to exceed $200,000 will be received until Oct. 16th.

St. Louis, Mo.—The 19th Century Building Co., 813 Chestnut st., will erect a ten story building on north side of Olive st., between 9th and 10th sts., for an office and theater building, to cost $1,000,000; passenger elevator, electric lighting, etc.; Architects Raeder, Coffin & Crocker, Chicago, Ill.

INCORPORATIONS.

The Elmira Safety Appliance Company, Elmira, N. Y—to manufacture electric engine stops, auxiliary governors, circuit breakers, etc. Capital stock, $5,000. Directors: Charles J. Langdon, George M. Diven, W. N. Eastabrook, James C. Miller and W. Mitchell Wood, all of Elmira.

The Lewiston and Youngstown Frontier Railway Company, Buffalo, N. Y.—to operate a street surface road by means of horses, electricity or any other motive power than steam, from the town of Porter, north of Youngstown, to Lewiston. Capital stock, $60,000. Directors: O. P. Letchworth, Frank M. Hayes, Henry C. Howard, A. J. Wheeler, Edwin T. Evans, L. D. Rumsey, F. R. March, Joseph L. Hunsicker, all of Buffalo, and A. H. Dutton, of Youngstown.

The Livonia and Lake Conesus Railroad Company, Livonia, N. Y.—to build a six-mile railroad from the New York, Lake Erie and Western railroad at Livonia to Conesus Lake, wholly within the County of Livingston. Capital stock, $60,000. Directors: Francis D. Hunter, David L. Gray, New York; William D. Blake, Tompkinsville; Walter E. Ayres, Harry H. Ward, Buffalo; Henry B. R. Potter, Edward F. Burns, Jersey City; Clarence P. Moore, Passaic; Chester C. Burritt, Bayonne, N. J.

The Bryant Zinc Company, Chicago, Ill.—to manufacture, buy and sell electrical and other articles. Capital stock, $2,500. Promoters: Geo. Bryant, W. W. Salmon, J. A. Wilson.

The Bethel Electric Light and Power Company, Bethel, Vermont—to furnish light and power for sale. Capital stock, $15,000. Promoters: W. H. Creamer, A. A. Brooks, R. M. Chase, M. A. Moody, Geo. H. Tupper, Bethel.

The Ascher Heating and Plumbing Company, Des Moines, Iowa—to engage in plumbing, gas fitting, electric light fitting, steam fitting, etc. Capital stock, $2[illegible],000. Promoters; O. K. Ascher, Will Scoville.

The Osceola Electric Light Company, Osceola, Iowa—to own, operate and maintain an electric light plant, sell, buy or lease real estate on which to put plant Capital stock, $20,000. Promoters: J. R. Harrison, A. W. Lewis, John W. Hall, D. Goldsmith, W. H. Hall.

The Hasbrouck Heights Light, Heat and Power Company, Hasbrouck Heights, N. J.—to make and sell gas for lighting streets, manufacture electricity for heat, light and power. Capital stock, $50,000. Promoters: Edward M. Anson, Geo. Broughton, Jr., Hasbrouck Heights, N. J.; Jules F. Vatois, New York City; David B. Mitchell, Brooklyn, N. Y., and John Q. Hanson, New York City.

The People's Electric Light, Heat and Power Company, Avoca, Pa.—to supply light, heat and power. Capital stock, $25,000 Promoters: Jas. Butler, Jno. A. Gillick, Michael J. McDonald, Moosic, Pa.

The Bryan, Hicksville, Mayville and Ft. Wayne Railway Company, Hicksville, Ohio—to build and operate an electric railway in Williams and Defiance Counties, Ohio, and Allen County, Ind. Capital stock, $50,000. Promoters: F. W. Horton, C. F. Swift, J. B. Colegrove, W. G. Deastman, John W. Winn, Geo. C. Serrill, John S. Hart, M. M. Hootman, W. H. Harter, J. J. Dorsey, R. M. Simons.

The Hermann Electric Light Company, Hermann, Mo.—to furnish electric lights, etc. Capital stock, $8,000. Promoters: H. C. Leisner, Geo. Mittendorf, Theo. Graf, Hermann.

The Punta Gorda Ice and Power Company, Punta Gorda, Fla.—to manufacture and sell ice and produce and transmit electric light. Capital stock, $10,000. Promoters: J. H. Farrington, Wm. S. Stetson, Lorenzo T. Blackmon, Punta Gorda.

The Consumers' Electric Company, Seattle, Wash.—to produce, transmit and furnish electrical current for light, heat and power. Capital stock, $50,000. Promoters: Thos. Boyd, A. M. Brooks, W. J. Grambs.

The Amber Investment Company, Tacoma, Wash.—to deal in real estate, electrical and street railways. Capital stock, $500. Promoters: Arthur C. Prichard, F. Bryant, F. C. Taylor, F. J. Miller, R. C. Applegate.

The Colorado Electric Heating Company, Denver, Col.——to engage in electrical heating, electric lighting, electric power apparatus of all kinds. Capital stock, $100,000. Promoters: Geo. B. Frally, J. S. J. Lallie, E. C. Ticknor.

The Kansas and Arkansas Construction Company, Kansas City, Kan.—to erect buildings, electric light and gas plants, and to build and equip railroads. Capital stock, $50,000. Promoters: W. W. Atkins, B. L. Short, C. A. Ellis, J. J. Spencer, Kansas City.

The Fort Wayne, Lake Everett and Columbia City Street Railway Company, Fort Wayne, Ind.—to organize, build, equip and control and operate an electric street railway in Ft. Wayne. Capital stock, $300,000. Promoters: Chas. E. Everett, Wallace E. Dowd, Wm. Geake.

The Columbia County Electric Railway Company, Greenport, Columbia County, New York—to operate a street surface electric road for a distance of fifteen miles between Hudson, Philmont and Stockport Station. Directors: Hiram McGonegal, of New York City; Walter S. Wales, of Syracuse, and A. J. Powles, R. J. Hodge, Charles S. Rogers, Wm. H. Van Tassel, Henry H. Smith, Sheldon B. Cook and Wm. J. Phillips, of Hudson, N. Y.

The Dickinson Electric Supply Company, New York City. Capital stock, $10,000. Directors: Henry S. Ritter, Henry H. Dickinson and Allen S. Goodacre, of New York City.

The Great Western Light and Power Company, Des Moines, Ia.—to supply electric light and power. Capital stock, $250,000. Incorporators: E. P. Thompson and N. A. Walker.

The American Incandescent Gas Company, Kansas City, Mo.—to establish a plant for the manufacture of appliances for making gas and electric light. Capital stock, $1,000,000. Promoters: A. E. Stilwell, George M. Meyers, E. L. Martin, E. P. Pratt, J. McD. Trimble, Arthur A. Mosher, Robert Gilham, George Matthews, Robert B. Cone, Ira C. Hubbell, and F. B. Wilcox, of Kansas City, and Thomas Hennessy, of Grand Falls, S. D.

The Colorado Gold Electric Extraction Company, Colorado Springs, Col.—to do a general mining and milling business by electrical process. Capital stock, $1,000,000. Promoters: Robert McKnight, G. M. Taylor, J. R. McKinnie, Colorado Springs.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

SEPTEMBER, 1895.

Date.	Light.	Date.	Exting.
1	12.40 A. M.	1	4.30 A. M.
2	1.40 "	2	4.30 "
3	2.30 "	3	4.30 "
4	No light.	4	No light.
5	"	5	"
6	"	6	"
7	6.50 P. M.	7	8.40 P. M.
8	6.50 "	8	9.20 "
9	6.50 "	9	9.40 "
10	6.50 "	10	10.30 "
11	6.50 "	11	11.00 "
12	6.50 "	12	12.00 "
13	6.40 "	14	1.00 A. M.
14	6.40 "	15	1.10 "
15	6.40 "	16	2.20 "
16	6.40 "	17	3.40 "
17	6.30 "	18	4.50 "
18	6.30 "	19	4.50 "
19	6.30 "	20	4.50 "
20	6.30 "	21	4.50 "
21	6.30 "	22	4.50 "
22	6.30 "	23	4.50 "
23	6.30 "	24	4.50 "
24	8.00 "	25	5.00 "
25	9.10 "	26	5.00 "
26	10.30 "	27	5.00 "
27	11.00 "	28	5.00 "
28	11.30 "	29	5.00 "
29	...... "	..	....
30	12.40 A. M.	30	5.00 "

ELECTRICAL PATENT RECORD.

Letters Patent Issued August 27, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

545,070. Underground Electric Railway. David F. Graham, Springfield, Ohio, and William P. Allen, Chicago, Ill., assignors of one-third to Oliver S. Kelly, Springfield, Ohio. Filed June 21, 1894.

545,073. Trolley. Julius L. Hanson, Omaha, Neb. Filed June 4, 1895.

545,158. Electric Railway. John C. Henry, Westfield, N. J. Filed April 20, 1895.

545,157. Trolley-Line Clamp. Warren J. Belcher, Hartford, Conn. Filed April 11, 1895.

545,204 Conduit Electric Railway. Charles H. Johnson, San Jose, Cal. Filed Feb. 23, 1894.

545,208. Underground Electric Railway. Emma E. Moore, Chicago, Ill. Filed Nov. 16, 1894.

545,230. Automatic Switch for Electric or Cable Railways. George T. Janvrin and Frank J. Conlon, Brooklyn, N. Y. Filed Dec. 12, 1894.

545,358. Trolley-Controller for Electric Railways Leonidas W. P. Gray and Philip G. Doescher, New Orleans, La. Filed May 23, 1895.

545,393. Guard and Guide for Electric Trolleys. John R. Trisler, Westwood, assignor of one-half to Joseph H. Moore, Cincinnati, Ohio. Filed June 1, 1893.

545,404. Electrically-Operated Mine-Car. Harry B. Dierdorff, Columbus, Ohio. Filed Dec 24, 1889.

ELECTRIC LIGHTS AND APPLIANCES.

545,359. Electric-Arc Lamp. Haydn T. Harrison, London, England. Filed Nov. 19, 1892.

DYNAMO ELECTRIC MACHINERY, ETC.

45,042. Hysteresis-Compensator. Bruno Abdank-Abakanowicz, St. Maur, France. Filed March 17, 1893.

545,1[illegible]1. Means for Synchronizing Electric Motors. Elihu Thomson and Edwin W. Rice, Jr., Swampscott, assignors to the General Electric Company, Boston, Mass. Filed March 8, 1893.

515,282. Means for Indicating Coincidence of Phase of Two Alternating or Polyphase Current Machines. Johannes H. F. Gorges, Berlin, Germany, assignor, by mesne assignments, to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed April 4, 1894.

545,347. Commutator or Collector Brush. Charles L. Coffin, Detroit, Mich. Filed Feb. 5, 1895.

545,405. System of Electrical Distribution. Thomas A. Edison, Llewellyn Park, N J. Original application filed Dec. 6, 1886. Divided and this application filed Aug. 29, 1887.

TELEPHONE AND TELEGRAPH APPARATUS.

515,191. Telephone Holder and Cut-Out. Arthur F. Boardman, Somerville, assignor of one-half to James D. Leatherbee, South Braintree, Mass. Filed Jan. 2, 1894.

545,2[illegible]3. Combined Telephone-Receiver, Support and Switch. George F. Shaver, Yonkers, N. Y., assignor to Amy R. Shaver, same place. Filed Dec. 6, 1894.

515,402. Telephone and Return-Call System. Thomas R. Brimmer, Baltimore, Md., assignor, by direct and mesne assignments, to the North American Interior Telephone Company, of Baltimore City. Filed Aug. 16, 1894.

515,4[illegible]6 Telephone. George F. Shaver, Yonkers, N. Y., assignor to Amy R. Shaver, same place. Filed June 8, 1895.

BATTERIES.

545,390. Secondary Battery. Illius A. Timmis, London, England. Filed Feb. 28, 1895.

MISCELLANEOUS.

545,0[illegible]9. Electric Annunciator. George J. Galbraith, Boston, Mass., assignor to the Electric Gas Lighting Company, same place. Filed April 27, 189[illegible].

545,091. Electric Gas-Lighting Apparatus. James W. Palmer, Nashua, N. H., assignor to the Electric Gas Lighting Company of Maine. Filed Jan. 9, 1895.

545 149. Electromagnetic Tool. Charles F. Carpenter, Louisville, Ky. Filed Aug. 20, 1894.

545,296. Electric Conduit. Charles L. Kintner, New York, N. Y. Filed March 16, 1893.

515 82[illegible]. Electric Target. Milton T. Weston, Kenton, Ohio, assignor to the Halcyon Cycle Company, same place. Filed Dec. 8, 1894.

THE TELEPHONE WORLD.

Competition in the South.

The Inter State Telephone and Telegraph Company of Durham, N. C., is actively engaged in establishing a competing telephone service throughout the South. The company began business by purchasing the Harrison telephone plant in Durham and reorganized with the following officers: L. A. Carr, of Durham, president; Julian S. Carr, of Durham, secretary and treasurer; W. W. Shaw, of Durham, auditor, and Edgar L. Miller, of Maryland, general manager, assisted by Geo. P. Lowe, superintendent of construction. The directors are L. A. Carr, Julian S. Carr and George W. Watts, of Durham, and Dr. P. D. Fahrney and James E. Walker, of Maryland. The company has practically rebuilt the Durham plant and is completing a large installation at Winston-Salem. At the latter place the local Bell Company is fighting hard, but the new company is encouraged and backed by the Chamber of Commerce and the Merchants and Traders' Union and is sure to win. The Inter-State Company has obtained franchises in the more important cities and towns in North Carolina and has arranged to connect Raleigh, Goldsboro, Winston, New Berne, Charlotte, Greensboro, Oxford, Henderson and other places. Work of constructon is already in progress at Wilmington, Goldsboro and Raleigh.

"American" Telephones in Demand.

The demand for the products of the American Electric Telephone Company, Kokomo, Ind., is not limited to the United States, as recent orders from foreign parts show. The company has lately made shipment of 100 telephones to Siberia, via Hankow, China, and transports, also shipments to Australia and South America.

Among the domestic contracts recently secured are New Castle, Pa., for 300 telephones; Greensburg, Pa., 150 telephones; Shreveport, La., 00 telephones; Monroe, La., 2 0 telephones; La Crosse, Wis., 500 telephones; Joplin, Mo., 200 telephones; Carthage, Mo., 20 telephones; Webb City, Mo., 100 telephones; Prescott, Ariz., 150 telephones; Logansport, Ind., 200 telephones; Huntington, Ind., 100 telephones; Defiance, O., 200 telephones; Macomb, Ill., 100 telephones

Telephone Competition in Iowa.

The Western Telephone Company, composed of Iowa capitalists, has in contemplation a widely extended telephone system in Iowa and adjacent States. The company has already constructed over 200 miles of line in the northern part of Iowa and secured control of nearly a thousand miles of leased line in that State and Minnesota. Work on other lines will be pushed rapidly, hoping to have a thousand miles of its own line in operation by spring. The intention is to reach as far east as Chicago and west to Sioux City or Sioux Falls, with a line to the north, touching Minneapolis and St. Paul. The officers of the new company are as follows: President, J. F. Case, Sumner; vice-president, C. Webster, Waucoma; secretary, T. H. Potter, Corwith; treasurer, T. H. Way, Britt.

A Cable to Hawaii.

Both Houses of the Legislature of Hawaii have ratified a contract made with Col. Z. S. Spalding to grant an annual subsidy of $40,000 and an exclusive franchise in return for laying and operating a cable from San Francisco to Honolulu. Application will be made at the coming session of Congress to secure a similar subsidy from the United States. It is estimated that the cost of the cable will exceed $1,000 000. Col. Spalding is one of the wealthiest sugar growers of Hawaii and is backed in his present enterprise by European capital.

The Svengali Buncophone Eclipsed.

Describing the new form of telephone instrument to be used at Kingston, N. Y., the *Freeman* of that place says:

> The telephone is so constructed that it can be kept in the drawer of a desk, and be pulled out only when needed It is guaranteed to be proof against falling on the floor, or out of the window, making it available as a weapon of offence against backyard cats. Its operation is so perfect that one can stand several feet away or even with his back to the instrument and still converse with remarkable ease.

The Gould-Smith Switchboard.

The Eastern Electric Company of Philadelphia, controlling the Gould-Smith patents on non-infringing switchboards, has just closed with a Pennsylvania telephone company a contract for a 400-wire board. This board was selected after a careful personal examination by the officials of the purchasing company of the many now on the market.

Telephones in Japan.

The cost of telephone rentals in Japan is $35 a year. There are now six exchanges in Tokio, two in Yokohama, three in Osaka and two in Kobe. There are about 2,672 subscribers.

The Memphis Telephone Company, Memphis, Tenn., has been granted a franchise in that city and has contracted with the American Electric Telephone Company, Kokomo, Ind. for the erection of a $100,000 plant. The city ordinance prohibits the Memphis Company from making any deal that will prevent the erection and maintenance of the plant, nor shall the company sell or give up its franchises, nor shall it do any act or thing by which its management or control shall be turned over or consolidated with the Cumberland Telephone and Telegraph Company, or do anything to deprive the city and its citizens of the competition in telephone service. In case of the violation of any of these agreements the company shall become bound to pay to the city of Memphis, as liquidated damages, the sum of $50 000, the sum to be a lien upon the works, franchise and all property of said company. Such violation shall authorize the city to have a receiver appointed, to hold until the full amount is paid.

The Home Standard Telephone Company has been granted underground rights at Albany, N. Y. The conduit system is to be completed within five years and is to be provided with ample space for use of city department wires for which no rental is to be charged. At a meeting of the directors of the company held last week a report was presented, showing that the capital stock of $ 50,000 has all been paid in. Plans for the construction of the line are to be submitted next week. The officers elected are: President, John M. Bailey; vice-presidents, James Rooney and Henry Russell; secretary, Charles L. A. Whitney; treasurer, Howard Hendrickson; general manager, William A. Graves.

The Philadelphia *Press* says that there is reason to believe that the franchise granted the Mutual Automatic Telephone Company of that city has passed into the hands of the Standard Telephone Company, and that an effort will shortly be made to construct the line. Some time ago J. W. Darlington was engaged as engineer to prepare plans for the conduits, and it is understood he will be engaged to superintend the construction of the plant of the new company.

The Central Union Telephone Company has reduced its rates at Wabash Ind., from $3 and $2 per month to $1 and sixty cents. The cut was precipitated by the Home Telephone Company which is just completing its new system and which proposed to furnish service at $2 and $1.50. The Home Company has 180 three-year contracts and expects to make a successful fight.

The Bell Telephone Company has established a "measured service rate" in Philadelphia, the adoption of which is optional with subscribers. Under this system the subscriber contracts for any number of exchange calls over 600 per annum, the price being based on the number of calls.

The Commercial Telephone Company of Alameda County, California, has presented a bid for a franchise in Oakland, that State, agreeing to give $50 upon the awarding of the franchise and in addition to pay the city semi-annually one-half of one per cent. of the gross income of the company.

A telephone line is to be built from Athens to Atlanta, making connections with Lexington, Jefferson, Crawford, Harmony Grove, Winder, Maysville, Hoschton and Pendergrass.

Among the recent large contracts closed by the Columbia Telephone Manufacturing Company New York, are Sacramento, Cal.; Ocala, Fla.; San Jose and Santa Cruz, Cal.

The city council of Lancaster, O., is considering the question of granting a franchise to the new telephone company represented by H. W. Winkoop and A. L. Conger.

A subscription paper is being circulated in Ross County to rebuild the old telephone line from Chillicothe O., to Andersonville and thence to Yellow Bud.

The Wausau Telephone Company, Wausau Wis., has contracted with the Standard Telephone and Electric Company, Madison, Wis for its exchange equipment.

The rush of new subscribers has compelled the Home Telephone Company of Mobile, Ala., to order 100 additional 'phones. Over 500 are already connected.

F. R. Phillips, of Covington, Ky., has organized the Cynthiana Telephone Company, with a capital stock of $10,000.

Representatives of the Stromberg-Carlson Telephone Company, Chicago, are organizing a local company at Galesburg, Ill.

The New York and New Jersey Telephone Company has been granted permission to lay conduits through the streets of Harrison, N. J.

Capitalists of St. Joseph, Kansas City and other towns, have organized a telephone company in Topeka, Kan., with a capital stock of $2,000 000 It is known as the National Long Distance Telephone Company and will combine all the other companies except the Bell.

C. S. Bash, representing the Fort Wayne Telephone Company, has made application for a franchise at Fort Wayne, Ind.

The local exchange of 100 subscribers erected at Rochester, Minn., by F. S Haines and J. A. Melone, has been put in operation.

Attorney H. K. Hawes is the leading spirit in the movement for a competing telephone exchange at Springfield, Mass.

The Mineral Point Telephone Company, Mineral Point, Wis.; capital stock, $1 500. Incorporators, W. R. Smith, P. Allen, Jr., N. H. Show and others.

The California Telephone and Construction Company have been granted a franchise at San Jose, Cal., for 25 years.

A franchise has been granted at Kenosha, Wis., to the National Telephone Construction Company of Milwaukee.

The Delaware County Telegraph and Telephone Company, has asked for a franchise at Chester, Pa.

All towns and villages between Patchogue, L. I., and Brooklyn now have telephone connections.

The Anthony Company of Cincinnati, O., is seeking a telephone franchise at Des Moines, Ia.

The city council of Menasha, Wis., has refused to grant a franchise to Fred Kraus, of Milwaukee.

A. H. Bartley has been granted a franchise to establish a telephone service at Sidney, N. Y.

The Southern Michigan Telephone Company is seeking a franchise at Schoolcraft, Mich.

Col. William P. Fogg, of New York, is in Cleveland organizing a telephone company.

The city council of Hearne, Ga., has granted a franchise for a telephone exchange.

The Baraboo Telephone Company has asked for a franchise at Baraboo, Wis.

A franchise has been granted to the local telephone company of Waycross, Ga.

The Central Telephone Company will erect a $75,000 building at Toledo.

Fayette and Vernon, Ala., are to be connected by a telephone line.

A telegraph line is to be built from Wickliffe to Paducah, Ky.

A telephone company is being organized at Tarboro, N.C.

New Companies Incorporated.

Articles of incorporation of the Baraboo Telephone Company, Baraboo, Wis., have been filed. The capital stock is to be $3 600.

The Cedar Valley Telephone Company, Waterloo, Ia. Capital stock, $100,000. Incorporators: D. C. Bickley, O. B. Dennett and J. K. Joder.

Gen. James S. Clarkson and A. T. Nye have filed articles of incorporation at Camden, N. J., for the Standard Telephone and Telegraph Company of Philadelphia. Capital stock, $250,000.

The Garrison and Duncan Telephone Company, Garrison, Col. Capital stock, $5,000. Incorporators: Paul B. Gates, Wesley Staley, Charles R. Foster Larin O'Bay.

The Greenwood Telephone Company, Greenwood, Ind.—to establish a telephone system. Capital stock, $3,000. Incorporators: Grafton Johnson, J. J. F. Crawford and Albert Johnson.

The North English and Green Valley Telephone Company, North English, Ia., has filed articles of incorporation

The McPherson Telephone Company, McPherson, Kan. Capital stock, $5,000. Directors: J. E. Wright, J. R. Wright, J. G. Maxwell, L. M. Waitt and H. G. Smith.

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EDITORIAL NOTES.

> **There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.**
>
> **It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.**
>
> **And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.**
>
> **If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—" ELECTRICITY," June 5, 1895.**

The Berliner Microphone Case. It is announced that the United States Court of Appeals, on motion of Mr. Storrow, of the Bell Telephone Company, has ordered that a mandate issue in the Berliner patent case, and that in consequence counsel for the United States, by leave of the Court of Appeals, has taken an appeal to the United States Supreme Court, thus leaving the case in status quo until the hearing takes place at Washington. By the terms of the act of Congress creating circuit courts of appeal the judgments of those courts are final in all cases arising under the patent laws, except where the judges certify a case to the Supreme Court, or where the Supreme Court directs the case to be brought before it for review on a writ of certiorari. The Government representatives say that a case involving the question whether or not the United States has the right to sue for cancellation of a patent is vastly different from a controversy between two private parties over a patent right, and that upon that point an appeal to the Supreme Court from the judgment of the Court of Appeals was demanded.

If, as seems to be the case, the Government is the only party that can bring the Berliner case directly before the Supreme Court, we think the independent telephone men are wrong in their idea that the Government should keep its hands off. They are certainly right in the attitude they propose to assume of defence of all cases brought in the lower courts for infringement of the patent, for no stone should be left unturned to defeat what they honestly believe to be an injustice. But if this is *all* that is done, what does it mean? What did it mean in the Bate Refrigerator case? It meant years of litigation before it was brought to the Supreme Court, and if the Berliner patent were to go through the same course as it would if the Government had kept its hands off it would be many years before it could be authoritatively decided either one way or the other. Those who are now in the business would better know now whether they are to continue to live or to die than to lead the precarious existence which must follow a protracted litigation leading through the legitimate and usual channels to the United States Supreme Court.

How many could survive such an ordeal? Probably of those who could few would desire to. Death—certain death, would be preferable to the lingering illness which the independent lamp business suffered pending a final hearing.

We are aware of the distrust which the Government's conduct of the Berliner case engendered, and have commented in no uncertain terms upon the almost disgraceful manner in which its case was presented. That case was a disgrace to the Government and a disgrace to the legal profession, and none have felt it more keenly than we. But if the Government is the only party who can bring this question to immediate issue, we are strongly in favor of such action. It is not only "any port in a storm," but in this case "the nearest port" in a storm which few can weather if they must battle against it for a protracted period.

The associations of independent companies, however, should see to it that the Government's next case is not made the farce that the former one was. With able attorneys and counsel, with the *moral* support which the independent companies if working in harmony could bring to bear, the legal representatives of the Government which is responsible for the conduct of the case would not *dare* to repeat the *fiasco* of the former hearing.

With all these forces added to that of public opinion intelligently aroused to the occasion, an Attorney General who would permit such slipshod work as that to which we advert would be eternally disgraced. We believe that the presence of attorneys for the Associations at the hearing, known to be ready to assist or to criticise as occasion required, would insure the best efforts of those assisting the Attorney-General in the conduct of the case, and insure the strongest possible presentation of the same. A decision rendered by the United States Supreme Court under these circumstances would at least be according to law. It would not only be this, but satisfactory even if it went in favor of the Bell Company, for then the people would know beyond question whether or not they had a right to use devices covered by the broad patent which now stands to the credit of Emile Berliner.

In the meantime let the Associations fight every step in the lower courts, but by all means let them exert every influence and assistance to bring the question to final hearing at the earliest possible moment, even if the most feasible means be the Governmental one which has once been tried and found so sadly wanting.

* * *

Electric vs. Steam Locomotives. The daily press and, to a less extent the technical press, have been much occupied of late in discussing the question of relative service of electric and steam locomotives. In discussing this question the element of speed has often been considered the dominating one, and if we are to take the lay press as a guide it is still a moot question as to which of the two can get up the higher speed. To the electrician and railway manager this is by no means the controlling feature. We all know that the difference in time between two points by express and way trains is due far more to the more frequent stops made by the latter than to any higher maximum speed attained by the former.

As an illustration in point we may mention the recent rivalry in England between the West Coast and the East Coast lines connecting London and Aberdeen, the distance by the former being 540 miles and by the latter 523. By reducing both the number of stops and the weight of trains, first one and then the other road beat previous records until the West Coast line covered its 540 miles in 512 minutes, or at a rate of 63½ miles per hour, thus beating the world's record, viz., that of the Empire State Express, which in September, 1891, covered the ground between New York and Buffalo at a rate of 61.56 miles per hour.

The maximum rate of the Empire State Express (Locomotive No. 999) was, we believe, 112 miles an hour, and this doubtless marks pretty nearly the maximum speed attainable to-day by means of steam locomotives drawing ordinary trains. This locomotive has drivers 86 inches in diameter and cylinders of sufficient diameter to impress upon these drivers the necessary power to overcome friction, air resistance and haul the required load at the given speed. But even at the relatively low piston speed required by these large drivers it is probable that the capabilities of the boilers and the exhaust valves had reached a limit. It has been stated that the Empire State Express could not start itself from rest with load, and required assistance at such times from another locomotive. Whether this be true or not, it was amply demonstrated that notwithstanding the enormous maximum speed attainable by No. 999 it lacked in a marked degree one feature essential to high average speed, viz., the ability to accelerate and retard its speed with that facility required for the best rapid transit service where intermediate stops are involved. Part of this deficiency seems to be inherent in types of steam locomotives calculated for highest maximum speeds, and another more important part is due to the enormous weight, not only of the trains as nowadays constructed, but of the locomotive in order that it may have sufficient tractive ability to pull the train at these high speeds.

These great train weights have been the growth of a comparatively few years and were the subject of an able editorial by that veteran railroad authority, M. N. Forney, in the last number of the *American Engineer and Railroad Journal.* He regards them as unnecessary, and states that the only excuse for them seemed to be the greater carrying capacity per train mile which they seemed to give, but he points out that the weights have increased unnecessarily even for this.

But certain it is that there is some limit to the speed at which heavy reciprocating parts can be safely operated. It is certain that, however extended that limit might be, it will be exceeded by the safe limit at which purely rotary motion can be safely operated. It has been well demonstrated that the electric motor on account of its purely rotary motion has a higher tractive effort per pound of weight than has the reciprocating engine. So marked is the advantage of the rotary motor that in the early days of electric traction many sought to explain it by assuming a sort of incipient weld between the wheel and the rail where the ground return was employed. It is now known that the greater tractive efficiency is due entirely to other causes, but the fact is no longer disputed. This being a fact, it follows that with a given weight on the drivers an electric locomotive can draw a heavier weight, or with a given available power and the same weight can attain greater speeds. It also follows theoretically, and this has been abundantly demonstrated in practice, that the electric motor can accelerate and retard its motion with greater facility; so that here, too, it has the advantage over the steam locomotive in the rapid transit it can afford.

The speed which an electric locomotive may attain is practically limited only by the ability of its revolving parts to resist centrifugal disruption. This does not necessarily refer to the speed of the armature or its strength, for it may be geared up instead of down, as is the practice at present, and the car wheels themselves become the limiting parts, but doubtless long before this becomes true the question of roadbed and ability of trains to keep on the rails will have stepped in to claim attention.

It is becoming more and more the belief of railway engineers that with a straight and well laid track far higher speeds than have yet been attained will be perfectly safe, so far at least as derailment is concerned, but it is a fact that our roadbeds as at present constructed will not permit much higher speeds than those already on record.

In Dr. Duncan's inaugural address to the American Institute of Electrical Engineers, he stated that the field for electric railway development lay along the line of more frequent train service. This will permit of lighter trains than are possible or desirable with steam traffic, and this will conduce to greater possibilities of speed in the electric service.

But this greater speed cannot be safely attained unless both track and motor are provided specially for the purpose. The recent reports of speed attained on the Nantasket Beach line are not to be credited, first because the motors were not designed for any such speed, and would therefore long before such speed was attained be generating a counter E. M. F. greater than that of the line, and second because on such a track such speeds would be suicidal.

* * *

WE understand that some individuals, who in the past have been somewhat proficient in the fine art of electric financing, express strong disapproval of the course of this paper in attacking and exposing the rascality in only one concern, and that they suggest that there are others that need and deserve our attention just as much, and intimate that we are neglecting our opportunities and evading our duty by apparently shutting our eyes to or winking at the very obvious sins and misdeeds of these others. We beg to assure our more or less worthy critics that ELECTRICITY will, in due season, deal out a fair measure of justice to any and all offenders against and transgressors of the laws of business morality, and that the expressed desires of our critics shall be more than satisfied. But just now we are engaged in dealing with what, in our opinion, is the biggest and worst case, and one such big case at a time, and that properly handled, is more to our taste than is rambling from one to another. Be patient, ye croakers, your wishes shall receive our most distinguished consideration and most vigorous attention—when *we* are ready. The complaints of neglect some now vociferously utter may then be turned into wailings.

We well know that we are only just on the threshold of our labors, and that there is much to be done in the future. Do you understand our position now? If not, and any further information is desired, please notify us.

We are always most happy to receive and listen to any suggestion concerning the big task of purifying the electrical industry which we have on our hands, and shall be especially thankful for any suggestions or recommendations offered in good faith by any one whose opinions are entitled to consideration; but ELECTRICITY cannot be swerved from its policy, deliberately decided upon after thorough consideration, by trivial or insolent advice.

Under the Searchlight.

Views and Opinions on Timely Topics.

AMONG the few members of the electrical fraternity of America who do not approve of the policy of ELECTRICITY, none has been more bitter (or less frank) in his criticisms than Mr. J. G. White. Of course no newspaper can suit every one, and ELECTRICITY does not try to. We would consider it a positive disgrace if this paper met with the approval of a certain element in the trade. There are those who see their occupation going from them by reason of ELECTRICITY'S exposure of electrical financing methods. These methods are not wholly confined to the G. E. Company. Mr. Coffin has had many imitators. Even now there are deals on foot as to Alton, Ill., to float securities in an amount largely in excess of anything warranted by the earning capacity of all the electrical enterprises in the town. The fact that ELECTRICITY stands ready to analyze each and every deal of this nature at the proper time cannot fail to render the paper distasteful to such men as Mr. J. G. White and Mr. J. T. Porter. However, we can stand their enmity better than their friendship.

* * *

A MATTER OF TECHNIQUE.

Among the many technical electrical journals of the day, perhaps no one is more entertaining and instructive than ELECTRICITY. It has a hobby of attacking some of the great electrical concerns of the country which becomes tiresome at times from constant repetition, but the magazine keeps abreast of the electrical thought of the day.

ELECTRICITY has another hobby which it rides with a persistence worthy of a better cause, and which does not add to its reputation for fair dealing. According to this sprightly magazine, no electrical fact, however simple and non-technical, can be correctly stated by a daily non technical newspaper. Commenting on a semi-technical statement in one of the Boston papers, ELECTRICITY says, in the current number:

> "We give space to this matter to convince the public that daily paper statements in regard to electrical subjects or electrical companies are totally unreliable."

That this charge, which is found in one form or another frequently in journals which are especially devoted to the technique of electricity, is not only gratuitous but untrue is now very plain. Whenever an investigator chances upon a phenomenon of the mysterious agency, which they all know so little about, his name is immortalized by attaching it to an alleged new unit.

And now, because a reporter occasionally becomes tangled in the mazes of these personal *terms*, electrical writers announce that electrical news in the daily papers is totally unreliable.

The fact that an enterprising individual establishes a monthly or weekly magazine devoted to technical papers on the art. does not of necessity preclude the daily newspapers from stating, plainly, clearly and correctly, facts of interest to the general public regarding the progress of the art. With all their assumption of superior knowledge, not one of them can to-day explain, in terms which can be comprehended by the most intelligent reader—whether he be technical in his habit of thought or otherwise—what this thing they call electricity is. While assuming to be the only safe and authorized pilots through the mysterious sea which surrounds them all, they do not pretend to be able to box their compass.

While statements of fact by the daily newspaper are not arrayed in the mysterious nomenclature of which the technical journals seem to desire to claim the monopoly, there is a growing tendency to let the people know something about the art, and it is presumptuous to say that statements made by the daily newspapers are totally unreliable. On the contrary, such statements will stand the test of criticism far better than will the statements of general facts made by the technical press.

[The above abstract from an editorial which recently appeared in the Rochester *Democrat and Chronicle* requires, we think, a few words in reply. In the first place the quotation of ours which gave rise to the above remarks was not, as seems to be assumed, due to a misuse of technical terms by the Boston paper, but a confession by the editor of the Boston *Transcript* that the article criticized was not inserted because it was supposed to be accurate, but simply to attract attention, and because the editor declined to correct some erroneous statements when they were pointed out by a correspondent.

It is not that the daily press cannot distinguish between that which is true electrically and that which is false, but that it does not *try* to that we find fault with. The daily press is a large beneficiary of the electrical charlatans whose advertisements of electric belts, electropoises, earth magnetos, thermo-ozone batteries, *et id genus omne* put them under obligations to print in their reading columns matter of the most sensational kind regardless of its truth or probability. What the daily press most seems to want is something sensational, and it gets it. We can well forgive the misuse of technical terms if only the facts are given, but when we see an otherwise respectable paper upholding charlatanism in its most flagrant form—and what is more doing so *knowingly*—we are disgusted. We are glad to believe that the *Democrat and Chronicle* does not do this, but it is doing something nearly as bad in criticizing us for calling attention to the misdeeds of others.

Our critic's idea of the origin of electrical units is something amusing. A new unit is only adopted by international agreement, and at the last Electrical Congress (1893) there was but one addition to the list. And his statement that we cannot yet explain what electricity is, and do not even pretend to be able to box our own compass, is made with an assurance that is charming. We have the same difficulty in defining electricity that we have in defining any of the ultimate elements of time, space, energy, matter. We cannot tell positively what electrical energy is any more than we can tell what energy is, but we know more about it than we do of gravity, of light or even of mechanical force.

Electrical science is becoming rapidly popularized, and the daily press might become a potent factor in this popularization, but let it discriminate against statements which are at variance with the fundamental law of the conservation of energy—let it refuse to sound the trumpet of the charlatan, if it would command respect from the technical press. Then let it make misuse of electrical terms, if it can do no better, and no harm will be done. This is a very mild sin but is a sin that the best edited papers will avoid as they avoid the use of ungrammatical expression.—ED]

* * *

OUR London correspondent gives this week some figures on the results of the operation of accumulators for traction purposes on the Birmingham system which are of some interest. The only data throwing a favorable light on storage battery traction are provided by the manufacturers of batteries. The figures of actual operation show a uniform poor result as compared with any other modern traction system.

* * *

"*As a voltage of* 10,000 *has proved to be entirely practicable, a territory within a circle of* 100 *miles diameter can be as easily served from a central point as can one town from its own plant employing the usual voltage*"—Electrical World.

* * *

THEIR VALUE.

Charles H. Bigelow, E. M. Van Duzee and Charles F. Miller, the appraisers of the A. H. Wilder estate, have filed with the clerk of the probate court at St. Paul a schedule of the valuations of the estate, in conformity with the order of the court. The total is $1,987,569.26. Among the items are:

	VALUE.
Capital stock of the Electric Corporation, 5) per cent. paid on $10,0 0 subscription	$250.00
200 shares Northwest General Electric Company	000.00

On June 15, 1892, Mr. Wilder had, according to the Northwest General Electric Company's stock book, 405½ shares of Northwest General Electric stock.

* * *

IF the makers of the 100-hour arc lamps (enclosed arcs) don't take pains to publish their own successes, we don't know how they can expect to convert the people. ELECTRICITY knows of one lighting station, managed by one of the most competent men in the country, where 50 such lamps have been in use nearly a year, and a good-sized additional order was recently placed.

* * *

LEADEN REALITIES.

(From the Cincinnati Commercial Gazette.)

VALUE OF AN ELECTRIC LIGHT PLANT.

The following, clipped from one of our exchanges, would indicate that golden promises and leaden realities are not the exclusive stock in trade of industrial promoters:

"The Morristown, Tenn., Electric Light Company's plant was recently sold under foreclosure proceedings. It was bought in by the General Electric concern for $4,000, which parent concern held the mortgage that was in default. What a choice collection of wrecks the General Electric is storing up on its dry docks!"

* * *

AND now the city of St. Louis is agitating the municipal lighting station question. The supervisor of city lighting is securing estimates of the probable cost.

* * *

Truths From Our Contemporaries.

(From the European Edition of the Herald.)

We do not seem to have come to the end of the resources to be derived from ELECTRICITY.

(From the Black Diamond.)

It becomes daily more manifest that the value of ELECTRICITY is more recognized.

Electrical Switching Engines on the Bridge.

The announcement is made, upon what appears to be good authority, that the noisy and dirty steam switching engines which have up to this time been employed at the termini of the New York and Brooklyn Bridge are to give way to electrical switching engines. This is as it should be, and the innovation will be hailed with delight by all patrons of the Bridge cars.

Two G. E. Railway Deals.

THE PUEBLO ROAD REORGANIZED.

At the recent foreclosure sale the Pueblo City Railway Company's property was bid in by Albert E. Pattison, of Denver, as trustee for the General Electric Company, for $400,000, of which $23,000 was paid in cash. Of this sum $5,000 was required by the master as a deposit, and the balance was for court costs and claims audited and ordered paid. The total indebtedness of the Pueblo City Railway to the General Electric Company was $579,661.37, $500,000 of which was secured by first mortgage bonds. The other $79,661.37 was to take up a floating indebtedness. Soon after the sale there was filed with the county clerk the incorporation papers of the Pueblo Electric Street Railway Company. The capital stock was placed at $500,000. The five directors are S. Dana Greene and Howard C. Levis, of Schenectady, N. Y.; Irving Hale and Albert E. Pattison, of Denver, and H. Eugene Chubbuck, of Pueblo. Mr. Greene is president of the company, Mr. Hale the secretary and treasurer, while Mr. Chubbuck is vice-president, general manager and assistant treasurer.

The Pueblo deal was a fair sample of the Coffinesque plan of building roads as put into operation by Mr. B. E. Sunny, manager of the Chicago office. Every patriotic man in Pueblo wanted a street railway, but not one could be found to incur the risk of building it. Therefore a first-class opportunity was offered for the manufacture of bonds by the Thomson-Houston bond factory. The road was built entirely for bonds and stock. The Thomson-Houston Company received no other consideration. The capitalization was $1,200,000—$700,000 in bonds and $500,000 in stock. Pueblo has a population of 24,558. An honest capitalization, therefore, would have been, at $12.50 per capita, $306,975. The road was equipped with 24 motor cars and 16 trailers, and 35 *lb. rails* were laid for track. It never paid operating expenses, and a receiver was appointed early in 1894. There were miles of track running through the cactus brush in the outskirts, where no human being ever lived or ever will live.

In 1894 the General Electric Company claimed to own only $50,000 of stock and $50,000 of bonds on this property, having apparently disposed of $1,100,000 of the securities.

Mr. S. D. Greene should not have accepted the presidency of the reorganized company, as his appointment was an evident insult to Mr. B. E. Sunny. The Pueblo road was Mr. Sunny's own child. He should be allowed to raise it.

THE SYRACUSE "CONSOLIDATED" ROAD SOLD BY THE SHERIFF.

A few weeks ago the property of the Syracuse "Consolidated" Street Railway Company was sold by the sheriff to the bondholders of the company for $835,000.

The building of this road was another typical Thomson-Houston deal. There was a horse railway company in Syracuse owning franchises and operating in the only desirable thoroughfares. This company did not care to trade with the Thomson-Houston Company. Therefore eight short and insignificant branch lines were gathered together in a Coffinesque consolidation to furnish raw material for the bond factory. There were 31.75 miles of road, 12 miles el. and 19.75 h. The capitalization was $7,300,000, $4,000,000 stock and $3,300,000 bonds, according to the General Electric Company's books in 1894, when the General Electric Company claimed to hold no bonds, and only $20,500 of stock. The company's car equipment was as follows: 29 motors, 68 box, 21 open cars, and it owned 220 horses. A receiver was appointed in December, 1893, when interest had lapsed and there was a floating debt of $180,000. Stockholders of course get nothing, and the bondholders about 25 cents on the dollar. The Pueblo and Syracuse swindling operations were cotemporaneous with the Northwest operations to which we are now giving so much space. Pueblo was worked through the Chicago office, Syracuse through the Boston office—and everyone, East, West, North, South, under the direct supervision of Charles A. Coffin.

More Trouble For G. E.

The Siemens & Halske Co. Bring Suit For Infringement.

The Siemens & Halske Electric Co. of America have filed suit against the Metropolitan Elevated Railroad at Chicago, alleging that the latter is infringing patent No. 324,176, granted to Dr. Werner von Siemens in the United States on August 11, 1885, covering the electric system now in use on the Metropolitan road. The patent was assigned August 5, 1891, to Siemens & Halske of Berlin, and May 22, 1894, by the latter to the Siemens & Halske Company of America. The G. E. Company of New York is of course the real infringer, and the defence is in its hands. President A. W. Wright of the Siemens & Halske Co. is reported as saying: "It may be asked why did we not bring suit against the General Electric Company when it operated the intramural road at Jackson Park. The answer is simple: The road was run at a World's Fair under the direct supervision of the Government, and it was agreed should be dismantled in a certain time."

The same company also brought suit, September 5, against the Baltimore and Ohio Railroad Company, in the United States Circuit Court, District of Maryland, for infringement of patent No. 520,274, granted to Ernst Werner von Siemens on an "Improvement in Electric Railways." We understand that the overhead trolley device used in the Baltimore tunnel is identical with the device described in the Siemens patent. It is a fact, though not published before, that the Siemens & Halske Electric Company some time ago threatened to bring suit against the General Electric Company under a contract entered into by the former Edison General Electric Company for the manufacture of Siemens cables. The General Electric Company, however, agreed to pay royalties for the use of these patents, and the matter was adjusted on this basis.

American Association for the Advancement of Science.

The following titles on electrical and engineering subjects were included in the programme for the meeting of the American Association for the Advancement of Science held at Springfield, Mass., beginning August 27 and continuing until September 4:

Flow of alternating current in an electrical cable. By M. I. Pupin.

The most general relation between electric and magnetic force and their displacements. By M. I. Pupin.

The economics of engineering public works. By H. N. Ogden.

Mathematical theory of the windmill. By De Volson Wood.

Experiments on the flow of steam, and comparison of the results with Napier's formula. By J. J. Flather.

On partially continuous drawbridge trusses, with a method of deducing formulas for the reactions. By Mansfield Merriman.

On the design of fishplate joints. By H. S. Jacoby.

The perfect screw problem; illustrated by a combined ruling engine and comparator in automatic operation. By William S. Rogers.

Magnetic storms and sun spots. By M. A. Veeder.

Solar magnetic radiation and weather forecasts. By Frank H. Bigelow.

Clouds and their nomenclature. By Cleveland Abbe.

Cloud photography. By Alfred J. Henry.

Californian electrical storms. By John D. Parker.

Electrolytic reproduction of resonators. By William Hallock.

An experimental investigation of the rotary field. By H. D. Carthart.

Phenomena with electric waves analagous to those of light, with a diffraction grating. By C. D. Child.

Calcium carbide. By Prof. P. de Chalmot.

From the address by Wm. McMutrie, Brooklyn, N. Y., on "Industries and Chemistry":

In no direction has the application of the methods in the larger way, either in the laboratory or in the works, given richer yields in new material than in the varied uses of the electric current in chemical work. It has led to the production of new compounds or has increased the means for production of old ones, and through it additions are constantly being made to the store of material of such composition and properties that they must inevitably lead to further new discoveries or the establishment of new principles or laws. The electrical smelting furnace has opened up a wide field of experiment and investigation as fascinating as it is new, and it is to be expected that many additions will be made to the list of new substances through its use.

"Economics of Engineering Public Works" was the subject of Prof. Ogden's paper. He said:

Water-pipes under the care of one commission are laid in one trench; gas-pipes under another management in a second trench, and so with the sewers and the steam-pipes and the conduits for wires and for other purposes. Each company is responsible for its own ditch and its contents, but the cost of the trench is, in each case, added to the cost of the service rendered, and the community has to pay for the many managements and their lack of co-operative understanding. It is not an unknown thing, after a town is well paved, to have the pavement ruined by the subsequent laying of water and sewer pipes, with the additional expense of repaving the street over the trench.

Were all pipes put together in a suitable and accessible conduit, paid for by the managements of the different pipe lines, and were the conduits built before any of the trenches are dug, a certain net gain to the community would ensue. Conduits could in most cases be built for less than the total expense of the trenches, and could be constructed in the streets of our large cities, thus avoiding the dead loss incurred whenever the streets are torn up for repairs.

ASSOCIATION NEWS.

American Street Railway Association.

Arrangements have been completed for a special train to leave New York on October 14, at 6 P. M., for the delegates and others who desire to attend the Montreal meeting of the above Association on October 15–17.

New York State Street Railway Association.

The annual meeting of the New York State Street Railway Association is to be held at the Kenmore Hotel, Albany, on September 17 next. A long list of topics for discussion will be presented.

Pennsylvania Street Railway Association.

The fourth annual convention of the Pennsylvania Street Railway Association was held in Wilkes-Barre last week. There was a goodly attendance and a liberal number of exhibits. The papers were of rather better quality than usual, the leading one being read by Mr. A. K. Baylor, of the General Electric Company, on "Power Consumption by Electric Railways."

Canadian Electrical Association.

The fifth convention of the Canadian Electrical Association will take place at Ottawa on the 17th, 18th and 19th inst.

The following papers will be presented:

"Some Notes on the Consolidation of Two Systems of Electric Supply," A. A. Dion, Ottawa.

"The Telegraph in Canada," Chas. P. Dwight, Toronto.

"Suggested Forms for Electric Light Accounting," D. R. Street, Ottawa.

"From the Coal Pile to the Meter," Jas. Milne, Toronto.

"Some Modern Alternating Current Apparatus," H. T. Hartman, Peterborough.

"Non-Interference Duplex Relay."

"A Percentage Method for Circuit Measurements," D. H. Keeley, Ottawa.

American Institute of Electrical Engineers.

The 99th meeting of the Institute will be held on Wednesday, September 25, the date having been changed from September 18 by the committee. A paper will be presented by Charles S. Bradley, on "Phasing Transformers." The meeting of Council will also be held on September 25, when applications received from the following candidates will be acted upon: Edgar. L. Morley, New York City; Sydney B. Austin, Sidney, N. Y.; David B. Rushmore, Plainfield, N. J.; D. W. Irvine, Chambersburg, Pa.; Gustav A. Wiese, Alameda, Cal.; W. Wallace Ker, Jersey City, N. J.; Thomas C Frenyear, Gloversville, N. Y.; Percy Howard Powell, Hempstead, N. Y.; Chas. E. Hewitt, Hanover, N. H.; Dwight Parker Robinson, Chicago, Ill.; Carl Harald Hakonson, Schenectady, N. Y.; Daniel Adamson, Hyde, Cheshire, Eng.; Philip Dawson, London, Eng.; Chas. H. Merz, Newcastle-on-Tyne, Eng.; Evan Parry, London, Eng.; Byron T. Burt, Charleston, S. C.; Harrison Wybro, Los Angeles, Cal.; Robert R. Harvey, Wilkes Barre, Pa.; Maurice Coster, Chicago, Ill.; Paul M. Lincoln, Niagara Falls, N. Y.; John F. Skirrow, New York City; Henry G. Stott, Buffalo, N. Y.; Chas. R. Huntley, Buffalo, N. Y.; Geo. H. Blaxter, Pittsburg, Pa.; John B. Cornell, Hamilton, O.; Robert Bruce Mann, Milwaukee, Wis.; Henry S. Carhart, Ann Arbor, Mich.; Will Knox Dunlap, Pittsburg, Pa.; Lewis Degen, Rio de Janeiro, Brazil; Russell B. Harrison, Terre Haute, Ind.; Josiah L. Merrill, Schenectady, N. Y.; Chester P. Wilson, Philadelphia, Pa.; Andrew Pinkerton, Apollo, Pa.; David F. Crawford, Fort Wayne, Ind.; Elmer E. Boyer, Lynn, Mass. James Mitchell, Rio de Janeiro, Brazil.

Personal.

Mr. Robt. T. Lozier has returned from his European trip looking brown and healthy.

Mr. S. A. Douglass, who has been in the West for a few weeks, has returned to the city.

Mr. William A. Doble, of the firm of Abner, Doble & Co., San Francisco, who has been in the city several weeks on business, has returned to the Coast.

Mr. James W. Godfrey, who has been enjoying himself abroad for several weeks, returned with his family on Saturday last.

Mr. George Cutter, of Chicago, was a New York visitor last week.

The firm of Fisher & Porter, Chicago, has been dissolved. Mr. Albert Fisher will hereafter represent Wm. Todd & Co., of Youngstown, Ohio. Mr. H. F. J. Porter will retain the agency of the Bethlehem Iron Company.

Mr. Maurice Hart, accompanied by his brother, Mr. Samuel Hart, has been in the city for several days, and will leave for his home in New Orleans the latter part of this week.

Mr. John J. Moore has retired from his connection with Mr. M. J. Perry's Narragansett station at Providence.

Mr. Brainerd Rorison, formerly of the Fort Wayne Electric Corporation, has accepted a position with the Barber Asphalt Company of Detroit.

Mr. Clarence E. Stump is among the recently returned European travellers.

Mr. Robert Wiggins, of Chicago, spent a few hours in New York last week on his way to Washington.

Fort Wayne Corporation's Recent Sales.

The Fort Wayne Electric Corporation has recently sold to the Narragansett Electric Lighting Company, Providence, R. I., sixteen Wood arc machines, 125 lights capacity each, and six of the same size and type to the Consolidated Company at Toledo, O., both contracts including lamps and accessories.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER X.

The Mitchell Plant and the Mitchell Electric Company.—II.

A valued correspondent informs us that there is some misapprehension on our part in relation to the exact order of events in the early history of the Mitchell plant. He claims that Mr. Robertson's report to Mr. J. B. Tarbox was made some time prior to the transfer of the electrical machinery from the grist-mill to the station, and that the language quoted by us from Mr. Robertson's report applied to the plant while it was located at the grist mill. We have carefully gone over the mass of notes and records in our possession relating to the history of the plant, and find that our correspondent is right, and we desire to express our regrets for the oversight which caused us to make the mistake. It is our most sincere desire to be strictly accurate in every detail connected with the history of the various transactions we depict, and we particularly wish to be absolutely free from the slightest suspicion of an effort to make matters appear worse than they really were, for we believe that such a course would not only be unwise but is also wholly unnecessary. The misapprehension referred to does not affect the accuracy of the statements made and conclusions so far drawn concerning the manipulation of this plant, except so far as it relates to the comparison of our estimated value of the plant as installed in the station with the values named in Mr. Robertson's report. If our readers will strike out all reference to the comparison of our values with Mr. Robertson's values, the article will be correct.

Such of our readers as are thoroughly familiar with the prices charged for apparatus and supplies at that date, and are also conversant with the costs of installation of electric plants, will no doubt be puzzled to know how the Northwest Company could have invested $12,000 in a plant furnishing only fifteen or sixteen arc lights and having a capacity of only 500 incandescent lights and run from hired power in a hired room, and at that time using no meters. The maximum price obtainable for arc lighting apparatus at that date was about $100 per light erected, and the apparatus itself could be purchased for closely approaching half that sum per light. The entire cost of installing a complete alternating current incandescent system of the magnitude of the one put in at Mitchell should not exceed $10 per lamp, therefore the cost of installing the plant as it existed when operated from the grist-mill should not have been more than $9,000, and ought to have been very much less if the prices actually prevailing for apparatus and supplies at that time had been charged on the books of the Northwest Company. We believe we shall be able to shed some light on the matter of the charges to these plants on the books of the Northwest Company which will fully explain how that company could have expended about $12,000 on a plant of so small capacity as that located in the grist mill at Mitchell.

We will now resume the further discussion of the operations connected with the history of the manipulation of the Mitchell plant.

Mr. Byllesby entered upon his duties in connection with the Northwest Thomson-Houston Company within a comparatively short time after the submission of Mr. Robertson's report to Mr. J. B. Tarbox, the treasurer of the company. The affairs of the company had been in a very bad way for some time past, and Mr. Tarbox took the position of treasurer for the purpose and with the intention of instituting radical reforms in its business management. The company was already greatly embarrassed financially, and one of the most serious difficulties confronting it at that time was that of the many electrical properties long carried on its books as assets but which entailed constant loss and from which nothing could be obtained in the way of substantial returns. The Mitchell plant had been on the books as an asset for over two years, and the evidence of its exact condition was conveniently at hand. Is it conceivable that Mr. Coffin and Mr. Byllesby were ignorant of the existence of that evidence and unacquainted with its exact nature at the time the scheme for the resurrection of all these properties was concocted?

It was during the very early part of Mr. Byllesby's vicarious administration of the affairs of the Northwest Thomson-Houston Electric Company that the plan for building the Mitchell station and transferring the plant from the grist-mill to it was evolved, and the work and expenditures connected with it were under his immediate supervision and control. Is it possible to believe that he undertook this task without an understanding of the exact condition of the plant at that time, and what its past history had been and what its probable future prospects were?

It must be remembered in this connection that Mr. Byllesby was no tyro in the business at the time he entered upon his duties in the Northwest Company. He had been employed for several years with the Edison Company, had been vice-president and general manager of the Westinghouse Company for about four years, and in those positions he certainly had abundant opportunity to fully qualify him to correctly estimate what revenues and what profits could be expected to be derived from electric lighting stations of large or small capacity. Moreover he had before him plenty of evidence in the way of numerous much larger stations than that erected at Mitchell to demonstrate that there was no margin for working the watering scheme in connection with electric lighting stations, and more especially so with the smaller ones. He could not possibly have been ignorant of the fact that in a town of such small size as Mitchell, with such a limited demand for lights and with a plant of such extremely limited capacity, there was little or no hope for any return on even a proper investment, and not the slightest justification for capitalizing a company at one dollar over that actually *necessary* to properly install the plant. He *must* have known that even under the conditions of the most rigid economy in first cost and subsequent running, it was well nigh impossible to earn enough to pay the operating expenses of such a station.

But Mr. Byllesby had spent considerable time in Boston before assuming the vicarious position in the Northwest Company, and he knew that the relations of the Northwest Company to the Thomson-Houston Electric Company were such that what one lost the other also lost, and the problem to be solved was: How was the Northwest Thomson-Houston Company to save itself and the parent Thomson-Houston Electric Company from the loss of money represented by the machinery, apparatus and supplies furnished and that expended in erecting the plant and meeting the constant loss incurred in its operation and maintenance? Why, of course, by making arrangements for the purpose of endeavoring to transfer these burdens to the pockets of others by means of the now well-known stock-and-bond scheme. For had not Mr. Coffin and some of his associates organized special companies for marketing stocks and bonds, and had not the Thomson-Houston Electric Company been admittedly quite successful in disposing of large amounts of such so-called securities to investors?

With the elaborate and extensive machinery provided by Mr. Coffin for the express purpose of floating so called electric securities, there was no reason, according to their code of business morals, why they should hesitate to arrange to put it into operation and seek to avail themselves of its advantages in relieving themselves of the burden of the loss incurred in connection with the Mitchell plant.

Accordingly articles of incorporation were drawn up for the formation of the "Mitchell Electric Company" under the laws of the State of Minnesota, and the certificate of its incorporation was filed with Minnesota's Secretary of State on the 1st day of February, 1892

A copy of this certificate is printed herewith. It will be noticed that the authorized

[COPY.]

ARTICLES OF INCORPORATION OF THE MITCHELL ELECTRIC COMPANY.

We, the undersigned, for the purpose of organizing and becoming a body corporate under and by virtue of the laws of the State of Minnesota in such case made and provided, have adopted and executed the following articles of incorporation:

Article First.

I. The name of this corporation shall be "Mitchell Electric Company."

II. The general nature of its business shall be:

(a) To construct, maintain and operate a plant or plants for manufacturing and generating electricity.

(b) To deal in, furnish and supply electricity for light, heat and power.

(c) To carry on any and all business in anywise appertaining to or connected with the manufacturing and generating, distributing and furnishing of electricity for light, heat and power purposes, including the transacting of any and all business in which electricity is now or hereafter may be utilized, and all matters incidental or necessary to the distribution of electric light, heat and power.

(d) To manufacture and repair any and all necessary appliances used in or which may be required or deemed advisable for or in connection with the utilization of electricity or in anywise appertaining thereto or connected therewith.

(e) To lease, purchase, hold, sell, convey, mortgage and exchange real ~~and~~ or personal property ~~and~~ or contracts, and to do any and all other things, and carry on any and all other business operations which may be necessary ~~and~~ or advisable in connection with the manufacturing, generating, distributing, selling and furnishing of electricity or the apparatus and appliances connected therewith.

III. The principal office of the company hereby incorporated shall be in the city of St. Paul, Minnesota, and the location of its principal electric plant shall be in or near the city of Mitchell, State of South Dakota.

Article Second.

The time of the commencement of this corporation shall be the first day of February, A. D. one thousand eight hundred and ninety-two (1892), and the period of continuance of said corporation shall be thirty (3) years from said date.

Article Third.

The amount of the capital stock of this corporation shall be fifteen thousand dollars ($15,000) and the same shall be paid in at such times and in such manner as the Board of Directors of this corporation may designate.

Article Fourth.

The highest amount of indebtedness or liability to which this corporation shall at any time be subject shall be the the sum of twenty thousand dollars ($20,000).

ARTICLE FIFTH.

The names and places of residence of the persons forming this association for incorporation are as follows:

Henry M. Byllesby,	St. Paul,	Minnesota.
Howard C. Levis,	"	"
Wm. Ely Bramhall,	"	"
Benj. F. Meek, Jr.,	"	"
Wentworth P. Johnson,	"	"
Charles K. Stearns,	"	"
S. P. Wells, Jr.,	"	"

ARTICLE SIXTH.

I. The government of this corporation and the management of its affairs shall be vested in a board of seven directors, each of whom shall be a stockholder, and in the following offices, viz., a president, vice-president, secretary and treasurer, and such other offices and agents as the Board of Directors may from time to time appoint.

II. The directors shall be elected at the annual meeting of the corporation on the first Monday in March in each year.

III. The officers of this corporation shall be elected annually by the Board of Directors at their first meeting each year immediately after the annual meeting of the stockholders.

IV. The president, vice-president, secretary and treasurer shall each be directors and their term of office and the term of office of directors shall be one year and until their successors are duly elected and qualified.

V. The names of the first Board of Directors of this corporation are:

Henry M. Byllesby,
Howard C. Levis,
Wm. Ely Bramhall,
Benjamin F. Meek, Jr.,
Wentworth P. Johnson,
Charles K. Stearns,
S. P. Wells, Jr.,

and they shall hold office until the first annual meeting in March, 1893.

ARTICLE SEVENTH

The capital stock of this company shall be divided into one hundred and fifty shares of the par value of one hundred dollars each.

In witness whereof we have hereto set our hands and seals this first day of February, A. D. 1892.

H. M. BYLLESBY. [Seal]
HOWARD C. LEVIS. [Seal]
WM. ELY BRAMHALL. [Seal]
B. F. MEEK, JR. [Seal]
W. P. JOHNSON. [Seal]
C. K. STEARNS. [Seal]
S. P. WELLS, JR. [Seal]

Signed and sealed in presence of
WALTER RUAN.
R. V. PRATT.

State of Minnesota, County of Ramsey, ss.

On this first day of February, A. D. 1892, before me personally appeared Henry M. Byllesby, Howard C. Levis, Wm. Ely Bramhall, Benjamin F. Meek, Jr., Wentworth P. Johnson, S. P. Wells, Jr., and Chas. K. Stearns, to me well known to be the same persons who executed the foregoing instrument, and each for himself acknowledged that he executed the same as his free act and deed for the uses and purposes therein expressed.

ROSWELL V. PRATT,
[Notarial Seal] Notary Public, Ramsey Co., Minn.

State of Minnesota, County of Ramsey, ss.
Office of the Register of Deeds.

This is to certify that the within instrument was filed for record in this office at St. Paul on the 3d day of February, A. D. 1892, at 9:40 o'clock A. M., and that the same was duly recorded in book G of incorporations, pages 63-70.

CHAS. L. HAAS,
Register of Deeds.

Filed for record in this office February 11, 1892, at 9:30 o'clock A. M.

F. P. BROWN,
Secretary of State.

OFFICIAL CERTIFICATE OF TRANSCRIPT.

UNITED STATES OF AMERICA,
STATE OF MINNESOTA,
DEPARTMENT [Seal] OF STATE.

I, Albert Berg, Secretary of State of the State of Minnesota, do hereby certify that I have compared the annexed copy with record of the original instrument in my office of articles of incorporation of the Mitchell Electric Company, as filed Feby. 11, 1892, and recorded in book "D. 2" of incorporations, page 340, etc., and that said copy is a true and correct transcript of said record of said original instrument and of the whole thereof.

Great Seal
of the
State of
Minnesota.
1858.

In testimony whereof I have hereunto set my hand and affixed the great seal of the State, at the Capitol, in Saint Paul, this 28th day of August, A. D. eighteen hundred and ninety-five.

ALBERT BERG,
Secretary of State.

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capital stock is $15,000 and the authorized indebtedness $20,000, making the total legally permissible capital of the company $35,000.

In another part of this week's paper we publish a full list of the employees of the Northwest Thomson-Houston Electric Company, and by a comparison of the names of the incorporators of the Mitchell Electric Company with those in the list referred to it will be seen that they were, with one exception, all regular employees of the Northwest Thomson-Houston Electric Company. The one exception is that of Mr. William Ely Bramhall, who was a lawyer in St. Paul. Each in his own way carried out the orders issued by C. A. Coffin, manager of the parent T.-H. Company at Boston. Their positions were as follows:

Henry M. Byllesby, President of Northwest T.-H. Co.

Howard C. Levis, Vice-President and Treasurer of Northwest T.-H. Co.

Wm. Ely Bramhall, Attorney Northwest T.-H. Co., and Private Attorney for H. M. Byllesby.

Benjamin F. Meek, Jr., Secretary and Assistant Treasurer Northwest T.-H. Co.

Wentworth P. Johnson, Auditor Northwest T.-H. Co.

Charles K. Stearns, Chief Engineer Northwest T.-H. Co.

S. P. Wells, Jr., Supt. Sales Dept. Northwest T.-H. Co.

Walter Ruan, Cashier Northwest T.-H. Co.

R. V. Pratt, Bookkeeper Local Properties, Northwest T.-H. Co.

We thus prove the correctness of our statements concerning the method pursued in forming companies on the local properties which we described in the introductory chapter to this series of articles.

Our readers will note that the original Mitchell plant was started in the early part of 1889, and Mr. Robertson's report was submitted about one year after the plant had been in operation. Notwithstanding his report, the operation of the plant was continued until Mr. Byllesby's inauguration, which occurred about a year after. At the time the resurrection scheme was formulated and put into operation the plant had therefore been running a little over two years. No plea can be successfully urged or maintained that these exploiters did not have before them at the time of the organization of the Mitchell Electric Company sufficient information to judge of the worthless character of the property as an investment, and the hopelessness of any such increased demand for lights as would warrant the continuance of the service. Indeed, any moderately well informed electrical engineer could have predicted with absolute certainty that there was not the slightest chance of commercial success for the undertaking, and that the new plant was practically just as worthless as an investment as the original one.

We have in our possession the official statement of the earnings and expenses of this "Mitchell Electric Company plant," a copy of which is here presented:

[COPY.]

MITCHELL ELECTRIC COMPANY.

STATEMENT OF EARNINGS AND EXPENSES FOR TWELVE MONTHS ENDING FEBRUARY 28, 1893.

Earnings.

	Arc.	Inc't.	
March	$188.90	$251.09	
April	188.90	228.53	
May	188.90	307.23	
June	155.11	291.52	
July	200.61	231.00	
August	153.87	208.21	
September	155.70	238.41	
October	57.05*	265.10*	
November	....*	....*	
December	159.00	473.17	
January	147.00	380.52	
February	141.00	338.39	
	$1,586.01	$3,213.17	$4,799.21
Wiring			87.23
Total earnings			$4,886.44

* NOTE—The plant was shut down during a part of October and the whole of November.

Total earnings brought forward		$4,886.44
Expenses.		
Lamps	$365.77	
General expenses	241.18	
Fuel	1,909.07	
Oil and waste	42.24	
Boiler compound	34.23	
Carbons	25.96	
Water rent	10.00	
Repairs to electric plant	222.70	
Repairs to steam plant	302.19	
Salaries of engineer and fireman	1,149.00	
Rent	5.00	
Taxes	250.66	
Insurance	271.78	
Discount	7.57	
		$4,863.37
Surplus for twelve months		$23.07
Interest.		
Interest on notes		$687.40

By this official statement it will be seen that, aside from interest on notes, the net earnings for the period covered was only $23.07. The interest on the floating indebtedness amounts to $687.40, leaving a deficiency of $664.33. But there is omitted from the statement the accrued interest on the $15,000 6 per cent. bonds, amounting to $900; this increases the deficiency to $1,564.33.

In our next issue we shall consider this statement more in detail, and shall present the results of a careful analysis of it and also of other accounts of the company.

(To be continued.)

LIST OF EMPLOYEES NORTHWEST G. E. COMPANY, AUGUST 1, 1892.

General:
- H. M. Byllesby, President.
- Howard C. Levis, Vice-President and Treasurer.
- George C. Duffie, Assistant Secretary.
- W. H. Moore, Manager Local Properties.
- R. V. Pratt, Bookkeeper Local Properties.
- Alice A. Barry, Stenographer.
- Frank Slater, Watchman.
- M. Horrigan, Janitor.
- Bert Warner, Office Boy.
- V. Toof, Office Boy.
- John McKnight, Office Boy.

Engineering and Expert Department:
- Chas. K. Stearns, Chief Engineer.
- Oscar Claussen, Civil Engineer.
- H. T. Purdy, Railway Engineer.
- F. D. Sampson, Railway Engineer.
- M. H. Gerry, Draughtsman.
- J. S. Bassett, Railway Engineer.
- F. M. Farwell, Railway Engineer.

Repair Department:
- J. M. Denniston, in charge.
- W. J. Bonwell, Superintendent.
- Jerry Horrigan, Engineer.

Accounting Department:
- B. F. Meek, Jr., Secretary and Assistant Treasurer.
- W. P. Johnson, Auditor.
- Walter Ruan, Cashier.
- Geo. C. McKnight, Bookkeeper.
- E. A. Patrick, Assistant Bookkeeper.
- Gerda Lund, Assistant Bookkeeper.
- Geo. W. Haskell, Stock Clerk.
- Wm. Blackburn, Stock Clerk.
- Chas. W. Hayes, Bill and Order Clerk.
- H. B. Warren, Statistics.
- A. J. Gifford, Freight and Invoice Clerk.
- W. L. Moulder, General Clerk.
- Fleming Meek, Copying and File Clerk.
- E. M. Warner, Stenographer.
- L. A. Healy, Stenographer.

Sales Department:
- S. P. Wells, Jr., Superintendent.
- F. N. Armour, Salesman.
- John H. Finney, Salesman.
- J. K. Metzger, Salesman.
- A. S. Huey, Salesman.
- I. C. Woodward, Salesman.
- W. F. Smith, Superintendent Construction.
- W. M. Deming, Meter Salesman.
- J. F. Bishop, Stenographer.
- Julia Gorgas, Stenographer.
- E. Sprague, Stenographer.
- C. W. Farnham, Salesman.

Supply Department:
- R. H. Beach, Purchasing Agent.
- S. B. Howarth, Salesman.
- H. J. Gile, Requisition Clerk.
- P. N. Nelson, Stock Clerk.
- C. M. Miller, Stock Clerk.
- Chas. Hirzel, Stock Clerk.
- A. W. Zahm, Salesman.
- C. B. Tarbell, Shipping Clerk.
- Chas. Jones, Packer.
- P. N. Hilgard, Packer.
- E. P. Wagner, Packer.
- Harry Ellems, Elevator Boy.
- M. Gibbons, Teamster and Team.
- C. B. Barteau, Stenographer.
- A. Lang, Stenographer.

An electrical novelty has been placed on the German imperial yacht Hohenzollern in the shape of a standard intended for night use. The flag is four meters square, and the design is traced in colored electric lamps.

UNIPOLAR INDUCTION.[*]

BY REGIERUNGSRATH DR. C. L. WEBER.

An article by Prof. Arnold on alternating-current machines with stationary winding[†] is prefaced by some remarks on unipolar induction. The latter subject has also recently been elaborately treated by Prof. Lecher, of Innsbrück.[‡]

While Lecher, on the basis of experiments extending over many years, claims to have come to a definite conclusion as to the explanation of the phenomenon in question, Arnold admits that the majority of the appearances can be explained by the specific reciprocal results, but finally declares for those which Lecher does not deem to be trustworthy. For this reason a short consideration of the subject may be justifiable, for it must be puzzling to anyone who is not perfectly acquainted with the details of the question when, regarding a matter which crops up daily in practical work, two views of so fundamentally opposite a character are maintained.

The question is as follows: A cylindrical magnet revolves on its geometrically coincident magnetic axis. Will the lines of force of the magnet rotate with it, or does the magnetic field stand still? The above mentioned article by Lecher is without doubt the most careful and most elaborate investigation of the subject of unipolar induction which has been published in the last 10 years. As they cannot again be recorded here, it may be mentioned that Lecher repeated nearly all the experiments hitherto made bearing upon the question and critically examined them, finding thereby that in the case of all previous investigations the observations could be explained by both the one and the other theory.

Finally, the following experiments, which are to be considered as conclusive, were devised and carried out by him. A magnet excited by a fixed coil is divided into two parts, I and II (Fig. 1), which can individually be rotated on the axes, S N, S' N'. Corresponding axle shafts are arranged at N S, N' S'. At the same points, and also at *b* and *d*, are the sliding contacts, *a*, *b*, *c*, *d*, *e*, which can be connected with a galvanometer, G. The direction of the lines of force has to be conceived in the manner indicated. As is known, there flows, if both parts rotate together along a path, *a* G *b* or *a* G *c*, a current which, in the acceptation of a revolving field, can be imagined as having originated in the fixed galvanometer leads; in the supposition of a fixed field, in the rotating mantel surfaces and in the radial parts of the iron core. The following outcome of an experiment can also possibly be explained by both views. Only magnet II revolves, the galvanometer being first at *c d*, next at *d e*. The issue in both cases is the same. It can here be taken with Faraday that in both instances the same amount of induction takes place in the actual conducting parts of the magnet on the fixed field being cut, as, according to the other view, that the total of the E. M. F. induced in the two fixed circuits in both cases is the same.

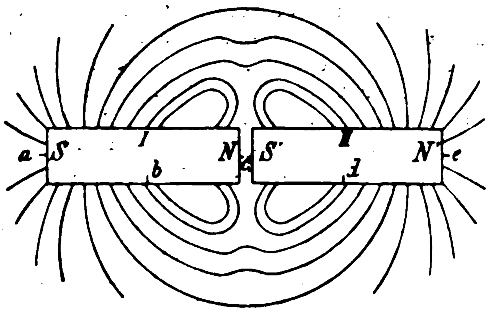

FIG. 1.

The course of the lines of force certainly causes the latter explanation to be considered with doubt, but the determination of this course is generally of an uncertain nature.

On the other hand, the observations about to be described cannot be brought into consonance with the theory of rotating lines of force. If Lecher altered the last mentioned experiment, so that not only magnet II, but also magnet I revolved, either in the same direction as, or in the reverse direction to, II, the galvanometric results were the same as if I were stationary. According to Faraday, this is immediately clear, since the magnetic field remains continually at rest and the actuated conductors connected with the galvanometer only belong to magnet II. The contrary happens if the lines of force revolve with the magnet; for then, if I be set in motion, an influence of the galvanometer circuit, *c* G *d*, is perceptible, as the lines of force emanating from and actuated with I reach into the circuit *c* G *d*.

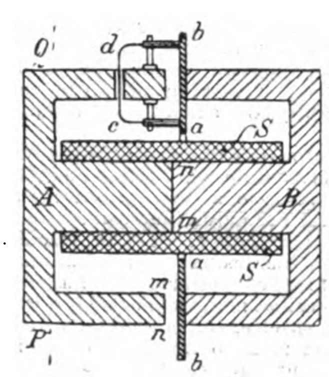

FIG. 2.

Clearer is the following experiment: If *b c* is at the galvanometer, and I rotates while II is stationary, exactly the same current is obtained if *b d* is at the galvanometer and I again rotates, II being stationary. If, however, both magnets are revolved in opposite directions, double the amount of current is the result.

Finally, Lecher connected the sliding contacts *a* and *e* with the galvanometer, so that the wires formed the extension of the magnetic axis. If now, I rotates alone, a current of 33 is obtained; if II rotates alone, and in the contrary direction, the same result is attained; if both magnets are simultaneously revolved in the opposite direction the total of the two previous currents is the result.

Arnold has a new but impossible theory. He says: "It must be considered, if only the one magnet revolves, that then its lines of force rotate at only half-speed, and that generally the speed of the angle of the magnetic field does not correspond with that of the revolving iron mass, but that the rate of both is dependent upon the ratio of the actuated to the total iron mass."

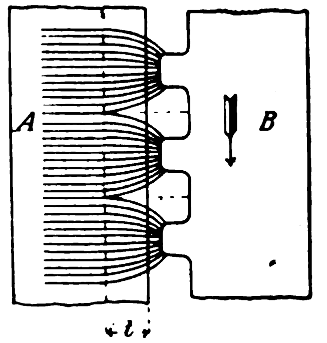

FIG. 3.

If it be sought to follow this idea it will be necessary, in the first place, to at least look upon the lines of force flowing within the iron as bound to the iron and revolving at the same speed. Then, however, a variation of speed must occur at the point of exit, and therefore a tearing off of each line of force and a sliding away of its termination at the magnet surface. Likewise must then at the place of entry in the stationary or opposite rotating part of the magnet a similar inconstant point in the lines of force with the half angle speed glide over the surface of the iron. The lines of force in the various parts of the course must exhibit a triple phase: (1) within the iron they have the same speed as this; (2) outside of it they show the half, or generally another speed; (3) at the points of transition a sudden change in the speed occurs.

The idea of a stationary field with rotating iron core has nothing overstrained in it. The lines of force are comparable to a condition of the ether, which is influenced by the properties of the surrounding matter. If, however, neither the magnetic excitation nor the exciting capacity of the material alters in a given direction from point to point, so will also the condition of the ether remain unchanged. A ground for a rotation of the field of force does not therefore exist with the rotation of a magnetic body whose geometric, magnetic, and rotation axes coincide.

If we take two bell-shaped iron cores which are excited by a common coil and can rotate independently of each other, something as in alternating-current machines, we find that between the two outer mantel surfaces gaps remain which can take up induced coils (Fig. 2). So long as the dividing surfaces run continuously throughout, the above considerations find application without further difficulty, and lead to the representation of a fixed magnetic field, by which, in simultaneously rotating parts of conductors (as, for example, in the disk *a b*), radial currents are induced; but if the dividing surfaces—in the first place on one side only—are not continuous (Fig. 3), the idea of the simultaneously rotating lines of force, shown as incorrect, again obtrudes itself. A little consideration, however, manifests that this theory is here quite unnecessary and liable to lead to error. This is best recognized by passing over to the next drawing, Fig. 4, where both surfaces are furnished with teeth. A is rotating and B is stationary; you fix an individual tooth in your eye and conceive that it on the rotation of position 1 pushes forward into position 2.

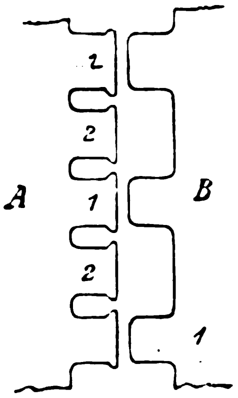

FIG. 4.

If here the lines of force rotate with the iron mass equally as many lines of force should pass through this one tooth in position 1 as if it after a short time had reached 2. This will in reality in nowise be the case; we are rather shown that the tooth in question in position 2, on account of the large air-gap, carries considerably fewer lines of force. The induction consequently which a coil placed on the tooth experiences proceeds here not from a rotation of the lines of force in the direction of the field, but from a fluctuation of the flow of force parallel to the rotating axis. The majority of the lines of force produced will now take their way through the one tooth, now through the other, accordingly as the one or the other path offers at the moment the least amount of resistance. The theory that here the lines of force should rotate at half-speed is obviously upon this hypothesis not feasible.

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[*] "Elektrotechnische Zeitschrift," August 15, 1895.

[†] "Elektrotechnische Zeitschrift," March 7, 1895.

[‡] "Sitzungsberichte" der kaiserlichen Akademie der Wissenschaften zu Wien (Abtheilung II., Band 103, Heft 8, S. 949-980).

For the estimation of the eddy currents set up, and of the magnetization energy, and for the selection and arrangement of the means to be used for the avoidance of these losses, it is a point of great importance whether in machines of the last-named form a side by-pass of the lines of force or a deviation in the direction of the rotating axis is presupposed. If you, in the last-mentioned case, look upon the actuated part somewhat as the field magnet of an alternating-current machine, the fluctuations mentioned will pass for armature reaction.

COMMUNICATION.

THE BERLINER PATENTS.

To the Editor of ELECTRICITY.

Referring to your recent editorial under the caption of "The French Berliner Patents," I would like to ask—1st. Upon what ground is the foundation for saying that the Berliner patent is a generic patent? 2d. What effect does Berliner's disclaimer in the following words, "Neither do I claim that I am the first who caused such electrical undulations by varying the resistance of an electrical circuit in which a current was passing," have upon the extent of his claims? 3d. If Berliner was not the first inventor to produce electrical undulations similar in form to sound waves by varying the resistance of the circuit, who was? 4th. What kind of a microphone does Bell's fourth claim of his 1876 patent refer to? 5th. Why is not Bell's microphone as claimed in his March 7, 1876, patent ever mentioned by the papers? 6th. To what does Bell refer in the following: "I have heretofore described and exhibited such other means of transmitting sound, as will be seen by reference to the proceedings of the American Academy of Arts and Sciences, Volume XII"?

A. B. STROWGER.

Chicago, Ill., Sept. 2, 1895

Answering the above questions *seriatim*, we would say—

1. That the Berliner patent is from the broadest view only a sub-genus patent—an offshoot from the original Bell patent, which covered the art of transmitting articulate speech by means of undulatory currents. In the fundamental patent *any* means of producing electrical undulations corresponding to sound waves was covered. The Berliner patent, covering one general method of producing these electrical undulations, was of course subordinate to this fundamental patent. Had any one patented a method of producing these undulations by the broad claim of *varying the resistance* of an electrical circuit so that this resistance should vary in a manner to produce electrical undulations similar in form to sound waves, that patent would be a species patent as related to the Bell patent and a genus patent as related to the Berliner. The latter, however, limits himself to a particular method of varying this resistance, viz., by causing the sound waves to *vary the pressure* between *electrodes in constant contact.* So far as we know, the patent of 1891, filed June 4, 1877, was the first to describe this particular method of varying the resistance. Evidently there may be a thousand specific ways of doing this, and to all of these the Berliner method stands in the relation of genus to species. It will thus be seen that the terms *genus* and *species* have no absolute meaning, but merely a relative one and that it is in this sense that we use the term.

2. Berliner's disclaimer, "Neither do I claim that I am the first who caused such electrical undulations by varying the resistance of an electric circuit in which a current was passing," is an acknowledgment by him that a genus method of which his was relatively but a species had existed before his invention. It is a disavowal on his part that he claimed the *broader* method of varying the resistance. He evidently knew that he could not patent this broader method, and in order that there might be no question as to his claims, he disavowed that which he did not claim. It is our idea that the Berliner method covered by patent No. 463 569 bears very much the same relation to that which is disclaimed as the latter bears to the original Bell method or as the carbon transmitter bears to the Berliner.

3. Berliner by his disclaimer admits that he was *not* the first one to produce electrical undulations similar in form to sound waves *by varying the resistance* of the circuit. We are under the impression that a number of others produced these undulations by varying the resistance before Berliner did, and among these were Bell himself and Prof. Elisha Gray, who used liquids in which the variation of resistance was caused by a varying depth of immersion of one of the electrodes or by varying the distance between two electrodes connected by a poor conductor of electricity.

4. Bell's fourth claim in the patent of March 7, 1876, reads as follows: "The method of producing undulations in a continuous voltaic circuit by gradually increasing and diminishing the resistance of the circuit, or by gradually increasing and diminishing the power of the battery." This very distinctly describes a genus method to which Berliner's is a species, and is evidently exactly what Berliner referred to in his disclaimer. If our correspondent had read the patent carefully he would have seen that Bell did not contemplate the specific method patented by Berliner, but intended to cover *all* methods of producing undulatory currents by varying the resistance of the circuit. In his descriptive remarks he mentions the dipping of the electrodes in mercury.

5. We cannot speak for the other papers, but speaking for ourselves would say, that we have never mentioned this form of transmitter in connection with the Berliner litigation because we never dreamed that it had the remotest bearing upon the validity of Berliner's patent.

6. Bell's references are too numerous for mention here, but we find none that we think could be used to invalidate the Berliner patent. To most of these references the Berliner bears the relation of species or sub-genus to genus, and therefore so long as the original genus patents were in force the Berliner patent was subordinate to them.

London Notes.

(From our London Correspondent.)

ACCUMULATOR TRACTION.

It is pretty certain that another line of electric tramways propelled by accumulator power will not be constructed in England for many a day. The extravagance of such a system is exemplified by a section of the Birmingham Central Tramways which has been running with most unsatisfactory results for some years. The company has divided its system into four departments, viz., horse, steam, cable and electric. The steam and cable departments are stated to be progressive and very profitable but the other two are a continued source of anxiety and difficulty to the management.

Over the electric section during the past year fewer passengers were carried than formerly, fewer miles were covered, and consequently the receipts were decreased. This accumulator line has resulted in a loss during the period of £1,735 odd. The directors blame the batteries, but given a perfectly satisfactory accumulator which will be very economical (if such were procurable), it would take a long time to remove the effects of past erratic management. However, in any case, an extensive system of accumulator traction on tramways is a thing of the past or the future, not of the present. The following figures of the costs on the Birmingham line go to prove that:

Steam	Traction	per	working	mile,	9.11d.
Horse	"	"	"	"	8.67d.
Cable	"	"	"	"	5.43d.
Electric	"	"	"	"	18.43d.

A MOUNTAIN ELECTRIC RAILROAD ON THE ISLE OF MAN.

The Isle of Man possesses some of the most beautiful if not the best specimens of British scenery. Its exquisite views are a thrilling attraction to tourists and visitors from all parts. The inhabitants, as might naturally be expected, have ever been alive to the necessity of making their various towns as attractive as possible to holiday makers, and perhaps their anxiety in this direction is primarily responsible for the erection of an electric tramway there last year from Douglas to Laxey, the length being about seven miles.

The promoters of that line and the inhabitants of the districts through which the tramway runs have every reason to be satisfied with the success of their undertaking; this success was evident in the early stages, for hardly had the cars commenced running when an extension for several miles was proposed.

That proposal was that the line be taken from Laxey a further distance of about 4¾ miles, terminating at the summit of the mountain Snaefell. The extension, which was taken up very enthusiastically by everyone interested, is now an accomplished fact, and the line was finally inspected by the Board of Trade officials who made a trial run on August 16th. Public traffic commenced on August 2 st.

The erection of the railway involved a great deal of heavy engineering work, which has been very costly, for the line at certain stages has had to be cut through the rocks and at others passed over high banks supported by massive retaining walls. The ground is rocky and precipitous. An item of interest is that after a distance of 3 miles from Laxey has been covered, the line begins to wind round and makes a complete circuit of the mountain (in 1¾ miles) and terminates.

The whole plant for working the line has been manufactured by Messrs. Mather & Platt, Limited, of Manchester. It includes four Lancashire boilers 26 ft. long by 6 ft. 6 in. diameter, capable of giving 700 H. P.; five horizontal compound engines of over 100 H. P. each, driving Mather & Platt dynamos, each of the latter supplying current at 500 volts. The dynamos have "Edison-Hopkinson" magnets and "Manchester" armatures. The power station where this plant is situated is about 2¾ miles from the Laxey terminus. The plant is of sufficient capacity to propel at least three fully loaded cars at the same time upon the ascending line at 8½ miles per hour.

The accumulator station is at the Laxey end of the line and is equipped with an installation of 240 chloride cells of the following capacities: 140 amperes for three hours, 80 amperes for six hours, 63 amperes for 9 hours, or 56 amperes for 12 hours. The accumulators absorb the spare current generated by the dynamos and distribute it to the line as the load requires. Messrs. Mather & Platt first introduced this method on the Douglas and Laxey section, where it proved a great success, contributing very materially to the economical and regular working of the line. The same firm has also adopted the same system on the Stockholm and Djarsholm electric railway.

The passenger cars, which are 35 feet in length and will seat 48 passengers, are each carried on two four-wheeled bogies. Each axle is driven by a Mather & Platt No. 5a "Manchester" motor. Every possible precaution has been taken to prevent the cars leaving the rails. It would be quite impossible for the flanges of the carrying wheels to mount the bearing rail whilst the guide wheels are in play. A powerful center rail brake is fitted to each car, the action of which is to grip the center rail itself, while each wheel has the ordinary brake fitted. The cars can be stopped within a few seconds. Each driver's cabin is provided with emergency switches and ammeters, with suitable resistances for regulating speed, etc.

General News.

What is Going on in the Electrical World.

San Leandro, Cal.—The town trustees are considering plans for an electric light and power plant to be owned by the town.

Richmond, Va—The ordinance granting the Broad street franchise to the Richmond Traction Company has been signed by Mayor Taylor.

Selma, Ala.—There seems to be a probability of the Chicago Incandescent Light Company removing its plant from Chicago to this city.

Parkersburg, W. Va.—The electric light plant on Avery street was damaged by fire on the night of the 28th ult. to the extent of $8,000.

Greenville, Ala.—A Greenville man has offered to donate the ground for a building for an electric light plant, and to furnish the fuel free of charge.

Springfield, Mass.—A company is being formed here for the purpose of manufacturing the Duryea motor wagon. The board of trade is backing the movement.

Williamsport, Pa.—The Beacon Electric Company has notified the city controller that its contract with this city for lighting has been assigned to the Lycoming Electric Company.

Ann Arbor, Mich.—The city council has accepted the bid of the Michigan Electric Company of Detroit for lighting this city during the five years beginning January 1st next.

Bordentown, N. J.—An ordinance authorizing the Bordentown Electric Light and Motor Company to construct and operate works has passed its first reading in the city council.

Clarksville, Tenn.—Books have been opened for subscriptions to the stock of the company to build an electric railway system in this city. The cost of the plant proper has been placed at $40,000.

Shelburne Falls, Mass.—A canvass is being made here to ascertain how much support citizens would give if a local company were formed to furnish electric lights for public and private use.

Buffalo, N. Y.—The Niagara Falls Power Company has refused to accept the franchise granted by the council of Buffalo, because of objectionable clauses relating to poles, conduits, taxes, length of grant, etc.

Troy, N. Y.—The Sandlake electric road is expected to be ready for the running of cars in a few days. The generators for the power house have been shipped from the Westinghouse works at East Pittsburg, Pa.

Washington, D. C—The final survey for the line of the new electric railway between Washington and Laurel has been made through Riverdale, and the contract for grading the road will be soon given out.

Newark, N. J.—The Livgro Incandescent Lamp Company has sold out its entire plant at Harrison to the United Electric Company of Philadelphia. The company had only a few hands employed.

Detroit, Mich.—The Citizens' Company has made application for a permit to remodel the Brush and Russell street car line into an electric line. The permit will be issued as soon as the material is on the ground.

Orchard Lake, Mich.—Col. J. Sumner Rogers, of Michigan Military Academy, Orange Lake, and others have secured the necessary franchises and right of way for an electric railway connecting Orchard Lake with lines in Detroit.

Albany, N. Y.—There is considerable agitation in Albany over the lighting contract prepared for the council's action, and decided opposition to the clause making it obligatory on the contractors to use the "Brush" system.

Charlottetown, P. E. I.—The Royal Electric Company of Montreal have contracted with the city council to supply Charlottetown with 65 arc lights of 1200 candle-power each for $73 per lamp per annum. The company also agree to allow the corporation 50 cents per night when the lights are out.

Owego, N. Y.—At a meeting held here recently to consider the project of building an electric road from this city to Speedsville, a committee was appointed to confer with some New York capitalists who are willing to invest in the scheme. Geo. F. Andrews is chairman of the committee.

Northport, L. I.—During the seven months in which the electric light plant has been in operation in Northport 3,000 lamps have been succeeded by electric lights. Before the company is one year old one of the present 500-light dynamos will be taken out and a 1,000 light dynamo put in its place.

Beverly, Mass.—It is said that the Lynn and Boston company who purchased the Beverly and Danvers street railway some time ago will equip it with the trolley system at once. The road has not been in operation for several years, having been run by the storage battery system, which was afterward abandoned.

Summit, N. J.—The Mountain Electric Light Company, which was incorporated two weeks ago by Carrol Ph. Bassett, Adolph Wagner and Frederick E. Green, with a capital of $100,000, has filed a bond of $5,000 with the township committee for the performance of the contract for lighting the streets of Summit.

New York.—The Metropolitan Traction Company, according to the latest reports, have decided to do away with horses on all their lines and install electricity in their stead. The company intend also to establish popular amusement resorts in the vicinity of the city which can be reached speedily by the electric cars.

Anderson, Ind.—A $500,000 blaze took place in this city a few days ago. It was not much of a blaze, being simply the burning of the bonds of the Marion Street Railway Company which have been redeemed. The company will be reorganized and will take the present plant out and put in a double track and improved electric service.

Palouse, Wash.—Local business men are making arrangements to put in a 600-lamp electric light plant, to be operated by water power. They have secured an option on the dynamos of the old plant and are now completing negotiations for the power. The plant will be located in the Palouse roller mill and operated by the surplus power of this mill.

Cleveland, O.—South Brooklyn citizens have presented a petition to the county commissioners requesting them to grant a franchise to the Wadsworth Electric Railway Company. The route mentioned is from South Brooklyn to Royalton, a distance of thirty-five miles. The proposed line will connect with the South Brooklyn end of the Big Consolidated.

Meridian, Miss.—The mayor and board of aldermen have accepted the proposition of Col. F. B. Merrill, representative of a New York corporation, to construct an electric light plant and light the streets of the city and maintain an electric street railway. An ordinance embodying the requirements of the city in reference to the franchise will be drawn up.

San Francisco, Cal.—James B. Stetson, of this city, has gone to the East to investigate the working of a recent invention—said to be an electric locomotive—that has not had practical work as yet. If he is satisfied of its superiority, electric locomotives may ere long be seen in operation on the Sansalito and San Rafael branch of the North Pacific Coast Railway.

Pittsburg, Pa.—The *Times* states that an agreement has been signed by the directors of the Birmingham Traction Company and the Knoxville, Fairhaven and Mt. Lebanon Railway Company, by which the latter company will construct, at a cost of $150,000, a double track electric road from Knoxville to Castle Shannon, a distance of five miles, and the Birmingham company will operate it.

Kansas City, Kan.—The appraisers appointed to place a value upon the property of the Argentine Electric Light and Water Company have made their report, fixing the value at $60,000. E. A. Wagener, the master in chancery in whose hands the property now rests, will sell it to the highest bidder at the court house in this city on October 3. The sale is under a first mortgage for $160 000 held by the Farmers' Loan and Trust Company of New York.

Nevada, Mo.—Col. Dudley having secured the franchise for lighting, etc., in Nevada, has organized his company and applied for a charter. The name of the company is the Nevada Electric Railway, Light and Power Company, and the incorporators are: George Dudley, Judge Mills, Judge Selden Spencer, F. T. Allison, Dr. T. F. Prewitt, all of St. Louis, besides several Missouri Pacific and Missouri, Kansas and Texas officials, also C. F. Strohm and Col. Moore, of Nevada.

Brooklyn, N. Y.—The contract for lighting the Ocean Parkway has been awarded to the Flatbush Electric Light Company at 28 cents per lamp per night. Ninety arc lamps will be required.—The Brooklyn Electrical Society held its third annual election on the evening of the 3d inst. The newly elected officers are: President, William Clinton Burling; vice president, R. M. Dickinson; corresponding secretary, Arthur A. Fisk; recording secretary, J. H. Russell; treasurer, Thomas A. Bamford; members of the board of governors: M. R. Rodrigues and W. H. Kirwin.

Philadelphia, Pa.—The charter of the Union Traction Company has been revised so as to substitute $100,000 for $30,000,000. The attorneys for the company made application over a month ago for the charter at a capital of $30,000,000, but Attorney General McCormick was of the opinion that the charter should be granted with a lower capital and afterward increased, as the law states that corporations "may increase their capital to $30,000,000." In order to come within this technical interpretation of the law the attorneys for the company agreed to make the change. The Union Traction Company is the new corporation formed from the combination of the Philadelphia, People's and Electric Traction companies.

The Tesla Patents.

The Westinghouse Electric and Manufacturing Company have issued the following circular letter to central station men:

Dear Sirs: In view of the great prominence given to the multiphase motors covered by the patents of Mr. Nikola Tesla, we think it right to direct your attention to the fact that this company claims the exclusive right to manufacture and sell all forms of motors operated by currents of two, three or more phases, and all forms of single phase motors where a second phase is induced so as to make the same a two phase induction motor—notably the form used for the operation of fans. Suits are now pending against the Thomson-Houston Electric Company (the General Electric Company), the Stanley Manufacturing Company of Pittsfield, Mass.; and numerous suits have been entered against the users of apparatus purchased from the above companies; it being the intention of this company to enforce its exclusive right to manufacture and sell multiphase generators and motors, the two being used in combination as a system, and such system being covered by the patents of Nikola Tesla above referred to. In the first-named suits, the General Electric Company has put in its defence, and the Court has limited it to October 7, 1895, in which to complete its testimony, so that a hearing may be had in the latter part of this year or the beginning of 1896. We are advised that the defence has been unable to produce a single working device that can in any way take from Mr. Tesla the pioneer character of his inventions.

We have been informed that the two companies named have offered to guarantee the purchaser of infringing apparatus against damage or loss, but you can well appreciate that it will be impossible for such companies to make good their guarantees to cover all losses if the courts enjoin the use of apparatus made in imitation of that covered by Tesla's patents.

We are prepared to furnish multiphase generators and motors for all classes of work, and being the owners of the patents, no contingency can arise by which the purchasers of such apparatus made by us can in any way be interfered with in its continued commercial use.

It is the opinion of those who have given the subject most careful attention that in the near future a very large proportion of electric work will be done by the multiphase system, and this together with the fact that in the main we believe men would prefer to purchase property from its rightful owners, has led us to write to you and give you an opportunity to place your orders with this company for such multiphase apparatus as you may desire to use, and thus avoid the risks incident to the purchase of apparatus from unlawful manufacturers.

The adoption by the General Electric Company of the term "Monocyclic" in connection with their use of multiphase apparatus does not free them from the charge of infringement, but on the contrary makes the case against them stronger, because of the sale of apparatus under misleading terms.

In conclusion, we wish to call your attention to the fact that with our system incandescent lights, arc lamps and alternating motors can be operated from the same circuits, and that it will be of especial advantage to companies desiring to remodel or to increase their plants to make a full and careful investigation of the Tesla apparatus as installed in our works at East Pittsburg, and you are invited to come or send a representative, to whom every facility will be given for careful inspection. Yours truly,

Westinghouse Electric and Mfg. Co.

THE WARREN ALTERNATOR.

The Aim: In the construction of the Warren Alternate Current Generator the aim has been the embodiment in the simplest possible form of construction of all the most advanced ideas in the generation of the electric current, for use wherever and however it may be required.

The Idea: The fundamental idea has been a machine of perfect electrical and mechanical balance, of highest possible efficiency and regulation, and withal, a machine that will not burn out or require costly repairs; a machine which, aside from a due regard to lubrication, may be put into the most severe service and left to run perpetually without attention of any sort; a dynamo of slow speed and low frequency, which meets all the conditions of the best of the well-known types of alternators, but from which all hazard is eliminated; a machine built to earn money with instead of spending money upon.

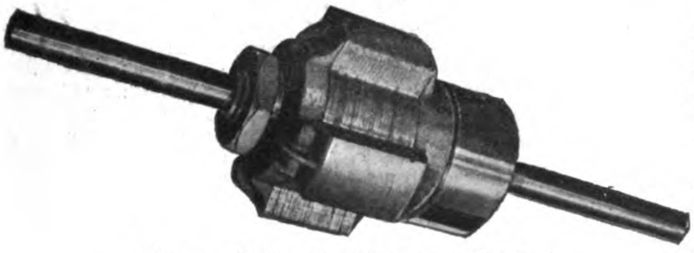

FIG. 1.—ROTATING MAGNETIC CORE.

The Design: In designing the Warren Alternator, the great consideration being simplicity and durability, the so-called inductor type of machine has been adopted. In working out the new design founded on this principle marvellous results have been attained—exceptionally close regulation and high efficiency (only one-half of one per cent. of K. W. capacity for excitation), smooth and noiseless running, no heating of any part, consequently no waste of energy.

Multivoltage: Its construction is such as to permit of various ways of connecting for different voltages without in any manner changing the machine or requiring new coils. It may be connected for a 110 or 220 volt system, and used without transformers for short distances, or for 1,000 or 2,000 volts to be used with transformers for long distance transmission; or it may be connected to operate a 110 volt circuit and a 1,000 volt circuit both at the same time.

Arc Lamp Service: Its low frequency (7,200 per minute) adapts it to operate arc lamps to greatest advantage and with perfect freedom from the hissing and humming noise at the lamp, so noticeable from alternating currents of the usual high frequency.

Simplicity: It is a dynamo, without collector rings or commutator, without brushes, without moving wires, without liability to burn out. Built wholly of steel in all its magnetic parts, it is massive and heavy but extremely compact; made for continuous runs without attention, and proportioned to run up to an enormous overload without wasting energy in heating any part.

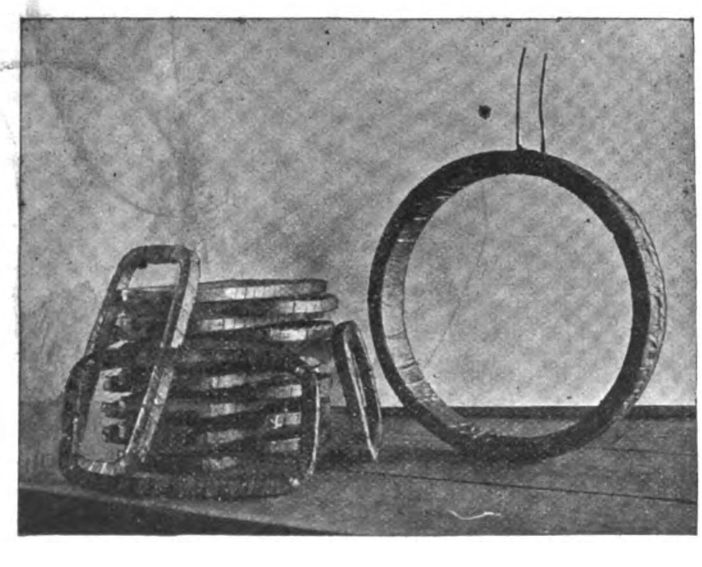

FIG. 2.—ARMATURE COILS AND EXCITING COIL.

Insurance Against Burn-Outs: The manufacturers will insure it against burn-outs (other than lightning discharges) for one-half of one per cent. on the purchase price per annum.

Armature Stationary: The armature coils being attached to the stationary removable laminated ring, which fits accurately into the bell-shaped steel frame, and exciting coil being attached to the steel frame; none of the coils being attached to any movable part it is clear that no brush or sliding contact is required.

The Rotating Magnetic Core: The revolving part consists of a cast steel cylinder, on which are pressed laminæ that form the rotary poles; thus constructed the revolving portion of the machine is simply a solid mass of steel, through the polar projections of which the magnetic flux is delivered to the opposite poles of the laminated annulus to which the coils are attached. In other words, the rotor is simply the core of a magnetic field—the rotating flux path. It is made to fill the opening in the closed end of the frame shell so closely, and the polar projections move so extremely close to the poles of the annulus, as to diminish the air-gap reluctance to the most inconceivably small fraction, as shown by the fact that less than one-half of one per cent. of the K. W. capacity of the machine is required for excitation.

The Coils: The armature coils as shown in Fig 2, are wound on forms; are small, and being attached to the stationary removable ring are easily replaced in case of an injury from a lightning discharge or accident. The cost of these coils is quite insignificant, only about $8 each. The large coil, shown in the cut, is the exciting coil, there being but one, and it also being stationary the extreme simplicity of the electrical features of the machine is apparent.

The Ensemble: The whole being composed of laminated parts and cast-steel, correctly proportioned, no heating is developed, even when running greatly overloaded. This has been fully proven by severe tests witnessed by many impartial engineers.

Mechanical: The mechanical features of the Warren Alternator have had most careful consideration. The exceptionally long self-aligning and self-oiling bearings carrying a forged steel shaft of great diameter permits running the rotor at the least possible clearance from the stationary parts, thereby reducing the reluctance due to the air-gap to the merest fraction.

The 40 and 60 K. W. machines will be built, as shown in the accompanying illustrations, frame cast of steel in one piece, making the most compact and durable form of construction known. In larger sizes the upper half will be cast separate and bolted to the lower half in the usual manner.

Appearance: No attempt is made at ornamentation for the purpose of handsome effect. Everything possible has been done for reliability, durability, ease of management and efficiency. Everything to avoid burn-outs, repairs and excessive cost of operation. The machine is, however, pleasing in appearance and impresses a thoughtful person with its solidity, simplicity and adaptation to the most severe and exacting service.

Why? The designer of this machine, Mr. C. C. Warren and Mr. H. B. Warren, having been pioneers in the practical every-day features of the electrical business, were long since made painfully aware of the limitations of alternators of the past, with their delicate and costly parts, the revolving wire covered armatures, their collector rings and brushes, and arbitrary single voltage service, set out to design a machine better adapted to earn money with, and less so for the purchaser to spend money upon for repairs, etc.

Frequency: The standard frequency will be seventy-two hundred alternations per minute at rated speed, but will be built for any frequency or speed desired.

Uniqueness: Its unique construction is such as to make it especially adapted to connecting direct to any engine for any speed.

A Siemens & Halske Steam Locomotive.

The first locomotive built by the Siemens & Halske Electric Company has just been completed. As is well known, that company purchased the plant of the Grant Locomotive Works at Chicago after the failure of the latter company, and the engine referred to is one of fifty five ordered from the Grant Company by the Chicago, Burlington and Quincy. Twenty of these locomotives will be built. The original design has been adhered to, and the locomotive is a ten-wheeler, adapted to either freight or passenger service.

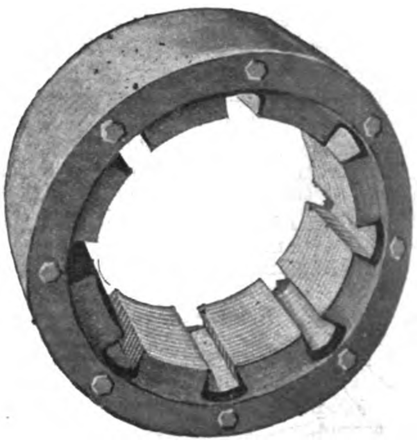

FIG. 3.—STATIONARY, REMOVABLE LAMINATED ARMATURE RING, WARREN ALTERNATOR.

Needs More Room.

Constantly increasing business has compelled the Standard Electric Company, Chicago, to contemplate the removal of its plant to some point near the city where more room can be secured for manufacturing purposes. Desplaines, Kankakee and other cities are making efforts to secure the location of the new plant. The first-named city has offered a bonus of $65,000 for the removal of the plant to that place.

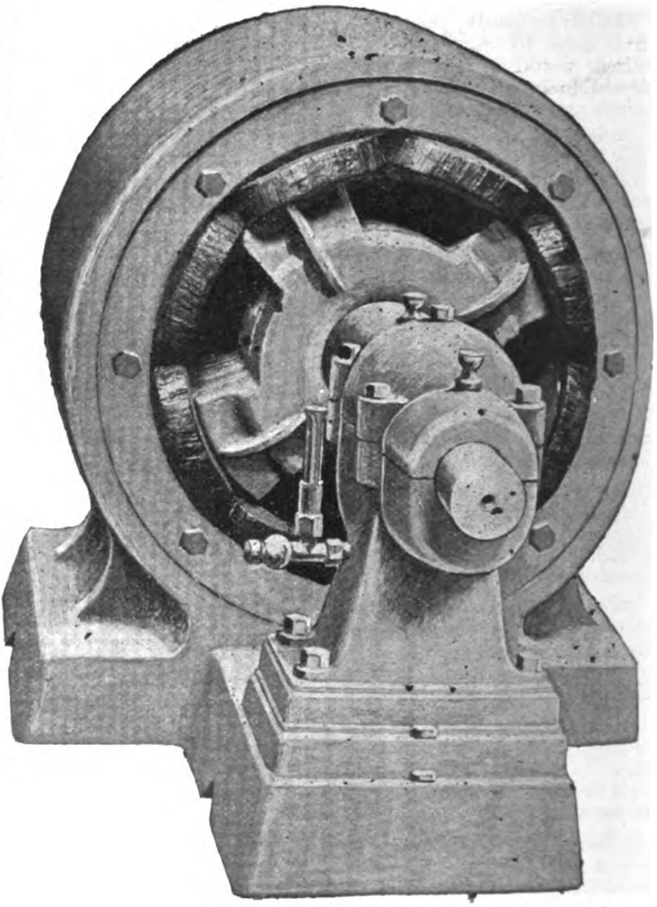

FIG. 4.—OPEN END SHOWING COILS AND ROTATING MAGNETIC CORE, WARREN ALTERNATOR.

The Card Company's Products.

The products of the Card Electric Company, Mansfield, Ohio, comprise generators and motors for any and all purposes to which electrical power may be applied. Multipolar slow-speed generators for power transmission or isolated lighting, multipolar slow speed stationary motors, reversible motors and controllers for rolling mills, bridges and traveling cranes, are among the forms of apparatus now manufactured by this company.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

SEPTEMBER, 1895.

Date.	Light.	Date.	Exting.
1	12.40 A. M.	1	4.30 A. M.
2	1.40 "	2	4.30 "
3	2.30 "	3	4.30 "
4	No light.	4	No light.
5	"	5	"
6	"	6	"
7	6.50 P. M.	7	8.40 P. M.
8	6.50 "	8	9.20 "
9	6.50 "	9	9.40 "
10	6.50 "	10	10.20 "
11	6.50 "	11	11.00 "
12	6.50 "	12	12.00 "
13	6.40 "	14	1.00 A. M.
14	6.40 "	15	1.10 "
15	6.40 "	16	2.20 "
16	6.40 "	17	3.40 "
17	6.30 "	18	4.50 "
18	6.30 "	19	4.50 "
19	6.30 "	20	4.50 "
20	6.30 "	21	4.50 "
21	6.30 "	22	4.50 "
22	6.30 "	23	4.50 "
23	6.30 "	24	4.50 "
24	8.00 "	25	5.00 "
25	9.10 "	26	5.00 "
26	10.30 "	27	5.00 "
27	11.00 "	28	5.00 "
28	11.30 "	29	5.00 "
29	...... "	..	....
30	12.40 A. M.	30	5.00 "

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Alexandria Bay, N. Y.—The Thousand Island Club will erect a club house on Welcome Island, near Alexander Bay, this fall, at a cost of $100,000; the plans and specifications are now being prepared.

Atlantic Highlands, N. J.—A project is reported to be in progress for the erection of a hotel to accommodate 1,500 persons and cost about $1,000,000 at Chelsea Beach on the site of the Seaview Excursion House.

Brockton, Mass.—At a meeting of the Palace Hall Corporation it was decided to erect a $30,000 building at once.

Brooklyn, N. Y.—E. Iverson will build a four story double apartment house on 27th st., west of 5th ave.

Buffalo, N. Y.—Architects Swan & Falkner are preparing plans for a block of flats, to be four or five stories high, and have a frontage of 79 feet, and will be built on the west side of the city....Ground will be broken shortly for a block of stores and flats to be built by the Buffalo Cement Co., Ltd., at the junction of Main st. and Parker ave.

Chicago, Ill.—Holabird & Roche have prepared plans for a residence on Grand Boulevard, for George W. Shannon; it will be equipped for steam heating electric lighting, etc....Plans are being prepared by J. W. Kenevel for a six story apartment house to be erected on Michigan ave. and 56th st., by J. R. Trenton, who will expend $175,000 on the building.

Morristown, N. J.—Jesse Eddy, of the firm of Dickson & Eddy, 29 Broadway, New York City, has purchased a building site on Normandy Heights, on which he will soon build a $40,000 house.

New Haven, Conn.—John Cox is about to erect a hotel at Savin Rock, to be four stories, and equipped with modern conveniences.

Newport, R. I.—Joseph Mayer will erect an apartment house on Spring st., which will contain a dance and concert hall.

New York City.—John C. Burne, 101 West 42d st., not F. Dinkelberg, as previously reported, has been engaged to make the plans for the mercantile building which John Kehoe, the builder, is to erect at southeast cor. of Vestry and West sts.; it will contain the latest improvements, including passenger and freight elevators, steam heating apparatus, electric wiring and fixtures, etc.....Leopold True, 352 4th ave., will build a seven story store and lofts, 23 x 125, at 150 Bleecker st.; Van Campen Taylor, 1 Union Square, is the architect....Leith & Glen have commissioned Architects Neville & Bagge, 215 West 125th st., to make plans for 8 four story dwellings on north side of 136th st., east of 7th ave....John A. Knox, cor. Marion ave. and Tappen st., will erect a four story flat on the north side of 148th st., west of Brook ave., to cost $15,000; Architect W. C. Dickerson, 534 Willis Ave....Thomas R. White will build a five story apartment hotel, southeast cor. of St. Nicholas ave. and 118th st.; it will contain the latest improvements, including elevators, steam heating, electric wiring and fixtures, etc.; Architect Julius Munckwitz, 227 West 125th st.

Niagara Falls, N. Y.—Ex-City Engineer Albert H. Porter will erect a block of six residences, cor. Walnut ave. and 7th st., which will be lighted by electricity and gas.

Philadelphia, Pa.—James J. Brannan is to build a three story pompeiian brick dwelling at southwest cor. of Broad and Moore sts....Plans are being drawn by John Flynn for a large residence and stable to be built by Henry Weekey, at Perkiomenville; cost $50,000.

Pittsburg, Pa.—The Schiller's Glucke Gesang Verein will build a $30,000 hall opposite Holy Cross Church, on Carson st.

Savannah, Ga.—Marcus Klaw, of the firm of Jefferson, Klaw & Erlanger, 25 West 30th st., New York City, theatrical agents, has been in this city, with a view of building a theatre and office buildings here; estimated cost, $300,000.

INCORPORATIONS.

The Randall-Noble Electric Company, Bridgeport, Conn.—to manufacture and sell electrical appliances, etc. Capital stock, $2,000. Promoters: Purdy M. Randall, Bridgeport; R. C. Noble, South Windsor, Conn.; F. S. Noble, Staten Island, N. Y.

The Electric Railway Construction Company, Kansas City, Mo.—to construct electric railways, etc. Promoters: Eli S. Young, Willard E. Menner, Geo. Lane, Kansas City, Mo.

The Santa Clara Valley Railway Company, San Francisco, Cal.—to purchase, build, construct and operate a railroad to be operated by steam, electricity or any other motive power; construct telephone and telegraph lines, build and operate steamboats. Capital stock, $100,000. Promoters: H. W. Goodall, Frank Piper, Alfred E. Pryor, Charles Shurtleff, San Francisco; H. P. Thayer, San Jose; R. J. R. Adan, Vallejo; Andrew Rocca, Great Western Mine.

The Pueblo Electric Street Railway Company, Pueblo Col.—to purchase and operate property of the Pueblo City Railway Company. Capital stock, $500,000. Promoters: Albert E. Pattison, Elmer E. Whitted, Anthony C. Campbell, Irving Hale, Frank B. Gibson, Denver, Col.

L. A. Chase & Company Incorporated, Portland, Me.—to manufacture and deal in electrical and mechanical apparatus and appliances. Capital stock, $50,000. Promoters: Josiah H. Drummond, Jr., W. G. Chapman, Wm. H. Hatch, Portland.

The Clinton Telephone Company, Clinton, Tenn., has received its charter. Capital stock, $2,500. President and general manager, Dr. R. K. Medaris; vice-president, D. R. Coward; secretary, S. L. Slover, and treasurer, R. A. Shiflett.

The Manhattan General Construction Company, New York City—to manufacture machinery, electrical apparatus and other goods. Capital stock, $100,000. Directors: Charles B. Hill, Benjamin A. Gould, Jr., Cortland Betts, E. H. Floyd-Jones, and N. H. Swayne, 2d, all of New York City.

The South Chicago Terminal Railway Company, Chicago—to construct and operate a railroad from a point near the Calumet River to a junction with the belt line of the Chicago, Rock Island and Pacific. Capital stock, $ 0,000. Incorporators: J. A. Ames, of Streator; J. J. Coleman, of North Greenfield, Wis., and others.

The Ætna Electric Company (incorporated in West Va.), Hartford, Conn.—to manufacture, buy and sell incandescent electric lamps and parts thereof, electric light specialties, etc. Capital stock, $50,000. Promoters: Geo. S. Miller, Henry Green, Chas. F. Reinmann, Arthur E. Howard, Hartford.

The Macomber-Grayson Company, San Francisco, Cal.—to buy, sell and operate mines, mining properties, mills, mining machinery; construct and deal in dams, ditches, flumes, electric light and power lines; manufacture and generate power, light and heat produced by electricity, water, compressed air or steam. Capital stock, $100,000. Promoters: Chas. A. Macomber, George W. Grayson, Jr., Eugene H. Gould, Edw. P. Cole, I. I. Greeley, San Francisco.

The Pneumatic Manufacturing Company, Philadelphia, Pa.—to manufacture pneumatic, electrical and mechanical appliances and apparatus. Capital stock, $30,000. Promoters: Thomas R. Brown, New York City; James J. Martin, Thomas B. Shriver, Philadelphia.

The Hatch Storage Battery Company (incorporated in West Va.), Philadelphia, Pa.—to manufacture buy and sell storage batteries, electrical supplies under patent rights, etc. Capital stock, $5,000,000. Promoters: George D. Armstrong, John W. Bethel, Lewis C. Maus Theodore Hansen, Philadelphia.

The Falls Electric Power Land Company, Niagara Falls, N. Y. Capital stock, $150,000. Directors: J. C. Morgan, Richard F. Rankine, of Niagara Falls; Commodore P. Vedder, of Ellicottville; Jerome B. Fisher, of Jamestown, and Geo. H. Johnson, of Niagara Falls, Ont.

The E. A. Briggs Company, New York City—to carry on a hardware, crockery, stove, plumbing and electrical supply business, etc. Capital stock, $15,000. Directors: George Briggs, Elbert A. Briggs, and William F. Dudley, of New York City.

The Union Construction Company, Wilmington, N. C.—to engage in electrical and mechanical construction of all kinds, including electric railroads, telegraph and telephone lines, boats, bridges, piers, mills, waterworks, etc. The articles provide for the right to do business at any place in North Carolina or in any other State of the United States, with the right to have branch offices at Baltimore, Philadelphia, New York, Boston, Mass.; Norfolk, Va.; St. Louis, Mo.; Savannah, Ga.; Charleston, S. C.; New Orleans, La.; Chicago, Ill.; San Francisco, Cal.; or any other seaport or town or city where or in the vicinity of which dredging work is done. Capital stock, $100,000, which may be increased to $1,000,000. Incorporators: J. E. Challenger, Stephen Greene, and P. R. Foley, of Philadelphia, Pa.; John D. Bellamy, Jr., of Wilmington, N. C.; and H. H. Dougherty, of Newark, N. J.

ELECTRICAL PATENT RECORD.

Letters Patent Issued September 3, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

545,520. Trolley-Guard. James T. Moody, William Shawd, and Adam J. Baker, Springfield, Ohio. Filed Feb. 23, 1895.

545,649. Trolley-Arrester. Henry F. Hildebrandt, Rochester, N. Y., assignor of one-half to Martin C. Rutherford, same place. Filed May 6, 1895.

545,686. Trolley. Zachry T. Furbish, Augusta, Me. Filed July 12, 1895.

545,806. Trolley-Wire Support. John W. Meaker, Evanston, Ill. Filed Nov. 17, 1894.

545,833. Bond for Electric Railways. Elonzo S. Wheeler, Saugatuck, Conn., assignor of one-half to Clarence L. Wheeler, Marion Ind. Filed Jan. 14, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

545,485. Adjustable Support for Electric or Other Lamps. Louis Goddu, Winchester, assignor to James W. Brooks, Petersham, and Frank F. Stanley, Swampscott, Mass., trustees. Filed March 30, 1894.

545,694. Electric-Arc Lamp. Rudolf H. Jahr, Opladen, Germany. Filed Nov. 26, 1894.

545,736. Electric-Arc Lamp. Rudolph Segerdahl, Chicago, Ill. Filed April 26, 1894.

54 ,7 5. Carbon-Holder for Electric-Arc Lamps. Thomas E. Adams, Cleveland, Ohio. Filed Feb. 15, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

545,524. Electric Motor. John O'Neil, New York, N. Y. Filed June 22, 1894.

545,551. Alternating-Current Generator or Motor. Elihu Thomson, Swampscott, Mass. Filed Sept. 29, 1891.

545,569. Electric Tool and Machine. Henry H. Bliss, Washington, D. C., assignor to Joseph A. Jeffrey, Columbus, Ohio. Filed Dec 24, 188 .

545,570. Electric Coal or Rock Drill. Henry H. Bliss, Washington, D. C., assignor to Joseph A. Jeffrey, Columbus, Ohio. Filed Sept. 6, 188 .

545,591. Electric Motor. Otto E. H. Kramer, St. Louis, Mo. Filed April 23, 1894.

545,592. Electric Motor. Otto E. H. Kramer, St. Louis, Mo. Filed May 10. 1894.

545,664. Method of and Apparatus for Controlling Current for Electric Motors. Thorsten von Zweigbergk, Cleveland, assignor of one-half to George C. Worthington, Elyria, Ohio. Filed Nov. 1, 1894.

545,670. Electric Transformer. William F. Brittin, Allegan, assignor of one-half to Edwin N. Howe, Coldwater, Mich. Filed Nov. 6, 1894.

545,693. Asynchronous Motor. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Societe Anonyme pour la Transmission de la Force par l'Electricite, same place. Filed April 19, 1895.

545,853. Rotary Field-Motor. Alard E. Du Bois-Reymond, Berlin, Germany, assignor, by mesne assignments, to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Dec. 26, 1893.

TELEPHONE AND TELEGRAPH APPARATUS.

545,58 . Telegraph-Key. George F. Philbrook, Lisbon Falls, Me. Filed Jan. 19, 1895.

SIGNALING APPARATUS, ALARMS, ETC.

545,469. Electrical Signaling Apparatus. John H. Fildes, Chicago, Ill. Filed June 12, 1895.

545,494. Railway Block-Signal System. Alvah W. Hall, New York, N. Y., assignor of one-half to Alfred M. Collett, same place. Filed June 15, 1895.

545,653. Electric Alarm. William S. Hull, Dallas, Tex. Filed Nov. 26, 1894.

545,701. Semaphore-Signal for Railways. Jacob W. Lattig, West Bethlehem, Pa. Filed Jan. 5, 1895.

545,815. Electric Signaling Apparatus. Benjamin Price, Baltimore, Md., assignor to the Electric Selector and Signal Company of West Virginia. Filed April 24, 1894.

545,835. Electrical Burglar-Alarm. John R. Alexander, New Albany, Ind. Filed March 20, 1895.

MISCELLANEOUS.

545,495. Support for Overhead Electric Conductors. Melancthon Hanford, Malden, assignor to Charles J. Goodwin, Springfield, Mass. Filed April 25, 1894.

545,498. Electric Brake. William L. Hedenberg, New York, N. Y. Filed May 7, 1894.

545,5 3. Electric Igniting Apparatus for Gas-Engines. Henry Thau, New York, N. Y., assignor to James W. Irwin, same place. Filed Oct. 20, 1894.

545,6 0. Cleat for Electric Wires. Montraville M. Wood, Chicago, Ill. Filed Jan 11, 189 .

545,629. Safety Appliance for Electric Conductors. Adelbert E. Hutchins, Detroit, Mich. Filed May 5, 1893.

545,696. Electric Time-Check Receiver. Charles K. Jardine, Georgetown, British Guiana. Filed March 26, 18 5.

545,69 . Electrical Annunciating-Target. Otto Kauffmann, Sacramento, Cal. Filed Nov. 15, 1894.

545,726. Indicator. Benjamin F. Rittenhouse, Philadelphia, Pa., assignor of one-half to Henry E. F. Borzell, same place. Filed April 13, 1895.

545,819. Electric Insulator. Daniel M. Rothenberger, Lancaster, Pa., assignor of two-thirds to Charles A. Inglis and Edward D. Reilly, same place. Filed March 8, 1895.

THE TELEPHONE WORLD.

THE VIADUCT COMPANY ENJOINED.

The Western Electric Company Wins the Suit on the Watson Telephone Switch Patent.

In the case of the Western Electric Company against the Viaduct Manufacturing Company, Augustus G. Davis and John R. Johnson, of Baltimore, a decree was signed by Judge Morris, in the United States Circuit Court, on the 3d inst. declaring that a patent on an improvement in telephone switches had been infringed. The decree was signed by consent of the parties interested, and the defendants are to pay to the plaintiff $300 as damages. A perpetual injunction was also signed restraining the defendants from manufacturing or using instruments to which is attached the improvement. Ex Governor Whyte, and Fish, Richardson and Storrow represented the complainant, and Price and Stewart the defendants.

The patent upon which suit was brought is, next to the transmitter patents, one of the most important now controlled by the Bell Company. It is patent No. 270,522 and was issued to Thomas A. Watson, as assignor to the Bell Company, January 9, 1883. The patent is a broad one, as shown by the following full text of its claims:

1. In combination with suitable contact points and springs electrically connected with the call circuit and the primary and secondary circuits of a transmitter, the latter circuit including the hand telephone, a lever electrically connected with the main line in a telephone circuit, substantially as described, to bring in the hand telephone and transmitter and break the call circuit, or to cut out the hand telephone and transmitter and establish the call circuit, accordingly as the lever is moved in one direction or the other.

2. In combination with suitable contact points and springs electrically connected with call circuit and the primary and secondary circuits of a transmitter, the latter including a hand telephone, a lever electrically connected with main line and provided with a hook to support the hand telephone, and a spring tending to overcome the weight of the hand telephone, substantially as described, to bring in the hand telephone and transmitter and establish the call circuit, accordingly as the hand telephone is removed from or hung upon said hook.

3. In combination with suitable stops connected with the primary and secondary circuits of a transmitter, the latter including the circuit through the hand telephone and provided with a spring tending to overcome the weight of the hand telephone, substantially as described, to complete the local circuit through the transmitter, and at the same time connect with the main line the secondary circuit through the transmitter and hand telephone from the hook.

4. In combination with a magneto-generator, a main line telephone circuit and a shunt circuit passing through the magneto-generator, the push button U to break the shunt circuit, substantially as described.

5. A switch lever and contacts for connecting with the line wire either a telephone circuit or a call circuit, according to the position of the switch lever, in combination with the magneto-generator, its shunt and push button, the said magneto-generator being connected with the call-circuit, substantially as described.

6. In a telephone circuit, the spring-hook D adapted to support the weight of the hand telephone, in combination with the contact springs s^1, s^2 and s^3, connected with the transmitter, hand telephone and a signaling circuit, substantially as described for the purpose specified.

7. In a telephone circuit, the spring hook D, adapted to support the weight of the hand telephone, in combination with the contact spring s^1, s^2 and their connections, substantially as described, to automatically establish the primary local circuit through the transmitter, and at the same time bring into the main line the circuit through the hand telephone and the secondary circuit through the transmitter by taking the telephone from the hook.

8. A switch lever connected with the main line of a telephone circuit and movable in either direction, in combination with the contact springs s^1, s^2, s^3, the transmitter, the hand telephone, a signaling circuit and suitable connecting wire, substantially as described.

What One Company Has Done.

The achievements of the Home Telephone Company of Chillicothe, O., serve admirably to illustrate what an energetic, aggressive management can do in the independent telephone field. This company was organized in the spring of the current year by the election of the following officers: Judge James M. Thomas, president; Frank Harper, secretary; John H. Blacker, treasurer; and A. H. Reutinger, general manager. The capital stock of the company was fixed at $25,000, all of which was paid in before operations were commenced. The rates were fixed at $2.00 and $1.50 per month and in a very short space of time over 300 five-year contracts were made. The contract for the construction and equipment of the plant was given to the Western Telephone Construction Company of Chicago. The construction of the plant occupied about sixty days.

The Home Company give not only exchange service to residents of Chillicothe, but offer to subscribers, free of extra charge, connection with Clarksburg, Roxabell, Frankfort, Andersonville, Anderson Station, Sulphur Lick Springs, County Infirmary, Londonderry, Vigo, Richmond Dale and points intermediate. The lines now projected will give connection with Adelphi, Hallsville, Kinnickinnick and Kingston, and before long with Waverly, Portsmouth and Ironton.

The Telephone as Chief Marshal.

During the recent parade of the Knights Templar in Boston a new departure was made in the use of telephones. Upon a platform, with a telephone at his command and a switchboard connecting with a dozen or more circuits, sat the general director of the parade. All along the proposed line of the parade there were placed at convenient intervals men with telephones. Each one was able to take in at a glance a considerable section of the parade. When a break occurred anywhere in the line the observer telephoned the fact to the general director, and it many times happened that this director was aware of such break before the commander of the commandery knew it. The director was therefore able instantly to communicate with the commander, telling him to wait until his line had been reformed. Thus the whole parade, containing perhaps 50,000 men, moved with the speed, the good order and the ease of a battalion in a drill room.

Western Union Company Loses.

A decision was reached on the 3d inst., in the United States Court of Appeals at Boston, in the case of the American Bell Telephone Company versus Western Union Telegraph Company, in favor of appellant. The original suit was for an accounting from the Bell Telephone Company under certain alleged contracts. The plaintiffs alleged there was a large sum due them for royalties, which the Bell Company denied. The case was referred to a master in chancery, who decided against the Western Union Company, whereupon counsel for the latter moved the Circuit Court to allow them to dismiss the bill without prejudice. The motion was allowed, and the Bell Company took an appeal, claiming that the lower court had not the right to dismiss the bill. The Court of Appeals holds that the contention is right.

More Telephone Litigation.

The Missouri and Kansas Telephone Company and Frank R. Colvin, representing the attorneys of the Western Electric Company, have instituted suit in the United States Court at Leavenworth, Kan., against the People's Telephone Company of Leavenworth and the Anthony Company, Cincinnati, O., for alleged infringement of several telephone switchboard patents.

A Telephone Company in Trouble.

The plant of the Citizens' Telephone Company, St. Joseph, Mo. has been seized upon an execution to satisfy a judgment in favor of Henry F. Strong, secretary of the company. Strong's claim is for salary alleged to be due him and for which he obtained judgment in a justice's court. A majority of the stockholders, who now have an application for a receiver pending, will fight the case in the higher courts.

Coming to the Front.

To the Editor of ELECTRICITY.

DEAR SIR: I am glad to see you take the stand you do and congratulate you on the rapid manner you are pulling your paper to the front. Yours truly,

EDGAR L. MILLER,
Gen. Mgr the Inter-State Telephone and Telegraph Co.
Durham, N. C.

May Take Time for Answer.

When the case of the American Bell Telephone Company vs. the National Telephone Manufacturing Company was called in the United States Circuit Court at Boston on the 3d inst., attorneys appeared in behalf of the defendant company. The answer to the bill of complaint may not be filed before October 2 next.

Negotiations between the Mutual Automatic Telephone Company of Philadelphia and the Standard Telephone Company have inferentially led to the incorporation of the Standard Telephone and Telegraph Company, under the laws of New Jersey, and the inference drawn is that the new concern is to absorb the Mutual Automatic, and is to operate under the franchise of the latter concern.

The Lansing Telephone Exchange Company, Lansing, Mich., has upwards of 500 subscribers on its list, and expects to have its plant ready for operation within thirty days. The local Bell Company has 267 subscribers, and it is positively asserted that 251 of these have filed notices with the Bell Company that within 30 days they will terminate their contract with that company.

The "measured service" rates put into effect in Philadelphia, September 1, by the Bell Company, range from $90 per year for 800 exchange calls, a fraction over two and one-half calls per working day, to $156 per year for 2,400 calls, a fraction under 8 calls per day. For two-party 'phones the rates grade from $60 for 600 calls to $120 for 2,400 calls. These rates are for metallic circuit service and long-distance equipment.

John P. Persch, who was the promoter of the famous Automatic Telephone Company of Philadelphia, which got a franchise from councils under circumstances which created a scandal when an investigation was made, has secured the passage of an ordinance by the city council of Atlantic City, giving sweeping privileges to a corporation he represents.

The Millen and Stillmore Telephone Company, Millen, Ga., organized some time ago, with J. F. Gray president and general manager, has completed a thirty-six mile line between Millen and Stillmore. Telephone connection is now established with Millen, South Millen, Summit, Garfield, Monte and Stillmore.

The Saginaw Valley Mutual Telephone Company, Saginaw, Mich., has been practically promised a thirty year franchise by Saginaw, and will soon ask the Bay City council for a similar favor. The company agrees to rent 'phones for $30 and $24 per year, with $3 extra for valley service.

The business men of Chester, Pa., have urged the local Bell Telephone Company to reduce telephone rates. The company has refused to do so, and at a public meeting it was decided to support the recently incorporated Delaware County Telegraph and Telephone Company.

The Harrison Telephone Company of Detroit, Mich., has accepted the ordinance passed by the city councils of that city, and has commenced the construction of its plant. The complete exchange is to be in operation July 1, 1896.

Arthur Overshiner and M. P. Krom, of Anderson, Ind., who have a local exchange in successful operation at that place, are negotiating similar prejects at Summitville and Alexandria.

The Walton Telephone Company has been organized at Walton, Ga., by the election of W. H. Nunnally president and H. G. Nowell manager. The charter has been granted and work will proceed at once.

The Mutual Telephone Company, Butte, Mont., organized some months ago, and which has secured a franchise, is preparing to begin the construction of its plant.

The Commercial Telephone Company has secured a franchise with liberal provisions in Oakland, Cal. The company will expend $72,000 on its plant.

The Keystone Telephone Company, Pittsburg, Pa., is endeavoring to organize a local company at Mt. Carroll, Ill.

W. D. Fletcher, of Pendleton, Wis., is interested in the proposed telephone line to connect La Grange, Union and Elgin.

The Bell Telephone Company is preparing to extend its service to a number of the rural towns adjacent to St. Louis.

The New England Telephone and Telegraph Company has secured underground rights at Springfield, Mass.

Five thousand dollars has been appropriated to extend the police telegraph system of Jersey City.

The Philadelphia post-office has been equipped with Clamond telephones.

C. C. Davis is interested in the proposed telephone exchange at Colfax, Ia.

A telephone exchange is contemplated at Decorah, Ia.

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EDITORIAL NOTES.

There are still left in this trade a large number of men who have entered into it for their life work. They may be disheartened, but they have not given up. It is for them that we write. To them we present our argument, and to them we must all look for the re-establishment of business principles, the reinforcement of the doctrines of common sense.

It is for these men to consider just why wrong has temporarily triumphed over right, why it was possible for the tricksters and adventurers to bring the industry to its present condition.

And when these questions receive careful thought the only answer possible is that the electrical press has not done its duty.

If the "Electrical Engineer," the "Electrical World," the "Electrical Review" and the "Western Electrician" had faithfully done their duty by the trade they claim to represent, whose best interests they claim to guard, the present situation would never have confronted us.—"ELECTRICITY," June 5, 1895.

The Bell Company and the Opposition. The past week or two has been pregnant of results that bode ill for the prosperity of the independent telephone companies. The developments seem to show only too strongly the unwisdom of the petty jealousies which have prevented concerted action among those whose interests are adverse to the Bell interests and to substantiate the position taken by ELECTRICITY at the very start, that success could only be hoped for from united action.

In our issue of August 21, in commenting upon the suit of the Bell Company vs. the National Telephone Company, we stated that there was a strong suspicion among the independent telephone companies that the suit was merely a collusive one. While the circumstances were exceedingly suspicious, we expressed the hope that the suspicions might prove unfounded. Scarcely two weeks have elapsed and another circumstance has arisen which seems to go further in substantiating the fear than all of the others which preceded, and which when taken in connection with the others leaves little room for doubt that the National Company never intended to make a fight with the view of winning.

The case came up for hearing September 3d, and the attorneys for the National Company, after having put in an appearance, withdrew from the case without filing an answer. While the National Company has still 30 days within which to file an answer, this withdrawal of counsel is regarded as indicating that they propose to allow the Bell Company to take judgment by default.

This is a most extraordinary proceeding for a party to take which has endeavored to make the public believe that it would contest every inch of ground to the last ditch. It is more extraordinary from the fact that there were others standing ready to defend the suit without expense to the defendants, and who for the benefit of the independent telephone interests would have assumed the whole burden had they but been permitted to do so. This was the avowed object for which the independent telephone associations were formed, and no one knew this better than the National Company. The action of the latter company is therefore looked upon by others who are in the telephone business for legitimate purposes as inexplicable on any other grounds than collusion.

It may be that that opinion has been too hastily formed, for since 30 days must elapse from the date assigned for the hearing before judgment can be taken by default, there is ample time for the National Company to employ new counsel and make an answer; but it seems to us that the National Company owes to the public some explanation of its action, for without this it is certainly placing itself in an anomalous position if its intentions are honorable.

Another recent circumstance to which we would advert in this same connection is the giving of judgment by consent in the case of the Western Electric Company vs. the Viaduct Manufacturing Company of Baltimore. The cause of action was the use of a telephone switch used by the defendants alleged to be an infringement of the Watson patent controlled by the Bell Company. We printed the specifications of this patent in full in our last issue, and stated that according to the decree, which was signed by consent of the parties interested, the defendants are to pay to the plaintiff $300 as damages, and are served with a perpetual injunction restraining them from manufacturing or using instruments such as they had been advertising in the electrical papers as "the only automatic switch that does not infringe."

Reference to the Watson patent No. 270,522 shows that it is an exceedingly broad one. The first claim reads as follows:

> 1. In combination with suitable contact points and springs electrically connected with the call circuit and the primary and secondary circuits of a transmitter, the latter circuit including the hand telephone, a lever electrically connected with the main line in a telephone circuit, substantially as described, to bring in the hand telephone and transmitter and break the call circuit, or to cut out the hand telephone and transmitter and establish the call circuit, accordingly as the lever is moved in one direction or the other.

From this it will be seen that the claim is so broad as to make pertinent the question as to whether it is valid. It seems to cover practically all methods of switching electrical circuits in and out of action, being limited in its application only to electrical circuits including a telephone, a transmitter and a calling apparatus.

It is well known that efficient means of switching circuits were in use long prior to the advent of the telephone, so that unless the patent covered some specific method of accomplishing this that was new its validity could not be upheld. It is also a principle in patent law that the application of an old idea to a new use is not patentable.

Every one is familiar with the convenient arrangement employed in the Bell instruments by which the simple hanging up of the receiver throws out of circuit the local battery and connects in the calling apparatus, and how the removal of the receiver reverses things, cutting out the call and connecting the battery, rendering the line ready for conversation. It is probably the simplest arrangement that could be devised, and therefore the party owning the patented right to this device would have an advantage over another which had a more cumbrous one.

Outside telephone manufacturers, recognizing the probable validity of the Watson patent in its more restricted interpretation, have adopted other methods of switching which they believed more or less completely filled the requirements of convenience. One obvious method would be to have separate hand switches such as are used on central station switchboards for throwing in and out of action the various circuits. Such a method would undoubtedly be effective, but it would be less convenient than an automatic method. The Viaduct Manufacturing Company improved on this method in that by their device it was not necessary to use the hand directly on the switch, but by resting the arm on a lever, as is convenient when placing the receiver to the ear, the commutation of circuits was accomplished. The step between their method and that employed long before the telephone came into use was so slight from a technical standpoint, viz., the mere substitution of the pressure of the elbow for that of the hand on the switching lever, that it would seem that one method could not be an infringement without the other being an infringement also.

Without desiring at the present time to go into minutiæ in regard to the relative merits of the two devices—Watson's and the Viaduct Manufacturing Company's—it is quite safe to say that the latter company had an excellent chance to controvert the claims of the Western Electric Company in 1893 that its device was an infringement. This is the opinion of some of the ablest patent lawyers in this country.

In 1893 this company confessed judment, thereby acknowledging the validity of the Watson patent. Having consented to a decree at that time they could not, of course, in this latter case plead the invalidity of that which they had previously admitted, but why did the Viaduct Manufacturing Company so plead in 1893? Since that time they have been using a modified form of switch which they have given the public to believe was at least not an infringement. If they really believed that their new device was not an infringement why should they now consent to a decree without a struggle which forever debars them from using their new device? Was it because they did not have material upon which, at least tentatively, to base a defence? It could not have been on account of the cost of the litigation, because there were others ready in this case as in the National case to supply the sinews of war. We know that legal advice was offered them, but they laid down and with consent had judgment entered perpetually enjoining them from using that which they claimed to believe did not infringe, and to pay damages to the amount of $300.

These small damages, if the device used were actually an infringement, were certainly inadequate and give additional grounds for the suspicion that this case, like that against the National Company, was collusive. There be those who say that they shall not be surprised if both the National Company and the Viaduct Manufacturing Company shortly appear as licensees of the Bell Company, and that the price of the license was the "lying down" to which we have adverted. This lying down of the Viaduct Manufacturing Company has a deeper significance to the independent telephone people than may appear on its surface. In this case the Berliner claims do not figure, but it naturally arouses the fear of the public that having lain down in this case they would also lie down were they made defendants in a case involving the Berliner patents.

If, as would appear on the surface, they had no confidence in their own claims, they were deliberately misleading the public, and by this action have cast a reflection upon the independent telephone movement which will go hard with it in its appeal for public favor.

The two suits referred to, together with others which it is understood are ready for announcement in other portions of the country, show the energy with which the Bell Company is prepared to take the aggressive. They have already what probably will be judgment by default in Boston, a judgment by consent in Baltimore, and if they win in the other suits, judgments in still other jurisdictions. In our review of the Brush arc-lamp litigation we pointed out how effective a weapon early judgments for the Brush Company had been in maintaining the validity of an alleged infringement which ultimately was held not to exist in fact. We look upon these early victories of the Bell Company with alarm as tending to the same result. We believe that a few more such reverses to so-called independent telephone manufacturers as those to which we advert will effectually kill the independent movement. The latter cannot afford to allow suits against them to go by default, for each such judgment forms another strand in the rope which must be broken before those opposing the Bell Company can hope to triumph.

Our idea expressed last week, that the independent element should uphold the Government in its attempt to annul the Berliner patent has been received with considerable favor, and has done much to change the opinion of those who opposed the idea originally. It is unfortunate that in the reopening of the case no new evidence can be admitted, and that final judgment will necessarily rest upon the very imperfect evidence originally presented by the Government. But the mere fact of there being a case before the United States Supreme Court involving the validity of the Berliner patent would act as a stay in the lower courts should the defendants raise that plea.

It is improbable that the Government's case could be decided within any very limited time, and pending its decision any telephone company sued for alleged infringement of the Berliner patent would, if in earnest, apply for a stay. If they were in collusion and willing to sell out to the Bell Company, they would let judgment go by default or consent. Is the entering of the Government's suit on the record the cause of the action of the National Company, and is this to be followed by other similar procedures?

* * *

The latest reports stated that Mr. H. M. Byllesby was in Missoula, Montana, working in the interests of Mr. Coffin in reorganizing the Missoula General Electric Company. We do not think he will be successful—Electricity is well read now-a-days in every town in the Northwest.

Will Electrical Discovery Extend in New Directions?

So rapid and astounding have been the advances in electrical discovery that the public seemed more than justified in expecting at any time a revolutionary discovery that might render useless or antiquated all devices already in use. So firmly had the belief in some such cataclysmic discovery become only a few years ago, that many business men actually postponed for months the installation of new plants or the extension of old ones, in the full expectation that by so doing they would be enabled to avail themselves of something not then on the market and thus avoid a handicap that immediate investment would imply. Along in 1888 this feeling was so widespread as to actually hamper the electrical manufacturing business, but the continual and repeated postponement of predicted improvements has long since brought the buying public back to a feeling of confidence in the permanency of types upon which alone a healthy business can be supported.

As to the nature of these promised revolutions in the art, nothing definite was ever known. Sometimes it was the charlatan such as Pennock and Keely who was the authority for the hope. Sometimes it was the exaggerated interpretation of quiet hints that seemed to emanate from reputable manufacturers, but the public has now become better educated in the law of the conservation of energy and are no longer so easily gulled by the promise of something for nothing.

The conquests of electricity have been so astonishing that the unthinking were easily convinced of the possibility of almost anything if only electricity formed one link in the chain of procedure. Thus the proposition to operate an electric motor by the current from a dynamo driven by this same motor appeared as reasonable to those in the early days who now would see its fallacy at once.

A revolution has been going on, however, in a perfectly legitimate direction, viz., in perfecting the mechanical and electrical details of existing types. Greater attention has been paid to increasing the efficiences of apparatus, until now the electric generator and motor stand among the most efficient of energy transformers. Everything has been improved and cheapened, so that the theoretical limit has already been practically reached.

With the advent of the dynamo, chemical means of generating current came into disfavor, and to such an extent that the appellation "primary battery man," given to those who made, sold or experimented upon primary batteries became a reproach.

It was a reproach, however, not deserved by those interested in a legitimate way in this line of activity, and as predicted of old, the stone which the builders rejected may become the head of the corner.

In our best steam engines and boilers we seldom get more than 10 per cent. of the energy contained in the coal. The conversion of this energy into electricity involves a further loss of say 10 per cent., so that even with dynamos of the best make we seldom get more than 9 per cent. of the energy with which we originally started.

The galvanic or primary battery is far more efficient than this, giving us at once an efficiency of from 60 to 70 per cent. The trouble heretofore has been that our fuel, in this case zinc, and the atmosphere employed to burn it, acid, have been so expensive that notwithstanding the far higher efficiency of the battery, the energy ultimately cost many times what it could be produced for from coal through the intermediary of the boiler, steam-engine and dynamo.

The problem now is to find a cheaper fuel and atmosphere for our primary battery, and in proportion to the success which attends these efforts will the primary battery again meet public favor. There is no theoretical reason why a very cheap fuel for the battery cannot be produced, but it has as yet baffled all attempts. Perhaps a single discovery may revolutionize all of our present methods of electrical generation, but it will not involve a contradiction of the law of the conservation of energy. It is more likely to be along the line of chemical activity as distinguished from that of mechanical activity now in vogue. Nor is it likely to be the result of chance, but rather of long and painstaking research by chemists and physicists of ability. When it comes it will not be open to the suspicion that attaches to Pennockism and Keelyism, but will be along rational lines which can readily be understood when once explained. When it comes it will doubtless be so simple that the world will wonder and upbraid itself for not having seen how to do it before. It will doubtless dawn upon the world nearly full-fledged, as did the telephone and the phonograph, but its uses to man will be far more significant than have been any previous inventions.

* * *

Franchises for Electric Railroads. The question is an ever-recurring one as to the conditions which should be attached by a municipality to the granting of franchises within its jurisdiction. When these franchises are of a quasi-public nature it is difficult to lay down any definite rule that will apply equally well in all cases, but when the franchise is one that will clearly benefit only the one enjoying it, the course is clear. The beneficiary should in this case, of course, pay to the municipality an adequate sum for the privilege, just as a tenant in an office building pays rent for his offices. When, however, the new franchise implies a benefit to the municipality as well as to the projector it becomes a question of doubt in each case how far it is well to go in requiring tribute. The building of an electric railroad, a gas plant or a water system is of direct benefit to the community, but without a franchise which gives the promoters the right to reach possible customers such undertakings will not be begun. In the hope of profit, the projector is willing to invest capital, employ his time and pay a bonus for the opportunity commensurate with his hope of profit, but if the bonus required is out of proportion to the reasonable expectation of profit from the operation, the enterprise is nipped in the bud.

There are those who hold that franchises such as are implied in water, gas and electrical distribution should be vested solely in the government, but there are others who contest this view, and show, as they think, plainly that such ownership is not advantageous to the people. We are among those who believe that when the millennium comes, and political management is as economical and honest as private enterprise, then and not till then will municipal control be conducive to the best interests of the community.

The *Engineering Record* for September 14 editorially advances a compromise between municipal and private control that we think is new.

Its remarks are called forth by the opposition of the citizens of Montclair, N. J., to the granting of a franchise to the New Jersey Traction Company to occupy the streets of Montclair. It says:

"The convenience of such a road to some of the citizens, and especially to those in Caldwell and Verona, is conceded. A year or so ago the proposition would not have been entertained on any terms. Now there is considerable talk to the effect that if the company is allowed to run through the town 'the privilege is very valuable and they should be made to pay well for it,' either in buying right of way or in paying the town a share of receipts. The people of Montclair, as well as those of other communities, should not be blinded to the real and permanent issue in the operation of an electric railroad by such suggestions. This is the preservation of the streets through which a street railway runs in a decent and passable condition for the use of other vehicles than the electric cars. Experience in Orange and other towns where such roads are operated clearly demonstrates that railway corporations, agreements or no agreements, disregard the right of the rest of the public to the use of the streets for which the public have paid.

"The promise of a share of receipts is usually a phantom. Roads are often projected primarily that their promoters can make a profit in supplying the plant and in disposing of the bonds, the proceeds from which being the only money put into the enterprise. Yet the company is managed by stockholders who never paid a cent for their stock. In due time such a corporation frequently passes into the hands of a receiver, is reorganized, and the new management is free of any obligation that can be enforced by those who gave the original franchise."

Our contemporary offers the following suggestion as a solution of the difficulty. It says: "In view of these facts, which must be admitted, the authorities of Montclair should profit by the experience of other places. When it is decided to allow a trolley road to pass through the town, and a route is agreed upon, the rails should be put down by the town and their ownership and the right of way remain vested in the town. The railroad using it should pay a rental or toll for the privilege of running their cars over these rails; when they cease to pay the rent they cease to run, or in other words, they be dispossessed so another tenant that will pay may be secured. In determining what this sum shall be, reliable expert advice should be obtained, and among other considerations the following items of cost must be taken into account: Changing the cross-section of street so that the crown will be at the minimum, to render carriage travel possible between the rails and curb; to maintain a suitable pavement alongside the rails and the macadam of the street, which necessitates continuous attention; to maintain a bond between the rails, and in addition a return wire of sufficient capacity to carry the return current; the cost of restoring water and gas pipes destroyed by electrolysis.

"If a trolley road is built and operated on these conditions it can be a useful public servant."

Under the Searchlight.

Views and Opinions on Timely Topics.

WE understand that Mr. John I. Beggs intends to retire from Cincinnati as gracefully as possible within a few months, and that he has accepted a position with the New York Edison Company. We welcome our old friend I John back to New York, and have no doubt he will add to the gayety of electrical life in the metropolis.

* * *

BY the way, would it not be a strange coincidence if there were to be another fire at 44 Broad st. about the time Mr. Beggs returns to New York?

* * *

THE stockholders of the United Electric Securities Company at their annual meeting last week adjourned for one week, no quorum being present. Our latest advices were that Mr. C. A. Coffin was to be dropped from the Board, but we suppose this is the expression of desire on the part of the majority instead of actual intent.

* * *

A STRAW showing the direction of the wind in the general telephone business is the announcement in a Detroit paper that the Harrison Telephone Company may not file its $25,000 certified check to carry out its franchise in that city. It is also stated that the Harrison Company in Indiana has abandoned its Anderson franchise, and Chicago papers report that it will give up its Fort Wayne, Terre Haute and Indianapolis franchises. These franchises were of course procured at some expense, and the only inference is that in the light of recent developments in patent litigation it is not considered advisable to put in new exchanges.

* * *

A SPECIAL to the *New York News Bureau* states that evidence has been presented to the United States District Attorney at Chicago, by President Keelyn of the Western Telephone Construction Company, to show that the American Bell Telephone Company is violating the anti-trust law. Its contract with the Western Union Telegraph Company is quoted as evidence.

* * *

"*As a voltage of* 10,000 *has proved to be entirely practicable, a territory within a circle of* 100 *miles diameter can be as easily served from a central point as can one town from its own plant employing the usual voltage.*"—Electrical World.

* * *

A Sure Winner.

(From the Marine and Railway Gazette.)

ELECTRICITY wins new successes each day that comes.

* * *

WE are not surprised to learn that the Boston Incandescent Lamp Company were one of the first of the half-dozen smaller incandescent lamp makers who have already retired from the field. They were among the strongest adherents to the notion that lamps could be sold at less than shop cost at a profit.

Personal.

Mr. Stanley S. Stout, of Chicago, spent several days in New York last week.

Mr. J. B. Crouse, of the Crouse-Tremaine Carbon Company, Fostoria, Ohio, was in New York this week closing some large orders for carbons.

Electric Lighting of Brussels.

There are few if any places in England where electricity used for lighting purposes can be said to have reduced appreciably the consumption of gas. In many towns it has had the effect of increasing the gas consumption by making the companies turn their attention to cooking and heating. There is a Continental instance, however, where it has had an opposite effect. The electric lighting of Brussels, which is worked by the municipality, has during the year reduced the gas consumption by 17½ million cubic feet. The central station plant there was started in November, 1893, at a cost of £100,000. There were three boilers of 2,500 square feet of heating area, two 500 H. P. engines and four dynamos of 143 units, and a battery of 140 cells of accumulators to give a current of 350 amperes for 10 hours. In February, 1895, another engine of 500 H. P. was put in for extensions and at present another station—a smaller one—is in course of construction for local demand. The India-Rubber, Gutta-Percha and Telegraph Works Company is running the installation for the municipality. The mains laid are 8¾ miles and the feeders 11,900 yards, the number of lamps being 11,655. For the first year the system has worked at a profit, but gas critics naturally say it has not been a success.

London Notes.

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

(From our London Correspondent.)

LONDON, September 7.

This year's meeting of the British Association is to be held at Ipswich from September 11th to 18th. The retiring president is Lord Salisbury, K. G., D. C. L., F. R. S., and Sir Douglas Galton, K. C. B., etc., the president-elect, will assume the presidency and deliver his inaugural address on the evening of the 11th inst. On the 18th inst., at 8:30 P. M., a discourse of especial interest will be delivered by Prof. Silvanus B. Thompson, his subject being "Magnetism in Rotation." The professor will use a number of experiments for illustration.

Apart from these general arrangements, the proceedings will, as usual, be divided off into a number of sections for the consideration and discussion of the various branches of scientific subjects, and there will also be the usual excursion parties to places of interest in the neighborhood of Ipswich.

Section G is the one in which most of the papers on electrical and kindred subjects are delivered, but the programme which has been drawn out up to the time of writing contains nothing of a very striking character. Mr W. H. Preece, C. B., F. R. S., is to report some notes of further advance in "Telegraphy by Induction," a subject which, with the aid of assistants, Mr. Preece has made essentially his own. Mr. Philip Dawson—a frequent writer in the British technical journals on traction subjects, and assistant to the late Mr. Anthony Reckenzaun—will read a paper on "Modern Applications of Electricity to Traction."

The subject of light railways, which has occupied so much attention during the present year, is to be treated by Major General Webber, who will also discourse on "The Development of the Telephone in Agricultural Districts." This is not the first occasion upon which Major General Webber has endeavored to tackle this matter; he has great hopes as to what the telephone may do in rural districts in helping the farmer and the village tradesman, but his proposals have not been altogether satisfactorily received in certain quarters.

Mr. W. H. Preece, in a second paper, will deal with "Glow Lamps," Mr. A. K. Bennett with "Telephony" (doubtless a reiteration or expansion of some of the facts given in his recent book, lately reviewed in these columns); Mr. P. V. Luke (the Deputy Director of Telegraphs in India) will deal with "The Field Telegraph in the Chitral Campaign," and Messrs. W. H. Preece and A. P. Trotter will contribute a paper on "A New Portable Photometer"; Mr. W. H. Earle will have a paper on "The Chloride Battery," while the Borough Analyst of Ipswich will discuss "Deodorizing Sewage by the Hermite Electrical Sanitation Process," which process was adopted for Ipswich a year or so ago.

It is almost certain that Lord Rayleigh or Prof. Ramsay, the "Argonizers," who sent last year's meeting and the scientific world in general into temporary hysterics on account of their alleged discovery, may have something more to say this year.

The "Electrification and Diselectrification of Gases" will be treated by Lord Kelvin, Magnus Maclean and Douglas Galt.

ROYALTY AND ELECTRICITY.

The provincial pressman is putting about at a penny-a-line some reports about Her Majesty Queen Victoria's dislike for and opposition to electricity. It will be seen how likely it is that this report is correct when I mention that at Osborne House there is a most perfect electric lighting installation, all the various departments being lighted in this manner. In addition to this, there is at one of the sovereign's residences an electric cooking outfit, by means of which the more delicate dishes are cooked.

RESEARCHES ON THERMO ELECTRICS.*

When Prof. Dewar succeeded in perfecting his now classical apparatus for producing exceedingly low temperatures, we anticipated that it would never remain a mere scientific curiosity, but would, in the hands of the professor, very soon be put to practical application. Our anticipations have been fully justified. Prof. Dewar has already, in the comparatively short time which has elapsed since his first epoch-making lecture on low temperatures, enriched our knowledge with discoveries which, but for him, would probably have been delayed for years; and it is clear that the researches which he has so far carried out are but an earnest of those which are to follow.

Recently Prof. Dewar has been collaborating with Prof. Fleming in an investigation, the object of which has been to throw some new light upon the thermo electric powers of metals and alloys at temperatures between the boiling point of water and that of liquid air. Their results are to be found in the *Philosophical Magazine;* but the authors have kindly favored us with a reprint.

We owe most of our knowledge up to the publication of this paper to Prof. Tait and Lord Kelvin. It was the latter's researches on thermodynamics which suggested to Prof. Tait the starting point for that work, the outcome of which was to show that on certain assumptions the curve representing thermo electric power plotted as a function of temperature should be straight lines, and consequently that the lines of thermo-electromotive force obtained by plotting as ordinates the E. M. F. in a thermo electric circuit, one junction of which is kept at a constant temperature whilst the temperature of the other is varied, should be parabolas with their axes vertical if plotted in terms of the variable temperature as abscissæ; but Prof. Tait's deductions were based upon experiments within the limits of the temperatures which can be reached by mercury thermometers and certain temperatures above that range. Nevertheless, these experiments confirmed Prof. Tait's conjectures for a large number of thermo-couples, although they led to the remarkable discovery that the thermo-electric lines of certain metals, notably of the magnetic ores, are for temperatures above 0° C., broken lines characterized by sudden changes of direction.

It has been the business of Profs. Dewar and Fleming to carry out experiments during which the temperature was lowered to −200° C. by the employment of boiling liquid air and oxygen. The data thus gathered have enabled them to continue the well known thermo electric diagram of Prof. Tait down to temperatures not very far removed from the absolute zero. This diagram, which, by the way, enables the temperature of inversion to be determined by inspection, may now be said to exhibit more elegantly and completely than ever the chief thermo electric facts.

The metals used were for the most part in the form of wires. From these a large quantity of thermo-electric couples were prepared, each consisting of two wires of lead joined by an intermediate wire of one of the following metals, viz., platinum, gold, palladium, silver, copper, zinc, cadmium, magnesium, tin, iron, nickel, pianoforte steel wire, Hadfield's manganese steel (non-magnetic and magnetic), manganin, german-silver, platinoid, bismuth (pure and commercial), antimony and aluminum; a carbon filament from an incandescent lamp was also coupled with lead.

The experimental difficulty encountered was that of determining the low temperature and the instant when the E. M. F. of the couple was made. Needless to say, this was after long preliminary investigation solved, and the apparatus finally used was based upon the employment of a platinum thermometer for measuring the temperature and a measuring instrument which could be changed instantly from a potentiometer into a resistance balance. This involved an expenditure of ingenuity such as invariably characterizes the apparatus with which Prof. Dewar conducts his researches. His account of the expedients to which he found it necessary to resort is well worthy of careful study by those who are young at experimental investigation.

The laborious work entailed by taking and reducing the observations recorded, as well as by the construction of some of the apparatus, was largely assisted in by Messrs. Morris and Jakeman. In the case of each couple a series of numbers for each metal representing at defined temperatures the thermo-electromotive force of that metal against lead was obtained; and all these observations were reduced to a statement of the E. M. F. in C. G. S. units of a couple formed of a given metal and of chemically pure lead, one junction being at 0° C. and the other being at a platinum temperature, *p t*, as defined by the standard platinum thermometer. The corrected results are graphically shown plotted down in a chart in the original paper. The lines of thermo-electric force thus found are in all cases curved. Wherever the curve has a maximum point so that its tangent becomes parallel to the line taken at the axis of temperature, the temperature at which this occurs is the neutral point of that metal with regard to lead. If, at any temperature, the tangents of the curves of two metals are parallel to one another, that temperature is the neutral point of these two metals with regard to each other, or is the temperature of inversion.

The diagram of thermo-electric powers can be at once obtained from that of the thermo-electric force by drawing a series of lines, the ordinates of which represent to proper scale the *slope* of the curves of thermo electric force.

The chief interest attaching to these investigations is obviously the ability to determine whether, over wide limits of low temperature, the thermo-electric lines of various metals remain in straight lines, and whether any of the metals exhibit changes of thermo-electric power at low temperatures which cause thin thermo-electric lines to be bent or broken, thus indicating a sudden change in the sign or magnitude of the "Thomson effect" at certain temperatures. The chart which has been constructed by Profs. Dewar and Fleming is capable of giving all the information that can be required, and thus of providing the data necessary for a full discussion of the subject. They, however, reserve a discussion of the interpretation of these thermo-electric curves and the bearing of the facts they disclose on the usually accepted thermo-electric theory for a future paper. Meanwhile we are glad to notice that they propose to convert the chart of electromotive forces into a chart of thermo-electric power, in which condition it will lend itself to a discussion of results. We shall await the publication of it with special interest.

Relative Heating Properties of Various Sources of Light.

Prof. Palaz gives the following figure as to the relative heating effects of different illuminants: Arc light, 4; incandescent light, 14; kerosene, argand burner, 331; gas, argand burner, 380; candle, 473; gas, butterfly burner, 511.

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* From *Electrical Review* (London).

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER XI.

The Mitchell Plant and the Mitchell Electric Company.—III.

It will be remembered that the official statement of the earnings and expenses of the "Mitchell Electric Company" for the year ending February 28, 1893, as printed last week, showed net earnings, aside from fixed charges, amounting to $23 07. But the plant was not in operation the whole of the period covered by the statement, it having been shut down during part of the month of October and the whole of November. It might therefore be argued that the net earnings would have been larger if the station had run without interruption. We concede the point, but it is certain that the increased net earnings resulting from uninterrupted operation for the whole period would not have materially added to the value of the property as an investment, or justified the founding of a company on it, nor would it have relieved the parties directly responsible for evolving and carrying out the fraudulent scheme.

We can readily form a fair estimate of the maximum earning capacity of the plant during the time it was shut down by taking the average income per month for the last three months of the fiscal year, namely, December, January and February. The average of these three months would be somewhat too high. During these months the total income from incandescent service was $1,1 2.08 and from arc service $447. The average per month for the former is $397.36 and for the latter $149.00, and for both $546.36. Substituting this amount for the decreased earnings for October and adding a like amount for November, we have the estimated earnings for these two months of $1,092.72. From this sum should be subtracted the amount of money needed to supply coal for two months, and the proper proportion of expense for lamp renewals, carbons and other supplies, and for general expense. Making these deductions, and allowing for the time which the plant was shut down that it would have done as well as it did for the last three months of the year, we find there would still have been a large deficit.

We will now devote some space to the consideration of the monetary returns from the incandescent service. During the ten months of uninterrupted running of the station, the gross receipts from supply of current for incandescent lights amounted to $2,948.07. The price charged per kilowatt hour for the energy delivered to the lamps was 20 cents. The average service per month on the incandescent circuits was therefore 1474 35 kilowatt hours.

With this knowledge of the price per K. W., and the total K. W. delivered, it is quite easy to form a correct estimate of the returns per month per lamp from the incandescent service.

It is well understood that an incandescent lamp of any type demands a certain amount of energy to bring it to its normal degree of brilliancy; the amount of energy required, however, may differ within practically somewhat narrow limits by reason of the selection of a more or less efficient lamp—that is, a lamp which requires more or less energy to bring it up to its normal C. P. In forming an estimate of the actual income per lamp, we propose to give the plant the benefit of all doubts, and to take a lamp of rather high efficiency as the standard. We shall assume that lamps were used of 3.1 watts per C.P. Such a lamp for alternating current service requires approximately one ampere and 50 volts to bring it up to 16 C. P., or the expenditure of 50 watts for the maintenance of its normal brilliancy.

Since the average income per month for incandescent service is $294 80, this at 20 cents per K. W. hour, practically equals 1,474 K. W. hours per month, and if one lamp takes 50 watts, then by dividing 1,474 K. W. by 50, we get 29,480 lamp hours, which is equal to 1 cent per lamp hour (a common rate) and the total capacity of the station was 500 lamps. This would give a service equivalent to two lamp hours per day, and yield an increase of 2 cents per lamp per day, 60 cents per lamp per month, or $7 20 per lamp per year, which is probably considerably higher than the actual results. The probabilities are that the lamps used would be much nearer 4 watts per candle, or about 25 per cent. lower in efficiency than we have assumed, and the result so far as income is concerned per lamp hour would be about 25 per cent less, or approaching 1½ cents per lamp per day, or 45 cents per lamp per month, or $5.40 per lamp per year. Within these two extremes it was perfectly possible for any intelligent electrical engineer to definitely state just what might be expected as the gross revenue of such a station, and with the statement of the efficiency of the lamp used on the circuit the margin for doubt in the estimate of the gross returns or net earnings would be very much reduced. As a matter of fact, at the time this Mitchell Electric Company's plant was started there was no difficulty in anticipating and stating just what revenue might be expected, and very closely what expenses would be incurred in operating the plant.

But there is no need to speculate or theorize as to what this Mitchell Electric Company's plant *might* have done for the first year after its capitalization of $35,000 if it had not been compelled to shut down for repairs for nearly two months.

We have at hand the record of the plant for the twelve months ending December 31, 1893, during which period the plant suffered no interruptions. This record we present herewith:

[COPY.]

MITCHELL ELECTRIC COMPANY.

STATEMENT OF EARNINGS AND EXPENSES FOR TWELVE MONTHS ENDING DECEMBER 31, 1893.

Earnings.

	Arc.	Inc't.	
January	$144.00	$383.69	
February	141.00	338.39	
March	141.00	332.80	
April	141.00	342.50	
May	139.80	253.19	
June	141.00	283.43	
July	141.00	180.63	
August	141.00	209.69	
September	291.00	395.59	
October	141.00	290.83	
November	141.00	474.51	
December	141.00	440.67	
Total	$1,8 3.80	$3,880.92	$5 724.72

Total earnings brought forward		$5,721.72
Credits.		
Wages engineer and fireman	$1,175.00	
Salary officers and clerks	260.00	
Fuel	2,150.27	
General expense	209.97	
Lamps	94.74	
Repairs to electric plant	68 83	
Repairs to steam plant	36.77	
Oil and waste	70.47	
Boiler compound	103.18	
Insurance	208.85	
Carbons	57.00	
Discount	117.48	
Traveling expense	65.66	
Water	8.00	
		4,650.67
Net earnings		$1,074.05

The above shows apparent net earnings from operation of $1,074 05. In the official trial balance of December 31, 1893, we find the item of "Notes payable, $13,364.65." The fixed charges of the plant, therefore, were at least—

Interest on bonds ($15,000 issued)	$900.00
Interest on notes	1,336.46
Total	$2,2 6.46
Deduct net earnings	1,074.05
Deficit	$1,162.41
And to show how far the plant fell short of being a sound enterprise, we must add—	
6 per cent. interest on stock ($15,000)	900 00
6 per cent. depreciation on cost of plant ($19,777.64)	1,186.65
Total deficit	$3,249 06

With the facts before us, we can estimate with exactness just what increase in the incandescent service would have been required to make a paying property of the Mitchell plant (for it must be borne in mind that there was absolutely no hope of extending the arc service). The net earnings from operation for the year ending December 31, 1893, were $1,074.05. To meet fixed charges, depreciation and dividends would have required $4,323.11, leaving a deficit of $3,249.07. To overcome this shortage with a revenue of $7.20 per lamp per year, it would have been necessary to take on about 450 new lamps without taking into consideration one cent of expenses for the operation of these additional lamps. Can there be any better proof of the absolute hopelessness of the financial success of the Mitchell Electric Company?

It is worthy of notice that the total income for December of 1892 (as shown last week) was $632.17, and for December, 1893 (as above), $581.67. The boom in the electric lighting business had not materialized in the town of Mitchell, S. D., (population 2,205).

Some of our readers may be interested to know just why the plant started in the new station February, 1892, should be compelled to shut down a part of one month, and entirely shut down for another month, only eight months after the date of starting. We will explain this matter fully. In the section of South Dakota in which this plant was located the water obtainable is quite strongly alkaline and contains quite a large percentage of mineral matter per gallon. During its evaporation it therefore leaves behind a large amount of solid residue which forms scale and mud in great abundance. It will be noticed that quite a large amount of boiler compound had been purchased and used during the time of operation of the plant, and this boiler compound was intended to keep the boiler free from such an accumulation of mud and scale as would lead to injury. Notwithstanding the fact that so much of this boiler compound was used, the mud and scale accumulated to such an extent as to result in serious injury to the sheets of the boiler by burning. From this cause the boiler was so seriously injured in October, 1892, it was really dangerous to run it. With the water available in that section of the country a mud drum should have been put in to prevent the accumulation of sufficient scale and mud to prevent such serious injury—but it was not done. In addition to this trouble, however, the Atlas engine first put in was found incapable of rendering satisfactory service. These engineering blunders or oversights led to the necessity for a reconstruction of the station, and it was decided to add another 100 H. P. Atlas horizontal boiler and to take out the Atlas engine and replace it by a Ball tandem compound engine. The cost of the second Atlas boiler would of course not exceed the cost of the first, and the cost of its erection would be somewhat less than that of the first boiler, but this would be more than compensated for by the cost of repairing the first boiler to make it safe. The cost for repairs and erection of the second boiler should not have exceeded $2,400, while the maximum cost of the Ball tandem compound engine should not have exceeded $1,800, and this last item was actually reduced by allowance of $800 for the Atlas engine. This allowance should fully cover the cost of foundations and erecting the Ball engine. The cost for the additional steam plant would therefore be about $4,200. With the new boiler it became necessary to add additional room to the building and to purchase additional property. The entire additional cost for building and land raises this one item of investment to a little over $1,700.

We have in our possession the official schedule of the property of the Mitchell Electric Company at the close of the first fiscal year of its existence and after all these changes had been made. This schedule of the property does not give the values of the articles included in it. We herewith present a copy of this official schedule, to which we have appended the cost of articles enumerated therein:

[COPY.]

MITCHELL ELECTRIC COMPANY.

Mitchell, South Dakota.

SCHEDULE OF PROPERTY, FEBRUARY 1, 1893.

(Photographs and Plans on File.)

Real Estate:		
Lots 10, 11 and 12 in Block 49, Cooley & Gurnsey's Addition (adjoining C. M. and St. P. R. R. tracks)		$225.00
Frame building containing:		
Dynamo room, 24 x 40	$576.00	1,504 80
Boiler room, 39 x 36	782.40	
Coal shed, 16 x 28	134.40	
Coal shed addition, 5 x 8	12.00	
Steam Plant:		
One Ball Tandem Compound Engine, 11 in. x 19 in. x 14 in.		1,800.00
Two Atlas H. R. T. Boilers, 66 in. x 16 ft. with 64 4 in. tubes each		2,000.00
One Buffalo Duplex Steam Pump, 6 in. x 4 in. x 6 in.		125.00
One Artesian Well Pumping Engine, 6 in. x 24 in.		850.00
One Iron Water Tank 48 in. x 14 ft.		175.00
One Wainwright Corrugated Water Tube Heater, 150 h. p.		160.00
One Globe Injector		45.00
Three Steam Gauges, 8 in.		24.00
One Nathan Double Sight Feed Lubricator		18.00
Two Detroit Lubricators, 1 pint and ¼ pint ($7, $3.25)		10.25
Steam and water piping and valves		250.00
Settings and foundations for boilers and engines		500.00
Belts:		
One leather belt, 53 ft. long x 14 in. wide		93.28
One " " 88½ ft. " x 8 in. "		33.12
One " " 7½ ft. " x 8 in. "		12.75
One canvas " 8½ ft. " x 7½ in. wide (extra)		16.94
Electric Plant;		
One K 12 Arc Dynamo, No. 3,417, capacity 30 1,200 c. p. lamps		850.00
One A 70 Alternator, No. 617, capacity 1,300 16 c. p. lamps		2,200.00
One D 3 S Exciter Dynamo, No. 2,043, 110 volts.		182.50
Sixteen 1,200 c. p. arc lamps (in use) @ $25		400.00
Seven " " (in stock) @ $25		175.00
One Controller Magnet for arc dynamo (included in price of dynamo)		
One buckle switch for arc circuit		10.00
One Lightning Arrester for arc circuit, No. 4,901, Type A		7.00
Two Lightning Arresters for incandescent circuit, Nos. 1,010 and 1,011		14.00
One D. P. Switch, 75 ampere, for incandescent circuit		10.00
One S. P. Switch, 30 ampere, for incandescent circuit		3.00
One Current Indicator, 72 ampere, for incandescent circuit, No. 1,685		20.50
One Current Indicator, 34 ampere, for incandescent circuit, No. 745		20 50
One Potential Indicator, 64 volts, No. 773		30.00
One Ground Detector, Type A No 112		15.00
One Rheostat Type 43, No. 4,362		40.00
One " Type 65, No. 5,024		20 00
One Station Transformer, Type 18, 52 volts, No. 15,818		120.00
One Arc Cut-out		3.00
Foundations for dynamo		100.00
Total		$11,519.11

Total brought forward	$11,519.11
Pole Lines:	
30 40-foot poles	erected, 1,979.00
94 30- " "	
18 30- " " (in stock)	
6,816 ft. No. 2 wire	
40,361 ft. No. 6 wire	
1 coil No. 2 wire (in stock)	
1 reel No. 4 wire (in stock)	
120 4-pin cross-arms	
5 2-pin "	
24 4-pin " (in stock)	
9 2-pin " (in stock)	
4 break-arms	
Transformers:	
Two 1—E, Twelve 2—F	erected, 3,426.00
Nine 2—E, Six 3—F	
One 3—E, Nine 5—F	
Two 5—E, One 1[illegible]—F	
One 8—E, Eleven 8	
Two 25—B, One 5	
Eight 1—F	
Meters:	
Thirty-eight, 10 amperes, 50 volts, $10 each net.	380.00

No. 7,022	1—2	constant.	22,151	26,944	22,0.8
" 7,059	1—2	"	22 060	27,026	22,0.0
" 7,156	1—2	"	22,263	24,167	22,114
" 7,[illegible]41	1—2	"	21,98[illegible]	24,624	22,358
" 7,162	1—2	"	21,818	24,684	22,36[illegible]
" 7,847	1—2	"	21,56[illegible]	24,208	21,685
" 7,605	1—2	"	25,336	24,210	21 482
" 7 161	1—2	"	26,1[illegible]3	28,170	21,686
" 21,869	26,186	27,954	25,629	21,947	21,568

Twenty-four, 15 amperes, 50 volts, $13 each net.	312.00

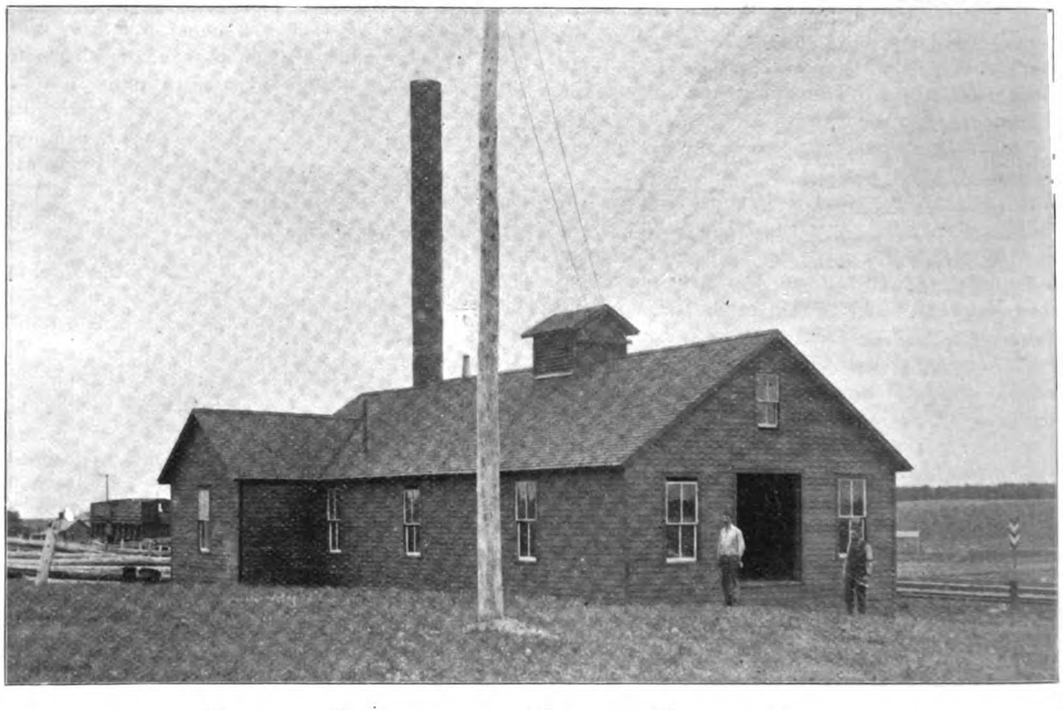
No. 15,951	1—2	constant.	19,348	19,450	19,193
" 19,168	1—2	"	19 440	19,729	19,471
" 19,251	1—2	"	19,784	19,[illegible]53	20,061
" 19,246	1—2	"	19,882	20,070	20,062
" 17,954	1—2	"	19,490	21,162	
" 18,[illegible]43	1—2	"			
" 19,481	1—2	"			
" 19,470	1—2	"			
" 19,262	1—2	"			
" 15,958	1—2	"			

Nine, 25 amperes, 50 volts, $16.50 each net					148.50
Type 1 1-4,	No 5,3 0	Type 1 1-4,	No.	5,150	
" "	" 5,075	"	"	5,363	
" "	" 5,0 2	"	"	5,146	
" "	" 5,092	"	"	5,36[illegible]	
" "	" 5,088				
Two, 50 amperes, 50 volts, $18.50 each net					37.00
Type 2 1-2.	No. 6,2[illegible]5				
" "	" 6,298				
One, 100 amperes, 50 volts, $25 each net					25.00
Type 5,	No. 7,761				

Tools and Fixtures:	
One Buffalo scale, capacity 3,500 lbs.	61.00
One combination vise	15.00
One 5-foot crowbar	1.85
One 3-foot crowbar	.95
Three round-nosed shovels, long handles	3.00
Three spoon shovels, long handles	1.50
Two scoop shovels	2.25
One coal pick	.75
One flue scraper	1.50
One steam flue blower	17.00
One " " damper	11.00
Four step ladders	6.00
Five pikepoles	3.00
One pair of come-along blocks	1.10
Two digging bars	3.00
One canthook	1.25
One pole support	2.50
One lantern	1.25
Fifty ft. 1 in. rubber hose and nozzle (hose $8, nozzle 65c.)	8.65
Fifty ft. 1½ in. rubber hose and nozzle (hose $12, nozzle $1)	13.00
One iron wheelbarrow	10.80
Two oil tanks 30 gals. and 25 gals	12.00
One oil filter, 3 gals	4.00
Three oil cans	.75
One cross-cut saw	1.75
One brace	2 00
One 3-16 in. bit	.40
Total	$18,051.86

Total brought forward	$18,051.86
One pair 8 in. side-cutting pliers	1.25
One meter sealing tool	5.00
Nine wrenches for engine, assorted sizes	12.00
Two steam radiators	25.00
One force pump and cylinder, two pieces of shafting, two iron pulleys, two wooden pulleys (belonging to old well pump)	75.00
36 arc globes	7.50
	$18,177.11
Add for freight, engineering services and other services, switchboard and extras	2,500.00
Total	$20,677.11

In this schedule there is one A 70 alternator, No. 617, with a capacity of 1,300 incandescent lights. This 1,300 light A. C. machine had been installed some little time preceding the breaking down of the plant in anticipation of a boom in the lighting business in the town, and on just what basis such a boom was predicted in a town of such size it would be difficult to say. We are however informed on good authority that the number of lights in use never exceeded 600. The appearance and general condition of the enlarged station of the Mitchell Electric Company can be appreciated fully from the accompanying illustration. The arrangement of the plant also in this enlarged station is shown in the photographic reproduction of the official plan.



ENLARGED STATION OF THE MITCHELL ELECTRIC COMPANY.

We also print a copy of the official Trial Balance of the Mitchell Electric Company for the twelve months ending April 30, 1894:

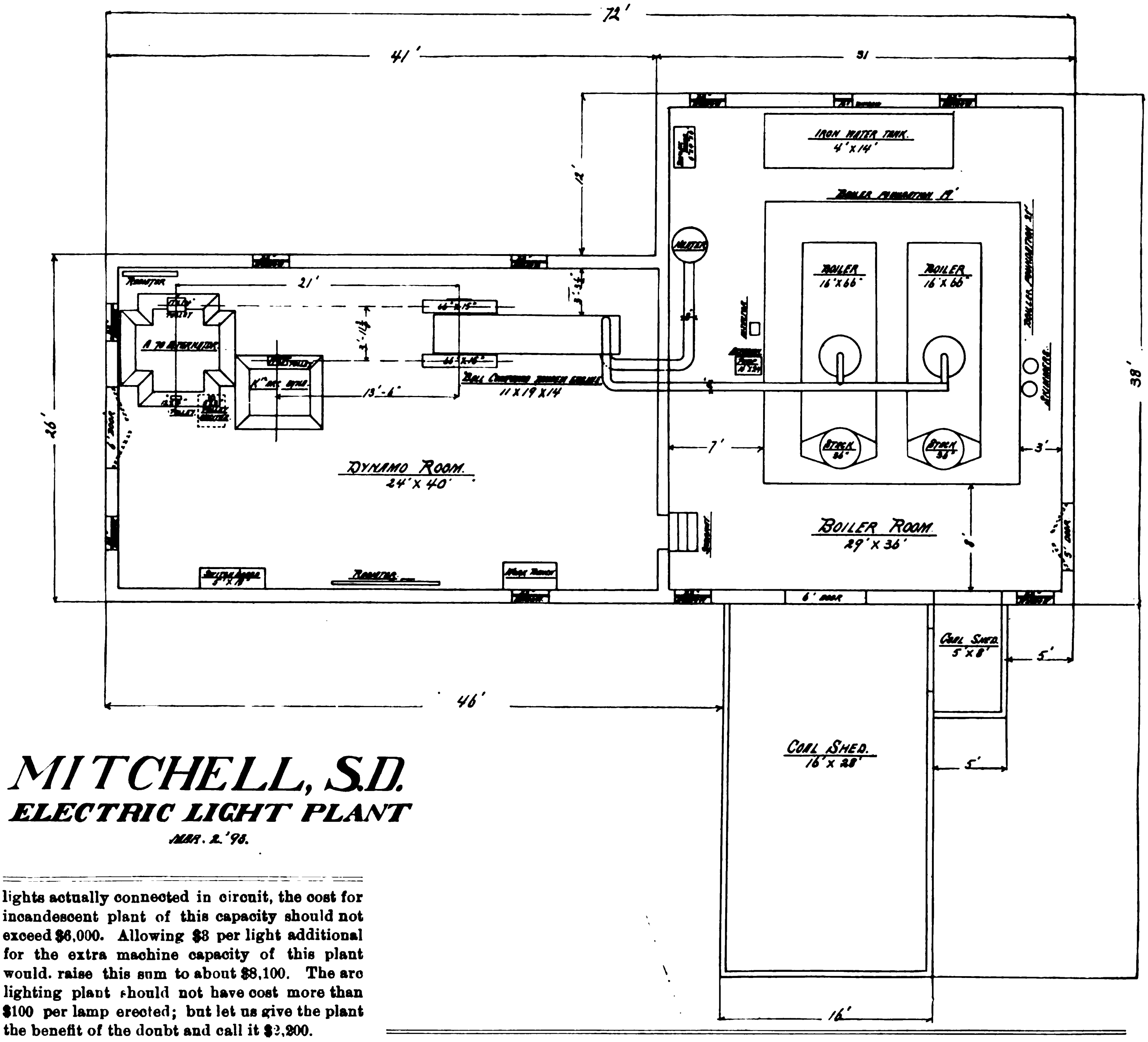
[COPY.]

MITCHELL ELECTRIC COMPANY.

TRIAL BALANCE, APRIL 30, 1894.

Plant account	$44,100.73	
Discount	98.54	
Repairs to buildings	88.99	
Accounts receivable	4 5.60	
General expense	81.77	
Fuel	972. 1	
General office expense	160.00	
Oil and waste	47.12	
Carbons	27.00	
Repairs to electric plant	19.85	
Repairs to steam plant	76.20	
Insurance	424.75	
Wages engineer and fireman	825.00	
Wiring account	13.40	
W. N. Hollands	6.80	
Taxes	365.29	
		$47,581.84
Credits.		
Capital stock	$15,000.00	
Bonds	15,000.00	
Notes payable	13,364.65	
Northwest General Electric Company	25 14	
Profit and loss	1,436.77	
Earnings	1,670.01	
Cash (overdraft)	67.95	
A. B. Hager	1 9.75	
W. A. Rogers	65.00	
Weed & Lawrence	140.00	
Geo. Fuller	53.04	
Robinson & Cary Company	5 03	
O. D. Buchecker	30 00	
Whitebreast Fuel Company	166.75	
Standard Oil Company	12.46	
Treasurer Davison County	365.29	
		$47,581.84

We desire particularly to call the attention of our readers to the item of "Plant Account, $44,100.73," that they may compare this amount with the valuation given by us in the schedule of property of $20,677.11. Every one familiar with these matters will admit that our valuations have been in error, if at all, on the side of liberality. We see therefore that the plant of the Mitchell Electric Co. carried on the books at $44,100.73, could not have cost over $20,677.11, leaving a discrepancy between book value and actual value of $23,423.62.



MITCHELL, S.D.
ELECTRIC LIGHT PLANT
MAR. 2. '93.

As we have previously stated, the average cost of erecting an alternating incandescent plant was about $10 per light, and as there were only 600 lights actually connected in circuit, the cost for incandescent plant of this capacity should not exceed $6,000. Allowing $8 per light additional for the extra machine capacity of this plant would raise this sum to about $8,100. The arc lighting plant should not have cost more than $100 per lamp erected; but let us give the plant the benefit of the doubt and call it $2,200.

If to this be added $45 per H. P. for steam plant erected, and size of plant be stated as 200 H. P., this would make $9,000. With an addition of say $1,700 for station building and land, the entire maximum cost of such a plant should not exceed $21,000.

It is absolutely certain that there could be no legitimate charges on the books of the Northwest General Electric Company which could swell the sum of the investment to $44,100.73, and such charges as bring the plant account to that figure must have been made up of all the costs of the various changes which took place, and, possibly, of all the losses which had been incurred in the operation of the plant up to that time. We defy anyone in the electrical business to justify any such charges against a plant of this magnitude, and we consider this a striking example of electrical bookkeeping as practised by some of the concerns in this country and as distinct and positive evidence of an effort to swell the assets of the Northwest General Electric Company far beyond the bounds of honesty, and for the purpose of misleading stockholders of that company. We claim, and we believe justly, that the charges against this plant are absolute proof of the fact that the book values of these plants were totally different from the actual values—the actual values being, as a matter of fact, vastly less.

We have shown with sufficient clearness, we think, in the earlier part of this article that there was no reason to hope for success for any electric lighting plant in the town of Mitchell. We have shown from the official records the failure of the plant, as at first installed, to pay its way, its remodelling, capitalization, etc., by successive steps. Now let us trace the progress of the plant in one special particular. From the various official trial balance sheets in our possession, we show herewith what the debts of the concern were at different periods from February, 1893, to April, 1894, as follows:

Date of trial balance.	Notes and floating debt.
February 28, 1893	$18,193.43
March 31, 1893	18,296.62
May 31, 1893	18,308.29
June 30, 1893	18,318.27
July 31, 1893	18,571.72
April 30, 1894	14,425.06

The indebtedness thus appearing in the accounts of the "Mitchell Electric Company" was made up partly of charges for machinery, apparatus and supplies furnished and of money advanced to make changes in or pay for additions to the plant and for money advanced to meet the deficiencies resulting from its operation. When the charges for these items accumulated to a sufficient extent, the "Mitchell Electric" or other "Company" was called upon to pay up, and this was done by the officers of the "Company" making notes for the amounts, which notes were made payable to the Northwest Thomson-Houston Company or the Northwest General Electric Company, and were discounted at various banks, or by individuals, and the interest, or the difference between the face value of the notes and the money actually received for them, was again charged to the plants. In this way the Northwest Company was, in reality, making and discounting its own paper under the guise of other concerns, and charging as an asset on its books the losses incurred in the operation. This may be designated as "scientific skinning" of a most advanced character. Properly speaking it was fraud, and nothing but the vilest kind of fraud at the best.

Thus, month by month, the floating debt of the "Mitchell Electric Company" steadily increased, and the increasing burden of debt was made to appear as an asset on the books of the Northwest Thomson-Houston Company and the Northwest General Electric Company.

In January, 1891, Mr. Robertson stated that the investment in the original grist-mill plant was about $12,000, but the official trial balances of the Mitchell Electric Company show that, step by step, the "investment" apparently increased to nearly four times that sum, and with each increase in the expenditures on the plant there was a corresponding swelling of the *apparent* "assets" of the Northwest Thomson-Houston Company or the Northwest General Electric Company.

We think it is obvious that in this Mitchell electric plant there was at no time a *bona fide* sale of any of the machinery, apparatus and supplies used in its erection and operation; but it is a fact that there was a fictitious expansion of the volume of business done by the Northwest sub company and by the Thomson-Houston Electric Company and the General Electric Company, by the trickery resorted to in the exploiting of the scheme. We shall show conclusively that this was the general plan pursued all over the country by the management of the Thomson-Houston Electric Company and the General Electric Company, and was in fact the one which Mr. Coffin, in his 1894 report to the stockholders of the General Electric Company, referred to in the following language: "The Thomson-Houston Electric Company (the organization of which was mainly adopted by your company) . . . had been in the habit of doing more or less exploiting work. . . . By the facilities which it had thus been able to afford to local enterprises, it was able to expand its business." But we shall also be able to show that a very large percentage of the assets, and particularly the items covered by the term "Notes and accounts receivable, $8,935,159.75." used in that report, were largely made up of just such transactions as were carried on in connection with the Mitchell plant.

We think that in presenting the facts relating to the Mitchell plant we have conclusively established—

1st. That the principal object of these "exploiters" was to install and operate plants without reference to questions of profitable investment, and mainly as a means of illegitimately expanding the business of the parent company, and to provide sources of revenue for that company by the sale of worthless stocks and bonds to confiding investors, for the further debauchery of the entire industry and the enrichment of a few insiders in the business.

2d. That it made no difference to these "exploiters" whether the property upon which the "Company" was founded and the stock and bonds were issued had been proved to be absolutely incapable of earning sufficient to meet the operating expenses and fixed charges—they still stood ready to, and did, capitalize it far beyond the equitable or actual investment, and were ready to dispose of the stocks and bonds, knowing that no interest could be paid on either.

3d. That up to the very last there appears to have been no qualms of conscience to disturb the concocters of this scheme or to deter them from carrying it to the uttermost limits.

4th. That while the actual amount of money involved in the transactions connected with this Mitchell scheme was very much smaller than was involved in the railroad swindles in the same territory, there was no substantial difference in the methods employed, nor was there any less depravity.

5th. That in Mr. H. M. Byllesby, Mr. Coffin had found a willing tool, capable of descending to the necessary depth of business depravity, to carry on the nefarious transactions in connection with the founding of the Mitchell Electric Company and the subsequent conduct of its affairs.

6th. That every assertion made in our introductory chapter, relating to the method pursued in forming local companies, is substantiated by the proof we have presented from the official documents printed in the series of articles on this Mitchell plant.

This is the system, manufacturers and honest workers in the electrical trade, which has resulted in the almost complete debauchery and ruin of the electrical industry, the almost entire abolition of legitimate profit, the loss of millions of invested capital, the destruction of confidence in worthy electrical enterprises, and the debasement of the manhood of many of the workers in the trade.

It is against this system that ELECTRICITY enters its most vigorous protest; and it is against this system that we will wage a relentless and most merciless warfare until it is forever wiped out of existence and those responsible for its inauguration and continuance are driven out of the business.

Thus we close the record of another one of the financiering schemes carried out under the auspices of Mr. C. A. Coffin, president of the General Electric Company, by Mr. Henry M. Byllesby, president of the Northwest General Electric Company, by which it was intended to fleece Eastern investors by unloading on them $30,000 or $35,000 of securities on a plant the actual net value of which decreased every month after it was first installed, the installation of which could never have been thought of by any one except as the basis for a fraud.

And this is the "system" inaugurated by Mr. C. A. Coffin to kill off all competitors, to enable him to control the entire electrical business of America, and which convinced Mr. J. Pierpont Morgan that he (Coffin) was the man to place in charge of the General Electric Company.

(From the Philadelphia Press.)

GRAVE CHARGES OF BOND INFLATION.

Accusations Against Electrical Companies Made By a Trade Journal.

THE ARMOURS BRING SUIT.

Strange Financiering Described in an Action Brought By the Chicago Magnates, Who Claim That They Were Duped.

From the Regular Correspondent of Press.

New York, Aug. 27.—For some weeks past the trade journal ELECTRICITY has been publishing what in many respects are the most astounding and discreditable accusations ever made against any of those financiers who have been engaged in developing the so-called industrials. The accusations were aimed at some men in the management of a corporation whose career has been in some things one of mystery, and yet with which are associated some men who have the finest repute for business integrity. This is that great corporation created by the consolidation of the Thomson-Houston and the Edison Electric Company, and which is known as the General Electric. Its career since the consolidation has perhaps occasioned more comment than that of any of the other great combinations of capital which are legally corporations but in the public mind are regarded as trusts. Some of the industrial trusts were characterized by management which after bankruptcy was revealed to have been devoid of the ordinary principles of business integrity. But the management in these cases was in the hands of men who were esteemed business sharpers, ready to undertake any piece of financing, however immoral in its purpose, which the lawyers declared was within the strict letter of the law.

But a corporation with which Mr. Pierpont Morgan and D. O. Mills and H. McK. Twombley were associated was naturally regarded as one whose management would not be characterized by those evil things which have caused so much public condemnation for trusts and monopolies. Therefore the accusations made by ELECTRICITY are all the more astounding, since if they are not true they constitute the grossest kind of legal libel, whereas if they are true they reveal a policy which in spirit, if not in law, does not differ very greatly from that of the burglar or highwayman. These charges have attracted a very great deal of attention in business circles, but it is probable that public attention would not have been directed to them had it not been for the litigation begun by Philip and J. O. Armour with one of the greater guarantee companies of New York as defendant. The Armours intimate that they were grossly duped into investing money in a railway and motor company established in the city of Tacoma in the State of Washington. As these men are known as determined fighters, ready to spend any amount of money that may be necessary to defend their rights, it was clear as soon as the litigation was made public that a fierce legal contest had been begun.

The Armours in their complaint against the New York Guaranty and Indemnity Company in the Tacoma Railway case assert that certain bonds and mortgages issued by the Tacoma Railway, and delivered by it to the Northwest Thomson-Houston Electric Company, are fraudulent and void, and at great length the complaint sets out the reasons for making this assertion.

SERIOUS CHARGES MADE.

Stripped of legal verbiage, it appears that the Armours became interested in the Tacoma company at a time when it was capitalized for $750,000. On this capitalization the president issued $1 5 0,000 in bonds, of which $1,350,000 were disposed of through the New York Guaranty and Indemnity Company. The Armours claim that they were innocent stockholders; that the bond issue was excessive and unwarranted, and that they were financed by means of a dummy syndicate. The Armours claim that in the deal resulting in the floating of these bonds there went a bonus of $910,000 in stock, and that the whole debt created exceeded the indebtedness permitted by the company's by-laws by more than $300,000, and that the whole transaction was a fraud against the laws of the State; that it was done collusively with the Thomson-Houston Company, and the entire frauds aggregated $746,000. ELECTRICITY goes further than the Armours, printing detailed statements of the condition of these properties, and asserting that they were in no condition to warrant any financiering scheme, excepting a confession of bankruptcy and reorganization.

But according to these tables and statistics presented by this trade journal the Tacoma affair was not the only one characterized by methods which are not recognized as honorable or moral by business men who believe that integrity should be a part of their capital. For instance, the experience of what is called the Northwest General Electric Company, especially in its relation to the Winona City Electric Railway Company, is set forth in great detail, accompanied by the reports of the condition of that property. It seems that in the little town of Winona, Minn., there was a few years ago a lighting plant, a horse railway with four miles of track and an almost worthless equipment. It had never been successful, was barely able to struggle along, and it was capitalized for about $25,000. The electrical financiers saw in this little company a fine opportunity for a piece of financing which might, not through legitimate returns but through the creation of something out of nothing, bring a fine profit to them. They got control of this little street railway, paying, it is alleged, about $25,000 for it. Immediately after, the capital was increased to $100,000, and $100,000 in bonds were issued. There was not business enough in Winona to make it possible to earn a sufficient sum to pay dividends on the stock and interest upon the bonds. In fact, it is alleged that it was scarcely able to pay its operating expenses, but instead of confessing bankruptcy and getting out as well as possible, these electric financiers planned to consolidate the little lighting plant and the street railway, and upon that consolidation to issue more bonds and sell them in Boston. This was done about three years ago. The inventory of the Winona Railroad Company at that time showed that its entire plant, exclusive of the franchise was worth only $83,000. The company had no power-house, buying its power and from so shrewd a company that it was compelled to pay cash weekly. It had only four miles of track, and its entire equipment of cars was seven; yet the expert accountants who examined the figures of the reports claimed that instead of any further financing the railway company should have been thrown into the hands of a receiver, since a condensed balance sheet made it appear that the capital was impaired about $34,000. Yet when the Winona General Electric Company was floated, its investment account was reported as being $288,000 in round numbers, of which $19 ,000 represented the railroad company, $60,000 improvements, and $35,000 the sum paid for the electric light company. Upon this foundation, Electricity says, with no other basis than two worthless companies, $500,000 of stock was issued and $400,000 of bonds were planned to be sold in Boston. The experts reported that the lighting company had no chance of making any money and that the railway company would have been turned over to the courts if the Northwest General Electric Company had not lent it money to meet the interest upon its bonds and notes while the financing of a larger issue was under way.

It is claimed by those who make these accusations that there was not the slightest hope that the properties could be improved by consolidation, and basing their figures upon Mr. E. E. Higgins's work upon street railway finances, it is claimed that in towns larger that Winona a capitalization of $12.50 per capita is the largest which good business interests permit. Upon that basis the Winona Company might perhaps have been capitalized for $225,000, or including the light company for $260,000; yet those who are called the Boston financiers planned to issue on that property $900,000 of obligations, or deducting $35,000 for the lighting company's share of the capitalization, there were $865,000 of securities on four miles of track, or $216,000 a mile, and on a road which never paid operating expenses; or, putting it another way, the accusation is made that $900,000 of securities were issued on a plant costing less than $300,000 and losing $30,000 a year.

FOR THE NEW ENGLAND MARKET.

The charge is specifically made that these and other securities are manufactured in this way for the New England market, it being found far more profitable to float bonds than to attend to the legitimate business of the electric company. The accusations are far more specific than it is possible to set forth in a brief report like this, which is intended only to call attention to these extraordinary charges which have been made in public print. Electricity says that it is little wonder that the Winona General Electric Company, unable to earn interest on its notes, confessed bankruptcy in less than two years after the great plan for raising the capitalization to $900,0 0 went into effect, and early in the present year it was placed in the hands of a receiver.

ANOTHER PIECE OF FINANCING.

The experience of the St. Cloud City Street Car Company is also cited as a shameless illustration of the business methods of some of these electrical financiers. St. Cloud City has only about 8,000 people. Its street railway was only four miles long, its equipment was of the cheapest sort. It had lost money every month of its existence, and although it had a nominal capital of $100,0 0, its owners were very glad to sell it for $16,000, not in cash, but in the bonds of a new enterprise. On reorganization $100,000 of stock and $125,000 in bonds were issued, or at the rate of $33,500 a mile, and that even when the company was hiring its power. The experts employed by those who are making these accusations, and who seem to have had access to the books of the corporation, reported that the total value of the property of the plant, leaving the franchise out, was only $32,0 0, so that the capitalization represented over 100 per cent. inflation. The earning capacity of this little railroad for ten months was very nearly $12,000, or a little more than $1,000 a month. Its expenses for the same time were $14,000, leaving a deficit of $2,000

Strangely enough, while the Winona system—Winona having a population of 18,000—was capitalized at $200,000, the St. Cloud system—St. Cloud having a population of 8,000—was capitalized at $225,000. The accusers say they have been unable to learn where the securities of this extraordinary enterprise were negotiated, but they are satisfied that some of them were negotiated somewhere, and perhaps they may be in the unsuspected possession of some investors in New England who will by and by view them in sorrow.

Only a few days ago an application was made in Minnesota for a receiver for this St. Cloud street car company which had defaulted the interest upon its bonds. Accusations were also made that by a similar system of financing the St. Paul and White Bear Railroad Company was made to yield handsomely for some one. "It was," says Electricity, "a veritable Colonel Sellers project, the scheme being to utilize a steam road, so that it would be possible to manufacture stocks and bonds, and float them after the methods described in the other cases."

Of course the financier who seems to be most severely attacked by these accusations is President Coffin, and it is his misfortune that his management of the great electric trust of which he is president has been such that business men of integrity do not rise up and defend him. There is, of course, recollection of the extraordinary success which attended the financing of the little Thomson-Houston Company. As a maker of bonds he has no equal. Jay Gould himself could not begin to compare with him. Electricity says "that in accordance with Mr. Coffin's methods every single railway property whose name appears upon the General Electric list was capitalized from 100 to 900 per cent. more than it should have been." There has always been some mystery about the reason which led Mr. Twombley and Mr. D. O. Mills to retire from the General Electric Company as directors. Their friends have said that notwithstanding their most strenuous efforts they were really unable to find out very much about the affairs of the company, and decided that they did not care to remain in association with a company whose management was so much a mystery for the directors. It has been one of the reports of the street for some time that one of the directors has no personal relations whatever with Mr. Coffin, and that there has been surprise expressed that Mr. Morgan should have remained in association with a man whose brilliancy as a financier is acknowledged, but of whom so many men of high character are speaking as they do.

The impression is, however, that Mr. Coffin remains as president of the General Electric because it has been found impossible so far to fix upon any man who will take his place. These operations in the Northwest of which accusations are made only affect the General Electric Company indirectly because those Northwestern companies were only the creations of some of the individual members of the General Electric, and were thus allied in interest to it. It is charged, however, that these financial operations in the Far West and Northwest are very much like some of those which distinguished the development of the Thomson-Houston Company before it was consolidated with the Edison. Those developments, however, were almost wholly in New England, whereas after consolidation it was possible to have the whole country for a field.

These accusations are reported at some length because they have now become a matter of a good deal of public interest, and because while they remain unanswered the impression is certainly increasing that there must have been foundation for them. Holland.

Electrical Work in Japan.

Japan has been quick to take advantage of electrical applications in her mining industries. Although the cheap labor is rather an obstacle to the installation of power plants, they are making headway, and, judging by the figures recently given out of the value of Japan's electrical imports, this country is gaining the business very rapidly. According to a German authority, the value of dynamos exported from Germany to Japan in 1892 was 73,741 yen, which far exceeded that from Great Britain or the United States; in 1894, however, those imported from Germany amounted to 18,120 yen, from England 49,222 yen, and those from the United States 145,200 yen.

THE PROPOSED MAGNETIC UNITS.

In view of the interest attaching to the proposed magnetic units and the nomenclature involved, as well as the stand which Electricity alone of all American electrical papers has taken, we reproduce herewith matter which has recently appeared on the subject in the columns of our esteemed English contemporary, the London *Electrician:*

Magnetic Units.

At the Oxford (1894) meeting of the British Association, Prof. Oliver Lodge, at the request of the Electrical Standards Committee, undertook to draft for future discussion a paper on Magnetic Units. This paper has been circulated among the members of this committee, and with a view of obtaining opinions on this subject from those who are not members we have been desired to give space to Prof. Lodge's paper in the columns of the *Electrician*.

Believing that the committee is impressed with the convenience of affixing names to some of the more important units connected with the magnetic circuit, I beg to suggest the following considerations and recommendations, which I will write out as briefly as possible. The statements are intended to be precise in their terms; but in several cases alternative forms of definition are given.

1. That the unit coefficient of self-induction, though frequently useful, is by no means one of the most fundamental units, but should be defined in a suitably subordinate manner with reference to other and more important quantities.

2. That it would be a mistake so to define it as to discourage the employment of the same term for as many other quantities of the same "dimensions" as possible, especially for the unit coefficient of mutual induction and for unit "permeance."

3. That the essentially different quantities commonly called H and B should be carefully kept distinct, although their measures in air have been conventionally so arranged as to be numerically equal.

[*Summary of known facts and definitions.*—H being the intensity of magnetic force at a point, or the slope of magnetic potential (ω),

$$\omega_a - \omega_b = \int_a^b H\,ds, \text{ along any length } ab;$$

and in a closed magnetic circuit the circuitation of H is equal to 4π times the total electric current through the area bounded by the magnetic circuit; or,

$$\text{cycle} \int H\,ds = \text{circuitation of } H = \iint 4\pi\,c\,dS = 4\pi C,$$

or, at any point of space,

$$\text{curl } H = V \wedge H = 4\pi c,$$

where c is current density.

If the electric circuit consists of n turns of wire threading the magnetic circuit, and each conveying the current C_1, then $C = nC_1$.]

FIRST QUANTITY TO BE NAMED.

4. The first thing requiring a name is this quantity *magnetic potential*, sometimes called *magneto-motive force*, a quantity spoken of and measured, not inconveniently but with insufficient generality, by electrical engineers as ampere-turns. It has been proposed (by Mr. Heaviside, for instance,) that it be called *gaussage*, and that its C.G.S. unit be one *gauss*.

5. The circuital gaussage round a closed curve is 4π times the total electric current through the area bounded by that curve.

In the case of a magnetic circuit wound with wire the gaussage is $1\frac{1}{4}$ times $\left(\frac{4\pi}{10} \text{ or } 1{\cdot}2566\right)$ the ampere-turns threading that circuit.

Note.—It *may* be best to retain the word "gaussage" for the whole of a closed circuit only, and to speak of the difference of magnetic potential between two points as the fall of gausses or the "gauss-fall" from a to b.

6. The gaussage, or gauss-fall, in any portion ab of a magnetic circuit, is measured by the change in the potential energy of a unit pole as it moves from a to b by any path which involves neither the cutting of magnetic layers nor the

encircling of currents (a long channel being imagined for its motion through solid material if necessary). Or, more practically, it is measured by the induction through a long narrow tube whose ends are at *a* and *b* respectively, divided by the permeance of that tube. (*Cf.* Chattock on a magnetic potentiometer, *Phil. Mag.*, July, 1887.)

In practice, however, gaussage is frequently calculable from the ampere-turns to which it is due.

7. Intensity of magnetic force, or H, will be naturally expressed as gauss-fall per centimeter, or the *gauss-gradient.* For instance, the earth's horizontal intensity at some place is 0·18 gauss per linear centimeter, or 5·4 gausses per foot.

Note.—H should not (strictly speaking) be expressed as so many lines per square centimeter; that mode of expression should be reserved for induction-density B. H is the cause, and should be thought of as the slope of magnetic potential, B is the effect. In a medium of so-called unit permeability the two quantities are numerically equal, but they should not be confounded, any more than the slope of electric potential, or electric-intensity (e) should be thought of as identical with current-density, even in a medium of unit conductivity.

8. The gauss-gradient inside a long or closed magnetic solenoid of length l, wound uniformly with n turns of wire each conveying the current C_1, is $4\pi n\, C_1 / l = 4\pi n_1\, C_1$, where n_1 is the total number of turns of wire (in all the layers) to the linear centimeter.

This is the measure of H in the interior of such a solenoid, quite irrespective of the material with which it may happen to be filled.

SECOND QUANTITY TO BE NAMED.

9. The second quantity requiring a name is the *total induction* in a magnetic circuit, also called "total flux," "total lines," "electromagnetic momentum," and "electrotonic state" It is the quantity whose time-rate of variation gives the voltage induced in an electric circuit surrounding it once. It is proposed that its practical unit be called a "weber," and be defined as equal to 10^8 C G.S lines (or unit tubes) of induction.

(Denote the quantity for the present by N, and its density by B.)

[*Summary of Known Facts.*—e being the intensity of electric force, or the slope of electric potential, or the volt-gradient at a point; the circuitation of e = the induced E.M.F. in a closed circuit = the rate of change of induction through it;

or, $$\text{cycle}\int e\, ds = \mathrm{E} = -\dot{\mathrm{N}} = -\iint \dot{\mathrm{B}}\, d\mathrm{S};$$

or, at any point of space,

$$\dot{\mathrm{B}} = -\operatorname{curl} e = -\mathrm{V} \triangle e.$$

Through a simple closed electric circuit of constant resistance,

$$\mathrm{N} = -\int \mathrm{E}\, dt = \int \mathrm{RC}\, dt = \mathrm{RQ}\ ]$$

10. The total induction through any area may be practically measured by suddenly surrounding it with a closed wire circuit of n turns connecting the terminals of a ballistic galvanometer, and measuring the quantity of electricity thereby impelled through the galvanometer. The induction is equal to the quantity so impelled, divided by n times the resistance of the circuit. If the quantity is 1 coulomb, and the resistance 1 ohm, the induction is $1/n$th of a weber.

Or, otherwise, if the induction through any boundary changes at the rate of 1 weber per second, the E.M.F. excited in that boundary is 1 volt.

In the case of a spiral wire circuit through which induction is varying at the rate of a weber per second, 1 volt is excited *in each turn* of the wire.

11. *Another* mode of measuring the total induction through an area is to surround that area with a movable electric circuit of n turns of wire conveying a known current, and to measure the potential (or mechanical) energy of the circuit under those conditions. The induction is equal to the potential energy of the circuit divided by n times the current circulating in each turn of wire.

Or, if the induction through a simple circuit carrying 1 ampere is 1 weber, the potential energy of the circuit is 1 joule.

DERIVED QUANTITIES.

12. Induction density, or B, may be expressed as so many webers per unit area—say per square centimeter or per square inch, or whatever is preferred for practical purposes.

For instance, the earth's horizontal induction density at some place is 0·18 C.G.S. unit = 0·18 $\times 10^8$ weber per square centimeter = 18 microwebers per square meter.

13. The inductivity (μ), or absolute permeability of a medium at any point under specified circumstances is the ratio of B to H at that point and under those circumstances. In many substances this ratio is far from constant. [It may be expressed in terms of henries or other units of permeance per unit length (see below), instead of in C.G.S. units, if convenient. For example, the inductivity of air is $\frac{1}{100}$th of a microhenry per centimeter, or one millihenry per kilometer.] More explicitly it is measured by the webers per unit area divided by the gauss-fall per unit length; in other words, by the ratio of the weber density to the gauss-gradient.

14. The relative inductivity of a substance as compared with that of empty space (μ / μ_0) may be called simply its "permeability" as at present, and is a mere number.

[Its electrical analogue is specific inductive capacity (K/K_0), as contrasted with absolute electric inductivity (K); which latter could be defined in practical units as the ratio of the coulombs displaced per unit area to the volt gradient]

THIRD QUANTITY TO BE NAMED.

The third quantity for whose unit a name is required is some form of ratio between the two fundamental quantities whose units are here named after Weber and Gauss respectively. It has been practically decided in America that this unit shall be named after Prof. Henry, of Washington, but the precise definition has not yet been agreed upon.

There are two quantities of the same physical dimensions to which the name is applicable, viz., the coefficient of self or mutual induction of a coil or coils of wire, and the permeance or inverse reluctance of a magnetic circuit.

The most logical order is to define permeance, first, as the ratio of the webers of induction to the exciting gaussage, and then to say that the inductance of a coil of n turns of wire is n^2 or $4\pi n^2$ or $0{\cdot}4\pi\, n^2$ times the permeance of the magnetic circuit which it embraces, according to the units of gaussage and current which have been decided on.

If the units of gaussage and current are both the C.G.S. units, then $4\pi\, n^2$ is the numerical factor connecting inductance with permeance.

If the C.G.S unit of gaussage is adopted along with the ampere current, then $4\pi\, n^2$ is the factor.

But if the circulation of H due to *one ampere-turn* is adopted as the practical unit of gaussage, then n^2 is the factor, and the permeance of a cylinder, instead of being simply $\frac{\mu \mathrm{A}}{l}$, is $\frac{4\pi\, \mu \mathrm{A}}{10 l}$.

The apparent simplicity of this last system has much to recommend it for commercial use, though it will complicate the specification not only of permeance but also of magnetic fields and potentials; but *some* inconvenience, due to the unfortunate definition of the unit pole and the only less unfortunate definition of the practical unit of current, cannot be avoided; and our aim must be to place the inconvenience where least likely to be felt in every day work.

FIRST SYSTEM.

We will begin with the more logical system, and with general statements which apply to both.

15. In a complete magnetic circuit the ratio of the total induction to the corresponding gaussage under specified conditions is called the "permeance" of that circuit under those conditions. It is not in general constant.

Or, the permeance of any solenoidal portion of a magnetic circuit, if free from intrinsic magnetomotive force or magnetic boundary layers, is the webers through it divided by the gausses between its ends.

16. The practical unit of permeance is that of a circuit in which a weber is excited by a gauss. Its reciprocal is the unit of reluctance. The practical unit so defined is 10^8 C.G.S. units.

Examples.—The permeance of a cubic meter of air to parallel induction from one face to the opposite is 1 microweber per gauss.

Under circumstances such that the permeability of iron is 400 times that of air, the permeance of an iron ring of one decimeter cross-section and one meter in mean diameter is $\frac{400\pi\, r^2}{2\pi \mathrm{R}} = 20\, r$ = 100 C.G.S. = again 1 microweber per gauss.

It is, perhaps, a question whether this amount of permeance could be called a "microhenry" without confusion.

[*Explanation.*—The inductance (or self-induction coefficient) of an electric circuit consisting of n turns of wire, so far as it is constant, is defined to be equal to n times the induction produced through it by a current of 1 ampere in each turn. But the gaussage due to n ampere-turns is $\frac{4\pi n}{10}$ or $0{\cdot}4\pi\, n$; hence the inductance of a wire coil is $0{\cdot}4\pi\, n^2$ times the webers caused by each gauss in the magnetic circuit surrounded by it; *i.e.*, is $0{\cdot}4\pi\, n^2$ times the permeance of that circuit considered as constant.]

17. A coil of wire threading n times a complete magnetic circuit of unit permeance under any given circumstances is said to have $0{\cdot}4\pi\, n^2$ units of inductance under those circumstances; and in general the inductance of a coil of n turns is $0{\cdot}4\pi$ n^2 times the permeance (as above defined) of the magnetic solenoid enclosed by it. (The permeance may here be considered variable.)

[With the ampere-turn as unit gaussage the $0{\cdot}4\pi$ is prefixed similarly to both inductance and permeance, so that only the factor n^2 is needed to convert one into the other. See below.]

18. The C.G.S. unit of inductance is equal to n times the induction excited through a coil per C.G.S. unit of current in every turn of wire; whereas the practical unit of inductance is n times the webers excited per ampere; hence the practical unit of inductance is 10^9 times the C.G.S. unit.

The practical unit is called a "henry." (It has also been called secohm and quadrant.)

Example.—If the above iron ring were wound closely with 1,000 turns of wire, the coil would have a coefficient of self-induction equal to $\frac{4\pi}{10}$ or $1\tfrac{1}{4}$ henries whenever the permeability of the iron was 400.

A coil of 20,000 turns of wire, wound closely on the same core, would have an inductance of $1\tfrac{1}{4}$ henries if it contained air or other non-magnetic substance.

ALTERNATIVE MODE OF DEFINITION OF INDUCTANCE ON FIRST SYSTEM.

In view of one of the above practical methods of measuring induction experimentally, the inductance of coils of wire, both self and mutual, may be defined more directly thus:

19. When of two simple circuits one conveys a current, the other in general has induction caused through it, and the ratio of the induction through either to the inducing current in the other is called the mutual inductance of the circuits.

20. Of two coils, with n n' turns respectively, the total mutual inductance is to be reckoned for every turn of wire on each coil, and is therefore $n\, n'$ times the inductance of the mean turn of one coil on the mean turn of the other.

21. The mutual inductance of two coils is 4π $n\, n'$ times the permeance of the largest magnetic solenoid which threads both. For if every turn of one conveys a current C, while every turn of the other surrounds an induction N′ in consequence, the permeance of the magnetic solenoid threading the second coil is $\mathrm{P} = \mathrm{N}' / 4\pi\, n\, \mathrm{C}$; but the total effective mutual induction, M C, through all the turns is $n'\, \mathrm{N}'$; hence $\mathrm{M} = 4\pi\, n\, n'\, \mathrm{P}$.

22. When two coils each conveying one ampere are constantly connected by one henry of mutual inductance, the kinetic energy of the field due to their mutual action is one joule.

23. If the *self*-induction coefficient of a coil is being considered, its total inductance may be taken as n^2 times the inductance of the mean turn; that is n times the total induction through it divided by the inducing current. Or the weber-turns per ampere give the self-inductance in henries.

24. The practical unit of inductance, whether self or mutual, is called a henry; and a coil of n turns has a henry of inductance, on itself or on another of n' turns, when an ampere in one maintains $1/n'$ weber of induction (through itself or) through the other.

25. When the induction through a coil varies for any reason at the rate of one weber per second, the E. M. F. generated in each turn is one volt.

26. When the inductance of a coil is one henry, on itself or on another, a small variation of current in it at the rate of one ampere per second induces an E. M. F. of one volt in itself or in the other.

27. When the inductance of a coil conveying one ampere varies at the rate of a henry per second, the induced E. M. F. is one volt.

28. When the self-inductance of a coil is constantly, or on the average, one henry, while an ampere current is generated in it, the kinetic energy of the field due to that ampere is half a joule.

SECOND SYSTEM.

29. If instead of taking a gauss as equal to a C. G. S. unit of magnetic potential, we take the *circulation* of H caused by one ampere-turn as the practical unit of magneto-motive force, we *shall* have 1 ampere-turn $= \frac{10}{4\pi}$ C. G. S. units of gaussage.

30. The practical unit of permeance will then *be that* in which a weber of total induction is excited by each ampere-turn; in other words, it will be $4\pi \times 10^7$ C. G. S. units of permeance.

31. And the practical unit of inductance will be that of a coil in which an ampere in every turn excites $\frac{1}{n}$th of a weber through every turn; that is to say, the inductance of a coil will be n^2 times the permeance of the magnetic circuit surrounded by it.

32. The difference between inductance and permeance is only one of reckoning. Permeance is webers per ampere-turn. Inductance is weber-turns per ampere.

SUMMARY OF THE ADVANTAGES OF THIS SORT OF MODE OF DEFINING UNIT INDUCTANCE.

The special feature of this mode of defining the "henry" is that it makes inductance depend on the simple ratio N/C, or weber-turns per ampere, instead of on something more complicated.

It might possibly be defined as the ratio dN/dC, that is, as proportional to the tangent of the slope of the B : H curve; and such a definition would emphasize its variability; but certain practical advantages would be lacking, because it would be detached from any connection with the *permeance* of the circuit. The N/C ratio on the other hand instantly connects itself with permeance, and represents the slope of the secant drawn from the origin to any point of the B : H curve. It exhibits the variability sufficiently, making the inductance reach a maximum at the shoulder of the curve, and then slowly decrease as saturation sets in.

It is sometimes said—but the mode of expression is, to say the least, very inconvenient—that there are three different principles on which to define L, all leading to a different result, viz., numbering them inversely but giving them in their usual order:

(3) Energy .... $W = \frac{1}{2} L C^2$,
(2) E. M. F. .... $E = L\, dC/dt$,
(1) Total induction $N = L C$.

But the real facts to be expressed are not here exhibited. The real facts are

$$(1)\ N = LC,$$
$$(2)\ E = dN/dt,$$
$$(3)\ dW = C\,dN.$$

The essential thing to name is, therefore, N; and if 10^8 C. G. S. lines or unit tubes be called a "weber," or a "weber-turn," then a volt is a weber or a weber-turn per second, and a joule is a weber-ampere-turn. Nothing can be handier than that; and a henry can be defined as a weber-turn per ampere.

Instead of saying, as above, that there are three ways of defining L, the simplest thing is to say that two of the three equations as first given above are incorrect, except for the special and, in practice, comparatively rare cases when L is constant. Written out correctly they stand as follows:

$$(1)\ N = L C,$$
$$(2)\ E = L \frac{dC}{dt} + C \frac{dL}{dt},$$
$$(3)\ W = \tfrac{1}{2} L C^2 + \tfrac{1}{2} \int_0^C C^2\, dL.$$

It is then obvious that (2) and (3) are too complicated to base a definition upon, and that the first alone gives a feasible system.

The fact that L is decidedly not in general constant deprives the henry of any such importance as the ohm possesses; moreover it refers explicitly to rather a special thing, viz., a coil of wire, and that under specified conditions if it contain iron; hence it would be rather absurd to name this alone of all magnetic units. In the above communication, in addition to a certain mode of defining the henry, it is urged that unit total induction be named too; for this is the quantity which is of real engineering importance—this is the quantity to attain which field-magnets are built and in the midst of which armatures are spun.

It is also urged that it would be convenient if unit magnetic potential could likewise be named, since electrical engineers have shown that they have need of some such unit for the exciting cause of induction by their practical employment of the phrase "ampere turns." The introduction of a gauss unit, in some form not too obviously limited to the case of a wire-wound coil, would assist teaching and would clarify magnetic ideas.

The present writer does not presume to decide between the two alternative systems of defining "the gauss" as given above: viz., the C. G. S. unit on the one hand and the ampere-turn on the other.

APPENDIX 1.

It need hardly be said that in the last resort it rests with practical men to employ or decline any suggested system of units. Those who daily deal with the quantities under consideration are the best judges of the utility or otherwise of a suggested unit, provided always that they take the trouble to give it a fair trial, and see how it works in practice. It may be hoped that the above or similar suggestions will meet with criticism at the hands of such men, and in order to make a beginning of criticism I asked the Departmental Lecturer on Electrotechnics at University College, Liverpool (Mr. F. G. Baily), to consider them with special reference to—

(1) The large size of the weber and henry units.

(2) The handiest definition of the gauss; and

(3) The least troublesome mode of bringing in the 4π.

His reply, which is annexed, covers these points, and also incidentally refers to the quantity called I or intensity of magnetization.

Now, as must often have been pointed out, the equation $B = H + 4\pi I$ is a barbarous one, involving as it does quantities of different dimensions in one equation. Its true meaning is, of course, $B = \mu_0 H + (\mu - \mu_0) H$; which, although algebraically only a roundabout method of writing $B = \mu H$, is yet convenient, as exhibiting separately the part of the induction due to the ether and the part due to a material medium.

The customary convention of further denoting $(\mu - \mu_0)/\mu_0$ by the symbol $4\pi\,\varkappa$ (or $\varkappa$), and then christening $H\varkappa$ as the magnetization I, is likewise convenient. With this definition $\varkappa$ is a pure number, and I is a gauss-gradient or field-intensity. Another, but on the whole less satisfactory, definition, viz., the omission of μ_0 from the denominator, would make $\varkappa$ of the same dimension as μ, and I an induction-density.

The pull between two parallel magnetized surfaces of area A is $\frac{1}{2} A B H \div 4\pi$, that is to say, $NH/8\pi$, and is therefore measured in webers multiplied by the gauss-gradient, or in joules per centimeter. But to maintain an induction density B in air requires a gauss-gradient B/μ_0, hence we might write the pull across an air-gap as $N^2 \div 8\pi\mu_0 A$. If the induction-density across an air-gap is expressed in microwebers per square centimeter the tension there comes out in units of which 2,500 would make an atmosphere; or, roughly, in pounds per square foot.

As for the strength of a magnetic pole—a quantity which, though fundamental in one sense, is seldom really dealt with—it will naturally be expressed in ergs per gauss, or in joules per gauss if it is very strong.

Mr. Baily's chief practical suggestions are first that a special unit of permeance other than the henry is desirable; and next that the $4\pi/10$ had best be thrown on to the μ, so to keep the gauss equal to one ampere-turn. The fact that the inductivity of air will then cease to appear in its artificial garb of unity may even be regarded as a positive advantage, because its existence will then be less likely to be ignored. But I much fear that the ampere-turn as unit of gaussage, so near the C. G. S. unit in size and yet not equal to it, will be awkward and may lead to mistakes.

O. J. L.

(*To be continued.*)

Electricity is making progress in South Africa, as evidenced by the rapidly increasing mining plants being put in operation there. The Electric Construction Company, Limited, of London, has supplied a plant for the City and Suburban Mine, and three dynamos for the New Crœsus Gold Mining Company, near Johannesburg. The same company has equipped the New Comet Mine with an electric lighting plant, and the Wemmer Mine is also installing electric lights.

Interesting Effect Observed With the Voltaic Arc.*

Two Brianne arc lamps were installed at Havre in front of a jewelry establishment in order to light up, at the same time, both the clock and the interior, and they were to be fed by the alternating current furnished by the central station of the "Havre Electrical Energy Company."

This current had a mean electromotive force of 60 volts, and was derived from a transformer fed by a primary current of 2,400 volts.

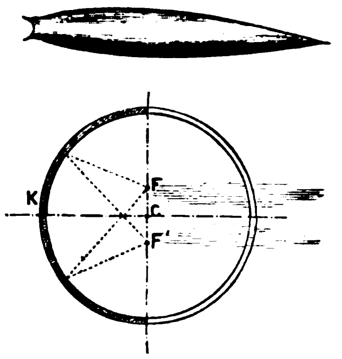
This difference of potential of 60 volts being too high to obtain a normal rate of working from a single lamp, and being besides too low for working two lamps in series, was reduced to 45 volts by the introduction of self-induction resistances on the secondary circuit, and the two lamps were connected in parallel.

Each absorbed 10 amperes when burning normally. The upper carbons of the lamp had a section of 14 millimeters and the lower carbons of 10 millimeters.

Lastly, these carbons were arranged in the center of a large globe of transparent glass, one-half of which had been silvered inside, so as to become converted into a *hemispherical reflector*.

The exterior of that part of the globe that formed the hemispherical reflector was covered with an opaque varnish, which completely hid the light on that side.

We have had to give all these preliminary details in order to facilitate the explanation of the curious phenomenon that we are about to describe.



FIGS. 1 AND 2.

When we made the first trial of these lamps in their reflecting globes, they worked at first very regularly, furnishing a satisfactory light for lighting the clock and the shop; but, after about half an hour, there was a sudden brief extinction of each of the two lamps, to which, at first, no great importance was attached.

But half an hour later another extinction occurred, followed, as before, by the immediate relighting of the lamps.

On examining the carbons, we were surprised to find that they were considerably reduced in length; it was evident that this abnormal combustion was far from being in proportion to the duration of working. The lamps were put out, and at the bottom of each globe were found two little spindles of graphite, about 4 centimeters long, pointed at one end and hollowed at the other. (Fig. 1.)

The presence of these spindles readily explained the cause of the apparently very rapid combustion of the carbons, and the successive extinctions of the arcs; but the cause of their formation seemed, at first, inexplicable.

In order to ascertain the cause of this curious phenomenon, the lamps were made to work again several times in succession, their voltage and amperage being modified; but after each fresh trial four fresh spindles of graphite, exactly similar to the first, were found.

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* Albert Nodon in "L'Electricien."

On studying this phenomena more closely, we soon found out the cause of this abnormal combustion. In fact, the carbons occupied the center of a hemispherical reflector, K (Fig. 2), and at the moment of lighting the focus made by the axis was formed at a point, F, situated above the center, C, of the sphere.

A *corresponding focus* was then formed by reflection at F′, on the lower carbon.

The result of this was that the greater part of the luminous and calorific rays were concentrated at the point, F′, and that the luminous focus, F, did not give out more luminous intensity than if it had burned with a naked light. The heat concentrated on the lower carbon soon became so great that the carbon became red hot, and began to be consumed at this point. The section of the carbon was consequently lessened by this combustion, the heating produced by the passage of the current in this resisting part was added to that furnished by the secondary reflection, and soon the section was reduced to a single point of contact, through which the arc was formed. At this moment the spindle became detached, and fell to the bottom of the globe in an incandescent state.

After the extinction produced by the separation of the spindle from the principal carbon, the action of the regulator brought the carbons in contact again, and the arc was again formed; but this time the arc was formed at F′, at a point below the center, C, of the sphere. A corresponding focus was then formed at F, and soon a second spindle detached itself from this carbon and fell to the bottom of the globe by the side of the first.

When once the cause of this defective working of the lamps was known, it was easily remedied. In fact, the reflecting globes were abandoned, as they were found to have such a disastrous effect, and they were replaced by cylindrical reflectors with a parabolic section. The lamps were arranged so that the carbons occupied, with regard to the reflectors, an axis parallel to the generators of the cylinder, and passing through the focus of the parabola. As the luminous focus was variable, we thus arrived, by a simple method, at a system of lighting which was to all intents constant during the whole of the time that the lamps were in service.

The result of this alteration was a considerable increase in the light projected and the absolutely regular working of the lamps.

In conclusion, therefore, we will advise all those who wish to use a reflector for an arc light never to arrange the luminous focus at the geometrical center of a *spherical* reflector; but we may add that there would be no objection to placing this luminous focus at the optical focus of the reflector, i.e., at a distance from the top of the hemisphere equal to half the length of the radius of the sphere, so as to project the rays in a luminous sheaf to all intents cylindrical.

Advantages of Electric Light in Bad Air in Mining.

The results of some recent experiments of Dr. Haldane have been made public. They refer to the presence of black damp; he finds that when the percentage of oxygen has fallen to 17·64 a candle is extinguished; at 3·38 per cent. of carbonic acid gas, and 15·3 per cent. of oxygen his respiration began to deepen, and at 7.32 and 9·62 per cent. respectively there was violent panting; at 7 per cent of oxygen consciousness would probably have been lost. He thus shows that there is a wide margin between the point of the extinguishing of a lamp and the point of danger to life; a miner provided with an electric lamp could therefore penetrate with impunity or escape through atmosphere containing at least three times as much black damp as would extinguish a lamp and the difficulty of respiration would give ample warning if the electric lamp did not.

The Electropoise.—II.

Methods of the Promoters Abroad.

(From Science Siftings, London.)

Our readers will readily understand how cautiously and slowly we are compelled to proceed in the matter of these revelations. We not only have to make analyses, but we have likewise to survey a vast quantity of advertisement and other literature, to inquire into testimonials, and satisfy ourselves in other cases about the antecedents of the quacks themselves. Delays, therefore, are unavoidable where so much has to be attended to, and for this reason we are unable to continue our exposé in this issue, but we shall return to it next week, making further disclosures.

We revert for the moment to the "Electropoise" fraud, in order to publish a letter from Mr. T. E. Gatehouse, whom readers of *Science Siftings* already know as one of the able conductors of the *Electrical Review*. We mentioned in our last article that Bourne, the agent for the Electropoise Company, was granted an interview by us because he stated that he called at the suggestion of Mr. Gatehouse. He added, furthermore, something that we did not deem necessary to publish last week: he claimed to have favorably impressed Mr. Gatehouse with the magically curative properties of his quack toy.

We knew that a man of Mr. Gatehouse's scientific attainments could not have been hoodwinked by so specious a sham, but we imagined that our contemporary might have reserved his opinion until the opportunity arose to express it in his own columns, and sent Bourne away laboring under the delusion that the low cunning of President John N. Webb would turn that opinion into one of gilt edged significance for the Electropoise Company.

Mr. Gatehouse, however, did nothing of the kind, and we publish below the text of a letter we have received from him:

To the Editor of SCIENCE SIFTINGS:

SIR: I have just read your third article "Crusade against Quacks." I beg to say I did not suggest that Mr. Bourne should call upon you with the "Electropoise." He intended doing so, and wanted to know where to find you. I gave him the desired information, that is all, and prepared him for the reception he might expect at your hands by personally giving him a bit of my mind, in even stronger terms than you have employed in your well-timed article.

I need scarcely say that everything you assert I can thoroughly endorse, as I have myself examined the apparatus, and was only prevented from forestalling *Science Siftings* in its exposure of this fraud by my time having been too much occupied in connection with another matter which has recently occupied the attention of a London magistrate for nearly three months. Faithfully yours, T. E. GATEHOUSE.

P. S.—But why not devote an article to condemning the practice of society journals employing writers utterly devoid of even a smattering of scientific knowledge, to extol the curative virtues (?) of these barefaced frauds, and thereby securing lucrative advertisements as the reward for bringing such bogus appliances to the notice of poor suffering humanity.

The passage in the last sentence of the first paragraph of this letter stamps the man Bourne as being an impostor and a liar of only meaner caliber than those who employ him. We endeavored last week to spare this creature, since we regarded him as the weak and ingenuous tool of strong-minded schemers. We hesitate no longer, and, after the wilful way in which he has endeavored to deceive us, condemn him along with those whose myrmidon he is.

Mr. Gatehouse also falls foul of that hybrid knight or lady of the pen yclept "the society journalist." These individuals, male and female, run riot in paths that even experienced scientists fear to tread. The society paper of to-day will give a prescription for remedying anything from a pimple to paralysis, from aortitis to a cold. This is highly reprehensible on the part of these editors who encourage the practice, and we are sorry that people are found foolish enough to follow the advice given. We believe that women are the worst offenders in this direction—both as prescribers and swallowers of the prescriptions.

The testimonials of a lay newspaper are usually of the most unreliable nature when they appertain to any branch of science. Science is a specialty of those who have made it their study, and the public should only regard scientific opinions and advice when they are offered by papers whose staffs are manned with specialists qualified in the departments dealt with. We trust Mr. Gatehouse's strong hint with regard to the advertisement *douceur* will not be disregarded, and that "poor suffering humanity" *will* benefit accordingly.

Considerable stress has been laid in these articles upon the quack device termed "The Electropoise." The story of the Electropoise fraud forms in part the subject of our second article, and the whole of the third article in this series has been devoted to the same matter. We regard the Electropoise revelations as the crown of the arch in the exposé of modern quackery. English law would speedily transform "the finest class of gentlemen in the United States" (for such is the self-description of the proprietors of the Electropoise) into a covey of jail birds. The Electropoise is an impudent and cruel fraud, and its very active proprietors are unblushing knaves who have conceived the notion of flooding our newspapers with fraudulent advertisements and raiding the attenuated pockets of our afflicted poor.

Up to date, and out-quacking every quack in cunning, boldness and extravagance, and with an apparently inexhaustible treasury, the Electropoise Company, under the generalship of "President" John N. Webb, intend if possible to occupy a larger and maybe a more notorious place than the late President C. B. Harness, of Electropathic Belt fame. Possibly the fate of M'Conville may have some occult influence, and a *douceur* of five years' penal servitude to a quack may cause these enterprising "gentlemen" to abide long in the United States and hesitate ere commencing operations in this country as threatened.

This we will say, that there is every reason to fear an invasion of England by the Electropoise quacks. Undoubtedly advertisements in newspapers and their marvelous publications would result in very large sales. It is an admission which is made with reluctance. Hence the Electropoise programme should be stamped out, not merely scotched, to revive again when these articles may have passed from public observation.

Our readers will recollect that in the third article of the Crusade against Quacks, the Electropoise was thus described: "This fraudulent instrument bears everything on its surface save the contents of the cylinder; clearly the cord and webbing are pure negations. The cylinder has been broken and examined—its contents analyzed. It is loaded with plumbago mixed with sulphur. This combination has been chosen probably because it is one of the cheapest forms of ballast that could be poured into the cylinder when in liquid or molten form. Observe the language of the "Electropoise" charlatans, who thus describe their crude and impertinent imposition: "It consists of a cylinder, called a 'Polarizer,' filled with imperishable materials, combined, after *years of study and experiment*, to produce the best possible results."

In the same article was set forth the fact that five guineas was the price placed upon this device, which a well-known City of London fancy goods dealer stated that he would hesitate to sell for a shilling in his establishment. There also appeared in the same article the extraordinary letter of President Webb, one of its chief promoters, offering a bribe to *Science Siftings*.

LEGAL NOTES.

The American Loan & Trust Company has begun suit to foreclose its mortgage upon the Olympia, Wash., Light & Power Company which has defaulted in payment of interest.

Lloyd G. Kirkland has filed a bill in the Circuit Court at Chicago asking for a receiver for the Mutual Electric Light & Power Company of Englewood, in which he makes serious charges against ex Alderman James L. Francis, formerly of the City Council.

Receivers Bierbower and Hunt, acting for the Farmers' Loan & Trust Company of New York, bondholders of the Omaha Water Company, have filed a damage suit in the United States Court at Omaha, Neb., against the Omaha Street Railway Company for $250,000 for alleged damage done to the mains owned by the plaintiff by escaping electricity from the company's wires throughout the city.

Thomas Wallace, Jr., has begun suit against the Carpenter Electric Heating Manufacturing Company for $5,900 and interest, said to be due on merchandise delivered to defendants by the Ansonia Electric Company of Chicago.

The Siemens & Halske Company have brought another suit against the Metropolitan Elevated Railroad Company in Chicago, and have asked for an injunction.

General News.

What is Going on in the Electrical World.

Stowe, Vt.—There is talk among the town officials of getting electric lights for this village.

Los Angeles, Cal.—D. M. McGarry has applied for a franchise for an electric railway forming a belt line in this city.

Bloomfield, N. J.—Paul W. Schroeder, of New York City, has applied for a franchise for lighting this town with electric lights.

Flushing, L. I., N. Y.—A movement is being made here toward forming a company to supply electric light and power for the village.

Fresno, Cal.—The city trustees have guaranteed a franchise to the San Joaquin Electric Company to operate in this city for fifty years.

Oswego, N. Y.—The Oswego street railroad has been purchased by George N. Burt and George D. Hart, representing New York capitalists.

Atlanta, Ga.—A Mr. Baer, of Cincinnati, is considering the construction of an electric line about twenty miles long from Atlanta to Douglasville.

Rush City, Minn.—Dr. A. J. Stowe, L. W. Wadlow and C. F. Jackson have been granted an electric light franchise for 30 years by the city council.

Augusta, Wis.—The vote in the recent special election on the question of bonding this town in $1,200 to put in an electric lighting plant was 112 for, 85 against.

Allegan, Mich.—F. A. Makin, representing Eastern capitalists, has been looking over the ground for an electric railway from Allegan to Saugatuck.

Owosso, Mich.—Alexander Ralph, who recently purchased the Owosso and Corunna Street Railway, is making arrangements to fit the road with electricity.

Van Buren, Ark.—The city council has granted a fifteen-year franchise to H. J. Isbel, of Parsons, Kan., to establish an electric light and power plant.

New Brunswick, N J.—The county board of freeholders have given the Brunswick Traction Company permission to build a trolley road from this city to South River.

Utica, N. Y.—The building of the Belt Line railroad has done so much to increase the growth of the city that the people are urging the company to make further extensions.

Springfield, Mass.—The move for an electric light plant in West Springfield, to be owned and run by the town, is meeting with a good deal of favor by residents of that place.

Little Falls, N. Y.—The *Times* says that, notwithstanding the opposition of certain gentlemen in Richfield Springs, the electric road from Little Falls to that village will be built.

Lansing, Mich.—The Lansing Electric Street Railway system has been sold by the Continental Trust Company of New York to the syndicate which operates a similar system at Battle Creek.

Aurora, Ill.—The council has granted a franchise to the Aurora Edison Light Company, which proposes to purchase a site and erect a $40,000 plant. Dr. I. W. Pritchard is president of the company.

New Orleans, La.—The Chalmette Railway Company has been organized with a capital stock of $100,000. President, Henry T. Beauregard; vice-president, R. C. Ducros; secretary, J. D. Alexander.

Kingston, N. Y.—The New York syndicate who have purchased the Burhans pulp mill at Winchell's Falls, together with the water power and other property, will build an electric railway from the works to Brown's Station.

Binghamton, N. Y.—A company of capitalists has offered to pay $5,000 per mile for a franchise to construct and operate an electric railroad, twelve miles long, in competition with the Scranton Traction Company's roads.

Georgetown, D. C.—The Potomac Electric Light and Power Company of Georgetown has transferred its plant to O. G. Crosby, Charles A. Lieb and J. H. Miller, who represent the Georgetown and Tennallytown Electric Railroad Company and the G. E. Company.

Manchester, Conn.—The Connecticut stockholders in the Perkins Electric Lamp Company are endeavoring to buy the stock in the company owned by Boston men, and if they are successful the company will resume operations in the manufacture of incandescent lamps at the old factory in Manchester.

Springfield, Mo.—A movement is in progress to have an electric light tower built in the center of the square, so as to give better light to the business portion of the town. It is proposed to build a steel tower 80 feet in height and have four arc lights placed thereon. Plans and specifications are now being prepared.

Canton, Miss.—The board of aldermen of Canton have let the contract for putting in waterworks and electric light plant at the cost of $85,10 . The Southern Electric Supply Company, of New Orleans, secured the contract. The plant will be owned by the city.

Tonawanda, N. Y.—There now seems to be no doubt that the apparatus to test the application of electricity to canal navigation will be ready by the day set, Sept. 24. The Lamb trolley system is to be tried. The experiment will be made on the Erie canal at Black Rock.

Keene, N. H.—The directors of the Keene Electric Railway Company have authorized a committee of three to make a contract for the construction of an electric road in Keene. The route as planned will eventually embrace Keene, West Keene, Swanzey, Factory and Marlboro.

Cohasset, Mass—It is stated on excellent authority that the New York, New Haven and Hartford Railroad will at once commence to equip that portion of the road from here to Braintree, a distance of about 15 miles, for running by electricity in connection with the Nantasket Beach branch.

Charleston, S. C—One of the sections of the revised ordinances now before the city council provides for the appointment of a city electrician every two years beginning on the fourth Tuesday of October next. The mayor makes the appointment and it must be confirmed by the council. The salary is $1,200.

Detroit, Mich.—Contracts have been let for the grading, ballasting and ironing of the new electric road between Mt. Clemens and Marine City, to be built and operated by the Detroit and River St. Clair Railway Company. The line is 32 miles long, and runs through New Baltimore and Algonac.

Waukegan, Ill.—The building of a street railway system here to be run by electricity or compressed air is now assured. A liberal franchise has been granted C. E. Lo s, a well known railroad contractor, and he gives a $5,000 bond to have a line running south from the business center to the Washburn & Moen Works by January 1 next.

Escanaba, Mich.—The city of Escanaba is now in possession of the electric lighting plant, having closed the deal for its purchase for the consideration of $70,000. Mayor Gallup appointed as a board of lighting commissioners, Solomon Greenhoot, F. D. Mead and W. W. Oliver, to serve for one, two and three years in the order named.

Monroe, Mich.—The Toledo and Petersburg Electric Railroad Company is being organized to build an electric road between Petersburg, this county, and Toledo, O. The promoters are O. S. Bond, W. S. Coon, E. C. Coon and J. J. Simmons, all of Toledo; Willis Baldwin of Monroe, and John O. Zabel of Petersburg.

Benton Harbor, Mich.—An electric railway is to be built from Coloma to Paw Paw Lake. The franchise has been secured and work will commence at once. As soon as this is completed it will be continued to this city, a distance of fifteen miles. The road will be built for the passenger and fruit carrying traffic, and will be run only in the summer.

Brooklyn, N. Y.—The stockholders of the Municipal Electric Light Company have decided to increase the capital stock of the company from $ 00,000 to $1,000,000.—The Edison Electric Illuminating Company of Brooklyn reports gross earnings for August of $51,328, an increase of $21,076 as compared with the same month of last year, and net $ 6,948, an increase of $5,597.

Salem, Ore—It is stated that F. N. Derby, superintendent of the Capital Railway, has been assured of capital by an Eastern firm to build and equip the proposed electric railway between Salem and Portland. There is ample water-power for the generation of electricity between the two points, and Mr. Derby estimates that $750,000 will put the line in operation.

Portland, Ore.—The new electric road which is to be built to Hillsboro by the Portland & Western Railway Company will be 17 miles in length when completed, and will open up quite a large section of country for suburban settlement. The promoters of the enterprise are S. Z. Mitchell, Fred V. Holman and W. F. Nelson, and the amount of the capital stock of the company is $50,000.

Conneaut Lake, Pa.—Among the improvements that will be made here before another season opens up will be the lighting of the Exposition grounds and all the buildings at that place by electricity. A large electric fountain will be one of the attractions. President S. B. Dick of the P. S. and L. E. Railroad is making arrangements to run all their passenger cars between Meadville and the lake by electricity.

Andover, Mass.—A street railway company, composed of residents of Andover and Ballardvale, is being formed to construct a railway between Andover, Ballardvale, North Andover and North Reading, with a capital of $30,000. The directors named are William H. Jowell, Joseph M. Bradley, H. Bradford Lewis, Walter H. Coleman, John M. Cole, William Od ing and Howell F. Wilson.

Philadelphia.—It is stated that a movement is on foot in this city to form a company that has for its object the absorption of six of the principal local electric light plants, namely, the Edison, Powelton, Columbia, Suburban, Manufacturers' and Diamond. According to the plan proposed it is understood that the company is to be organized with $5,000,000 capital, to be divided equally into common and preferred stock, the latter to be subscribed for with the common stock as bonus.

Wooster, O.—The Wooster, Medina and Cleveland Electric Street Railway Company's recently elected directors are: Crosby Thompson, of Cleveland; R. M. McDowell and J. Andrews, of Medina; F. H. Hawley, of Leroy; Warden Wheeler, of Creston; C. V. Hard, W. J. Mullins, A. Cunningham, L. P. Ob iger and C. W. Ka ke, of Wooster. The directors state that active steps towards building the road will be taken at once.

Lowell, Mass.—The Bradbury Stone Storage Battery Company of this city has just consummated a deal with the Electric Storage Company of Philadelphia by which the stock of the Bradbury Stone Company is guaranteed a value above its par by the Philadelphia company, and the payments for the newly acquired property are to be made in annual installments, taking the

THE TELEPHONE WORLD.

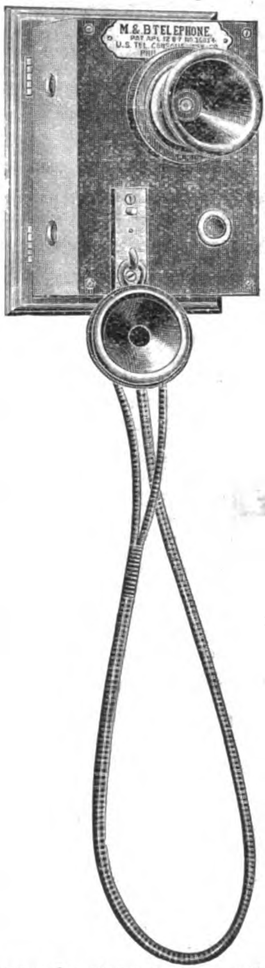
For Another Telephone Bill.

The fight for the passage of legislation intended to regulate the rates for telephone service in New York State will be renewed at the coming session of the Legislature. Several commercial organizations throughout the State have already taken action. The Pharmaceutical Association of Kings County has passed resolutions indorsing the members of the Legislature, at its last session, who voted for the Persons-Gerst bill and denouncing those who did not vote in its favor.

The Business Men's Association of Black Rock has adopted a resolution calling for a mass-meeting to be held October 1 for the purpose of considering the advisability of continuing the effort to have favorable telephone legislation enacted.

The M. & B. Telephone in a Philadelphia Club.

Since the United States Telephone Construction Company of Philadelphia has had the M. & B. Telephone on the market they have produced a variety of designs and instruments for interior use. The accompanying illustration shows one type, known as Style E, which is in use in the Manufacturers' Club, Philadelphia. This club has recently acquired property adjoining their club house and fitted it up into parlors and bachelors' apartments. There are 17 rooms, each of which is supplied with one of these Style E M. & B. Telephones. In the cashier's office down stairs there is a needle annunciator, manufactured by the Partrick & Carter Company, to which are added telephone connections and a fire alarm system. In each of the Style E Telephones is placed a fire alarm bell.



The telephone measures 4½ inches by 8½ inches and is 8½ inches deep. It is made of polished oak, finished with a black rubber face and nickel trimmings. All the batteries of this system are in the basement and are so arranged that any of the rooms can communicate with the office, or intercommunication can be effected between any points desired. The annunciator is in the hallway by the cashier's desk, where there is always some one in attendance. The service given by this arrangement is extremely satisfactory, and combining as it does a fire alarm system with the telephone system it is doubly valuable.

In case fire should be discovered, any employee can go to the annunciator, open a little door in front and pull out a plug, which releases the clockwork mechanism and starts the fire alarm going. This rings all the bells throughout the house, so that the system insures both convenience and safety to the occupants of the club.

Death of Henry H. Bentley.

Henry H. Bentley, the "father of the local telegraph," and widely known through his connection with telegraphy and electrical affairs, died on the 7th inst. at Stanford Heights, near Rhinebeck, N. Y.

Mr. Bentley was born in Dutchess County, New York, in 1884, and at the age of 20 years he went to New York City on a canal boat to seek his fortune. He got into the electrical business by becoming connected with J. B. Richards, a skilled mechanic, who was perfecting Royal E. House's printing telegraph instruments. Mr. Bentley assisted in organizing the New York City and Suburban Printing Telegraph Company, of which he was made the general manager. The company opened offices for the transmission of messages at a low rate, but did not succeed. Then Mr. Bentley proposed to the capitalists who were in the concern that they lease the lines to him for 25 per cent. of the proceeds, and they accepted. He opened offices in various hotels and other places and soon began to make money rapidly. He laid a cable to Brooklyn, which no one else had successfully done, and thus added a large and profitable business to what he already had. The success of this enterprise, it is considered, made him the father of the local telegraph business.

Soon afterward his health broke down and he disposed of his local telegraph interests and removed to Philadelphia where he was engaged as war correspondent of the "Inquirer." Shortly after the war he again took up local telegraphy and built several private lines, which were subsequently amalgamated under the management of the Philadelphia Local Telegraph Company. He organized a service for bankers and brokers and a local news service which was maintained for many years. A branch office of the local service was organized under the name of the "Gold and Stock Reporting Telegraph Company." Of this company Mr. Bentley was also the president. He was identified with the management of all the Western Union Telegraph Company's subordinate companies. Mr. Bentley helped to organize the Bell Telephone Company of Philadelphia and for eight years was its president.

Threatened Litigation in the South.

The "Tribune" of Knoxville, Tenn., states that Frank R. Colvin, representing Barton & Brown, solicitors and counselors for the Western Electric Company, has been in that city looking into the telephone patent situation. Mr. Colvin is reported having said that the People's Telephone and Telegraph Company of Knoxville has made certain infringements of the Western Electric Company's patents, and when the time comes the whole matter will be made public through the courts. J. C. Duncan, manager of the People's Company, in an interview declared that the Western Electric Company would not scare his company, as they knew what they were doing before they built their exchange.

In the Interest of the Public.

To the Editor of ELECTRICITY.

DEAR SIR: We have no doubt that your independence on the telephone situation, being, as it is, in the interest of the public, will bring you, as it deserves, a large increase of business. Yours very truly,

THE RAWSON ELECTRIC COMPANY,
T. M. BRUSH, Secretary.

Elyria, Ohio, September 9.

After repeated delays the Board of Public Works of Indianapolis, Ind., and the Phœnix Telephone Company have come to an adjustment of differences touching the matter of a telephone franchise. A contract has been executed under the terms of which the Phœnix Company agrees to establish an underground service in a prescribed district, such conduits to be of sufficient size to accommodate all other electrical wires, the rentals for which shall not exceed ten cents per lineal foot per year. Telephones for the city's use are to be furnished at $18 and $15 per year; for business houses, $42; residences, $30, if within the two mile limit. For each additional mile $6 per annum is to be added to the above rates. The company agrees to pay the city [illegible] per cent. of its gross receipts each year after and including the fourth year of its operation. The company will execute a bond for $ 0,0 0 for the faithful performance of the terms of the contract; assumes all liability for damages to person or property, and will defend all suits for alleged infringement. During the first five years the company will put in a conduit system, and after that will extend the system at the rate of 2,[illegible]00 feet each year for fifteen years. The plant is to be completed by December 31, 1896.

The exchange of the Blue Earth Valley Telephone Company at Winneboga City, Minn., has been opened, giving connection with Woodland, Nashville, Blue Earth City and Elmore. The company will, as early as possible, extend lines to Fairmont, Wells, Amboy, Lake Crystal and Mankato. When connected with the line from Mankato northward it will give this entire system connection with the Twin Cities.

The Harrison International Telephone Construction Company has given up the fight against the Bell Company in Anderson, Richmond, Fort Wayne and Terre Haute, Ind. This company had franchises in each of these places, but the local Bell companies put up such a show of fight that the Harrison Company became frightened and quit the field.

The plant of the Meridian and Tuskaloosa Telephone Company, covering the post-offices of Zero, Causeyville and Hurricane Creek, Miss., and Pashmatha, Butler, Mount Sterling and Tuscahoma, Ala., has been put into operation. Another line is being constructed to Daleville, Miss., via Marion, Topview and Lockhart.

To meet the $21 and $18 rates of the Lansing (Mich.) Telephone Exchange the local Bell Company has reduced its rates to $20 and $16. The new company has contracts for 350 instruments and will be ready to open its exchange about October 1.

The City Council of Franklin, Ind., has reconsidered the vote by which a twenty-year franchise was voted to the Phœnix Telephone Company at a previous meeting. This was done in deference to public sentiment, which is unalterably opposed to long-term franchises.

The village board of Penn Yan, N. Y., has decided to grant a franchise to W. Stanley Bruen to erect and operate a telephone system in that village. The system will be extended to Keuka and Gibson, and into Ontario County, N. Y.

The village board of West Springfield, Ill., has passed an ordinance giving the Central Union Telephone Company right of way through the village, but requiring them, after five years, to pay 4 per cent. of their gross earnings to the village.

The Pana Telephone Company proposes to build exchanges at Anderson, Tipton, Kokomo, Logansport, Summitville and Alexandria, Ind., connecting them with Elwood.

The Subscribers' Automatic Telephone Company is being organized in Cleveland, O., by prominent local capitalists. The new company is to be capitalized at $1 000,000.

The Standard Telephone and Electric Company, Madison, Wis., will supply the equipment of 125 instruments for the new exchange at Menominee, Wis.

Dr. T. W. Renshaw and William and Joseph Snyder, of Summit Hill, Pa., are promoters of the new telephone company being organized in that place.

W. B. Hardman, L. G. Hardman, T. C. Hardman and W. D. Thurmond have applied for a charter for a telephone company to build a line from Harmony Grove to Athens, Ga.

The City Council of Delaware, O., has granted an extension of six months to the telephone franchise to D. S. Fisher and associates.

An ordinance has been adopted by the City Council of Jacksonville, Fla., granting a telephone franchise to W. N. Shine and A. H. King.

The City Council of Rochester, N. Y., is considering the granting of a franchise to the Standard Electric Telephone Company.

The Wisconsin Telephone Company will make an extension of the long-distance line to Eau Claire from Madison by way of La Crosse.

The Southern Michigan Telephone Company has a franchise at Schoolcraft and will put in instruments at $8 and $12 a year.

E. A. Buck, of Douglas, Ga., will build a telephone line from Douglas to McDonald's Mill.

S. B. Kinard will erect a telephone line from Jackson to McDonough, Ga.

Louisville, Ky., now has long-distance telephone connections.

T. A. Parrish is organizing a telephone company at Pine Bluff, Ark.

P. E. Blumer will establish a telephone system at Ellisville, Miss.

Telephone exchanges are proposed at Stanford and Paducah, Ky.

New Companies Incorporated.

The Phœnix National Telephone Company, Des Moines, Ia.; the general nature of the business shall be that of constructing, owning, operating and managing telephone exchanges, telephone plants and telephone instruments, and constructing, owning, managing and operating steam and electric railways, including appliances and necessary real estate connected therewith, and constructing and operating gas and electric light and power plants and construction of vehicles propelled by electricity or other power. Capital stock, $1,000,000. Incorporators: Charles M. Waterbury, John W. Paris, Noah J. Clodfelter, Charles A. Meeker, Addison Bybee, Curtis D. Meeker, Gould Rhodes, Jacob Frankel, George W. Hadley and J. M. Smith.

The Alice, Wade City and Corpus Christi Telephone Company, Alice, Texas—to construct and maintain a telephone line in and through a number of counties of Texas Capital stock, $3,000. Incorporators: George Hobbes, Thomas C. Wright and John Wade.

The Greenwood Telephone Company, Greenwood, Ind. Capital stock, $3,000. Incorporators: Grafton Johnson J. F. Crawford and J. Albert Johnson.

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EDITORIAL NOTES.

Meeting of the British Association. The meetings of the British Association for the Advancement of Science, which were held at Ipswich from September 11 to September 18 inclusive, are now a matter of history.

The British Association has about the same scope as and is the prototype of our American Association for the Advancement of Science, viz., it aims to cover the whole field of scientific research, and its deliberations are concerned more with pure theory than with practice. In order to cover this wide field, the Association is divided into sections, each of which concerns itself with some particular branch. That under whose especial care comes electrical science is designated as Section G.

As announced in our issue for September 18, the papers to be read before this section were one by W. H. Preece and A. P. Trotter on "A New Portable Photometer," one on "Deodorizing Sewage by the Hermite Electrical Sanitation Process" by J. Napier, the Borough Analyst of Ipswich, where the process has been introduced, and one on "Modern Applications of Electricity to Traction" by Philip Dawson, all of which are given in abstract in this issue of ELECTRICITY.

The leading feature of these meetings is always the Presidential Address of the incoming president. It is usual for him to take up some one branch of science in which his life work has been done, and to treat it somewhat exhaustively either from a historical or from an experimental standpoint. These addresses are usually of a very high order, as was that of Lord Salisbury, who opened the Association meetings last year.

The incoming president was Sir Douglas Galton, K. C. B., who reviewed scientific progress during the existence of the Association.

After a few introductory remarks he said: "About forty-six years ago I first began to attend the meetings of the British Association, and I was elected one of your general secretaries about twenty-five years ago.

"It is not unfitting, therefore, that I should recall to your minds the conditions under which science was pursued at the formation of the Association, as well as the very remarkable position which the Association has occupied in relation to science in this country."

It must be confessed that Sir Douglas's intimate and long association with the organization particularly fitted him to undertake the self-imposed task, and it is doubtful if any one could have done it better or so well, but it was a herculean task, and by reason of the necessary limitations, both of time and space, it was impossible to do justice to any one branch.

The address as it appears before us is a pamphlet of thirty-three pages and embraces nearly 16,000 words—too long to be reproduced even in abstract, and covering too wide a field to be interesting to the tillers of any. It will, however, be treasured by all as a work of reference—a hand-book, as it were, of the progress of science, to which reference may handily be made for the milestones of scientific progress. As such it will find a place on every scientist's library shelves, whether he be an electrician, physicist, chemist, astronomer, geographer, botanist, physiologist, anthropologist, bacteriologist, sanitary, civil, mechanical or mining engineer, or what not, for the specialties of each of these professions are separately touched upon.

The paper by Messrs. Preece and Trotter on a new portable photometer treats of a most important question, viz., how to determine practically the actual illumination received by a surface from a more or less distant source.

The practical difficulties in the way are admitted at the outset, but one of them at least seems to have been fairly well met, viz., that of grading nicely the standard of illumination. This is accomplished by making the standard a reflected light from a source of predetermined photometric value and the graduation of this standard by varying the angle of incidence of the ray. By moving this reflecting surface through varying angles with the ray its reflected strength will be as the cosine of the angle. Very nice gradations can thus be attained, and it appears to us that a very great step has thus been taken towards a method of determining the important desideratum of practical illumination values. There still remains one serious defect, viz., that due to the difference in color between the standard light and that whose illumination is to be measured. The authors suggest a method, however, by which this disturbing effect of color may be reduced to a minimum. The first part of this paper is given in full in this issue and will be followed by the second part in a succeeding issue. Abstracts are also given of Messrs. Napier and Dawson's papers.

Other papers read, and which will appear later, were "Magnetism in Rotation," by Silvanus Thompson; "Telegraphy by Induction," by W. H. Preece; "The Development of the Telephone in Agricultural Districts," by Maj.-Gen. Webber; "The Glow Lamp," by W. H. Preece; "Telephony," by A. K. Bennett; "The Telegraph in the Chitral Campaign," by P. V. Luke, and the "Chloride Battery," by W. H. Earle.

Altogether Section G seems to have been pretty well supplied with papers, some of which at least are of extreme interest. In this respect the B. A. meeting will compare favorably with the recent meeting of its offshoot—the American Association for Advancement of Science. We are sure, however, the American organization will not suffer in the least by a comparison between the electrical papers presented to the two Associations.

* * *

Standardizing Lamp Sockets. In the early history of the incandescent lamp manufacture, as in the early history of most other new lines of manufacture, there was a tendency with each manufacturer to impress his own individuality upon that which he had to sell. In the lamp industry each manufacturer had a different base and socket. This was done partly as a trademark and partly because each manufacturer thought he had something a little better than his competitor. In time the inevitable law of the survival of the fittest began to make itself manifest, and those types of lamp bases and sockets which had lesser merit disappeared and only those survived which had either more persistent support from their manufacturers or were of greater merit.

At the present time there are practically but three sockets in the market, viz., the T.-H., Westinghouse and Edison. Granting that all of these three sockets have equal merit, why should they exist? The incandescent lamp is now such a staple article that there should be no lack of uniformity which would render the interchange of lamps of different makes impossible. A correspondent, himself a large lamp manufacturer, Mr. J. H. Rhotehamel, writes us a very timely letter on this subject which we indorse most heartily. He says:

> By reference to our cost sheets we note that the bases for our lamps to fit T.-H. sockets cost between $7 and $8 a thousand more than do the Westinghouse or Edison bases. The cost of all the other odd bases to fit the various odd sockets in use, such as the U. S., Brush-Swan, Mather or Perkins, Shafer or National, and Hawkeye, is still an additional amount. It is, therefore, desirable, as far as possible, that the best style sockets be used in original installations, and we think that an editorial on this subject in your valuable paper, calling the attention of construction men and supply houses to this fact, would aid the lamp manufacturers as well as the users of incandescent lamps, as the time is not far distant when an additional charge must be made for lamps mounted in other than Westinghouse or Edison style bases. We ourselves would prefer the Westinghouse style, but of course you could not afford to take any position of this kind as it would show some favoritism, but as the Edison and T.-H. sockets are practically made by the General Electric Company, they would no doubt be glad to eliminate entirely the T.-H. base. We at present understand that the General Electric Company are charging one cent more for lamps with T.-H. bases.

Aside from the inconvenience resulting from the lack of uniformity, Mr. Rhotehamel points out that in view of the fact that the margin of profit in the lamp business is growing smaller and smaller, one of the greatest essentials for fitness is cheapness. The T.-H. socket is at a disadvantage in this, and it would seem must surely drop out of the race. But why should there any longer be a Westinghouse or an Edison socket? Cannot those most interested get together and decide upon a *standard* socket? We do not know who "the most interested" parties are, whether they be the lamp manufacturers, the contracting engineers or the users of the lamps, for all three are deeply interested parties. We surmise that the National Electric Light Association comes more nearly comprising all these than any other organization, and we suggest that this question of a *standard* socket be brought before the body at its next annual meeting in New York.

* * *

THERE is some reason to believe that the managers of the G. E. Company are at last convinced that ELECTRICITY has been telling them wholesome truths in regard to the lamp business for the past year. There have been lately several consultations over the affairs of the Harrison factory, which is admitted to have been losing money right along. It is now proposed to abolish the rebate plan. If they will go one step further and advance the price of lamps about five cents, they will stand a better chance of ultimate success. They also need to improve the quality of their lamps, which are the poorest made at this time. We guess they realize now the serious mistake made in displacing Mr. F. M. Upton, who knew more about the economical management of a lamp factory than any half dozen of the men now in charge at Harrison.

Under the Searchlight

Views and Opinions on Timely Topics.

WHEREVER Mr. James E. Keelyn is there is always activity and also excitement. He has already, with a small and conservative company, made more stir in the telephone field than the Standard and Harrison companies with their one or two hundred millions of "capital." Mr. Keelyn's latest effort is to have the Bell Telephone Company proceeded against as a Trust. This would be an amusing job to a man of leisure. The very thought of it no doubt amuses the Bell Company. But the independent telephone companies have more serious matters on hand just now, the most important of which is to stop the Bell Telephone Company from winning patent suits. A few more victories for the Bell people and the independent telephone movement will be a thing of the past.

* * *

IT is stated that Mr. Coffin's associates on the G. E. Board, in the belief that his sudden death would result in an immense financial loss to the company by reason of the many trades and deals which no one but Mr. Coffin can interpret, is carrying $1,000,000 insurance on the latter's life. There is grim humor in this valuation of Mr. Coffin's life. Nervy Evans used to say that Coffin's smile alone was worth a million.

* * *

What They Are Here For.

We have now about a dozen State Railway Associations, besides the National organization which meets at Montreal next month. Those who criticise the quality of the most of the papers read (by title) at the annual meetings of these Associations are reminded by the annual report of the Executive Committee of the N. Y. State Association that the binding tie for the members is not the reading of papers. The report says:

> Upward of thirty bills pending in the Senate and Assembly of this State at one time, all of which, with very few exceptions, were obnoxious and adverse to the interests of street railroads throughout the State, will enable you to form an idea of the activity during the past year of legislation affecting street railroads and their operation, without questioning the good intent of the various members presenting these measures.
>
> Had half of the bills offered become laws, street railroads would have been driven out of business. Energetic, prompt and persistent effort on the part of this Association and its active counsel undoubtedly aided materially in defeating a large number of the adverse bills. The presiding officers of this Association, together with the counsel and different members of the Association, appeared from time to time before the various committees of the Assembly and Senate, to whom these bills were referred, and in every instance were accorded courteous treatment and a polite hearing, and found only a disposition on the part of the various committees to treat all questions upright and fairly.
>
> With the increased number of representatives comprising the next session of the Legislature, it is consistent to anticipate the presentation of an increased number of bills affecting our interest; therefore your committee urges the importance of the continuance and enlargement of this Association, so that united effort and concerted action may be obtained in considering and meeting the various issues as they arise. Increased membership and active interest in our organization will prove fruitful of beneficial results.

* * *

IF there had been no ground for fighting the patent suits which were sure to be brought by the Bell Company, then the telephone companies which started in business were guilty of the grossest kind of an offence against business morality in offering their wares to the public.

* * *

THE *Electrical Review* in speaking of the "Marks Electric Sparks," an association composed of the workmen of the Bishop Gutta Percha Company, says:

"Captain Marks, after whom the association is named, is a prominent member of many societies and organizations, and has the proud distinction of being longer connected with the manipulations of gutta percha and similar compounds for the insulation of copper wires for all electrical purposes than *any man* in America—an unbroken period of over 26 years."

Does Brother Price mean that Capt. Marks has been longer connected with the business than any *other* man, or does he really mean that Capt. Marks has been connected with the business longer than any *man*. If he means the latter, what species of animal does he consider Capt. Marks to be?

Be careful of your English, Brother Price; be careful of your English!

* * *

Sleepy Eye Wakes Up.

Sleepy Eye, Minn., Sept. 17.—At a special meeting of the village council held last evening the contract for an electric light building was awarded to Angus McLeod & Co., of Minneapolis, the consideration being $6,100.

COMMUNICATION.

The Telephone Situation.

To the Editor of ELECTRICITY.

SIR: In the *United States Investor*, under the date of May 18, there was an article on the Harrison Telephone Company, and in connection with it were the following words: "It may not be generally known (but it is confidently asserted by those who are in close touch with the workings and management of the Bell Telephone Company) that the Standard and Bell are no more and no less than one and the same. In territory where the Bell cannot operate successfully, the Standard will be the alternative."

There has been a good deal of curiosity here regarding the Standard Telephone Company, of which Thurlow Weed Barnes is president, and they have made certain representations which electrical people here would like to be assured of, and as one of the readers of your valuable journal, write you to learn if possible the standing of the company. Can you inform me whether or not they own a telephone and whether or not they have built or are building any plant whatever? They claim that they are manufacturing telephones in Cleveland; also claim to own a multiple switchboard; also that they are now building long distance lines from Washington to New York via Baltimore and Philadelphia and putting lines underground in Newark. We should like to be thoroughly posted, if possible, about the points above; and for the benefit of your readers, should like your opinion about this company, their intentions and their operations. The *United States Investor* is of course a very reputable journal, and making the assertion which it does, it has naturally drawn some attention; if such a journal would take upon itself to make this statement, or at least to publish it, we think that you could benefit your subscribers and readers by your views in the matter. Very truly yours,

B. L. Woom

600 Oregonian Bldg., Portland, Ore., Sept. 7, 1895.

It is difficult to make any definite or instructive answer to the above. The Standard Telephone Company has so far been engaged chiefly in selling its stock and State rights. What it has to offer in the way of an operative telephone outfit it has not yet made known to the public. The opinion of most telephone men in the East, that the company has nothing solid to build on, is not an unreasonable one taking into account the refusal of the Standard Telephone Company to give out any authentic information. We do not believe that they are building any lines, or that they have any factory. They are possibly having a few instruments made under contract.

No municipality should give or sell a franchise to any of the independent telephone companies without full assurance under guarantee that they will install an exchange within a reasonable length of time or forfeit their franchise and lose their bond.

The public is justified in looking askance at any company launched as were the Standard and Harrison companies. Relief from telephone monopoly is not likely to come through such organizations.

The Young Men's Institute.

There is an institution at 222 and 224 Bowery, New York City, which is a fine example of practical Christianity, and for the past ten years has been doing a most commendable work. It is the Young Men's Institute of the Young Men's Christian Association, and is much like the Polytechnic Christian Institute of London. A prominent part of its work is the educational department. Last season 463 young men, between the ages of 17 and 35, were enrolled in the evening educational classes in the following subjects: Bookkeeping, penmanship, arithmetic, English grammar, short-hand, typewriting, mechanical, architectural and free-hand drawing, carriage drafting, steam engineering, electricity and vocal music. Most of these pupils come from the shops, offices and factories of the city. There are also bowling alleys, a well equipped gymnasium and shower and spray baths.

The fees charged are only nominal, varying from $4 to $7.50 per year, according to the number of privileges taken by the member. Improvements have been made in the building during the past summer and the public is invited to a grand opening on Tuesday evening, October 1.

SOCIETY NEWS.

The Canadian Electrical Association.

The Canadian Electrical Association opened its Convention at Ottawa on the 17th inst. under most auspicious circumstances. The headquarters were at the Russell House.

Among the papers read were the following:

"Some Notes on the Consolidation of Two Systems of Electric Supply," A. A. Dion, Ottawa.

"The Telegraph in Canada," Chas. P. Dwight, Toronto.

"Suggested Forms for Electric Light Accounting," D. R. Street, Ottawa.

"From the Coal Pile to the Meter," Jas. Milne, Toronto.

"Some Modern Alternating Current Apparatus," H. T. Hartman, Peterborough.

"Non-Interference Diplex Relay;" "A Percentage Method for Circuit Measurements," D. H. Keeley, Ottawa.

Mr. K. J. Dunstan, the president, in his address, among other things, said "that the question of municipal control of city lighting was fought to an issue in Toronto in a contest remarkable for warmth and energy. Every effort was made on both sides to educate the people in the way they should go to the polls, the result being that the by-law to provide funds to erect the civic plant was defeated by a vote of 8 to 1." In reference to the conflict between gas and electric light, he said that "this year a new disturbing element was found in the form of acetylene gas. This gas had important defects to prevent it coming into general use, but at the same time it will prove an important factor."

The election of officers of the Association resulted as follows:

President—A. B. Smith, Superintendent Great North Western Telegraph Co., Toronto.

First Vice-President—C. B. Powell, Ottawa Electric Co., Ottawa.

Second Vice-President—L. B. McFarlane, Manager Eastern Department Bell Telephone Co., Montreal.

Secretary-Treasurer—C. H. Mortimer, Toronto.

Executive Committee—W. Y. Soper of Ahern & Soper, Ottawa; George Black, Manager Great North Western Telegraph Co., Hamilton; E. C. Breithaupt, Electrical Engineer, Berlin, Ont.; J. J. Wright, Manager Toronto Electric Light Co.,Toronto; O. Higman, Internal Revenue Department, Ottawa; J. A. Kammerer, General Agent Royal Electric Co., Toronto; F. W. Badger, City of Quebec; A. Wickens, Electrical and Mechanical Engineer Parliament Buildings, Toronto; John Carroll, Secretary-Treasurer Eugene F. Phillips Electrical Works, Montreal; K. J. Dunstan, Manager Bell Telephone Co., Toronto.

The next place of meeting will be in Toronto, in June, 1896.

The banquet tendered to the Association was a novelty in more than one respeet. Electricity was utilized in every possible way to beautify the dining-room of the Russell House. The decorations were illuminated by electricity, and in the midst of the room was a brilliantly lighted revolving float. Many ladies were present, and occupied seats with the gentlemen at the tables. Each chair at which a lady was seated was surmounted with a floral arch, at the top of which was an electric light. The serving of the dishes was done on a raised platform within the sight of all, and as the knives were sharpened they emitted flashes of electricity.

American Institute of Electrical Engineers.

The 99th meeting of the Institute will be held on Wednesday, September 25, 8 P. M., at the Hoffman House, corner Broadway and 24th street, New York City.

A paper will be presented by Mr. Charles S. Bradley, of Baltimore, on "Phasing Transformers."

Arrangements are being made for an exhibition of the apparatus in operation in the banqueting hall of the Hoffman House.

A meeting of Western members will be held the same evening at the Armour Institute, Chicago, where the above paper will be read by Mr. Hulse, and the apparatus also exhibited in operation.

At the meeting to be held October 16, a paper will be presented by Mr. Herman Lemp, Jr., of Lynn. Mass., on the "Local Annealing of Harveyed Armor Plates."

Henry Electrical Club.

The Henry Electrical Club will hold its first meeting on Friday, October 4, at the rooms of the American Institute of the City of New York, 111–115 West 38th street. Hereafter lectures will be delivered on every Friday night.

One other night in the week, Tuesday, will be devoted to class work, where the members are allowed to ask questions, and such questions are discussed by an instructor. This part of the club is under the supervision of the University Extension of the State of New York, which ought to be of direct advantage to the members, inasmuch as they are allowed to undergo examinations, as a result of which they receive, if their knowledge is sufficient, a regent's diploma in due time.

For further particulars, people are requested to address Mr. Geo. W. Whitefield, the secretary of the Institute, 111–115 West 38th street.

New York Electrical Society.

The opening meeting of the Society for the season 1895–96 will be held at Columbia College on Friday, September 27, at 8 P. M.

Mr. T. C. Martin, Editor of the *Electrical Engineer*, will deliver a lecture entitled "Niagara on Tap."

The Brooklyn Institute Programme.

The Department of Electricity of the Brooklyn Institute of Arts and Sciences make the following very attractive anouncement for the season 1895–6:

October 4. Lecture by Mr. T. Commerford Martin, of New York, Editor of the *Electrical Engineer*. on "The Electrical Use of the Niagara Water Power Plant, or Niagara on Tap."

November 4. Lecture by Prof. William A. Anthony, Ph.D., of New York.

December 6. Mr. Gano S. Dunn, of the Crocker-Wheeler Company, has been invited to lecture on "The Principles of the Dynamo. and Recent Improvements in the Application of the Same."

January 3. Lecture by Prof. Harris J. Ryan. M.E., of Cornell University, on "The Properties of Paraphase Currents."

February 7. Prof. M. I. Pupin. Ph.D., of Columbia College. has been invited to lecture on "Electrical Resonance and Alternating Currents."

March 6. Lecture by Mr. A. E. Kennelly of Philadelphia, on "The Electrical Transmission of Energy from the Niagara Electric Power Plant."

April 3. Lecture by Mr. William S. Barstow, first vice-president of the department, on ' New Problems in Electric Lighting for Large Cities."

May 1. Annual meeting. Lecture by Prof. George W. Plympton. M. E., of the Polytechnic Institute. on "The Action of Electricity Escaping from Trolley Lines on Water and Gas Pipes. and the Remedy."

A course of six illustrated lectures on "The Applications of Electricity in the Arts and Sciences." Prof. William A. Anthony, Ph.D., of New York, has been invited to give the lectures on successive Monday evenings, beginning in November. The course will be given in the lecture room of the Edison Electric Illuminating Company, 360 Pearl street. where excellent facilities for illustrating lectures are provided.

Meetings for the reading and discussion of papers on special subjects will be held alternately with the regular monthly meetings of the department. A library and reading room in which will be kept the leading books and periodicals on electricity will be accessible to members on the evenings of meetings and lectures, at 174 Montague street.

The Montreal Convention.

As announced last week, a special train will leave New York over the New York Central Railroad on the evening of October 14, arriving in Montreal Tuesday A. M.

The eastern Pennsylvania delegation are arranging for a day ride, and expect to leave New York on Sunday morning, October 13, arriving in Montreal at 9:50 P. M. on that day. They will have two or three special cars, and also go over the New York Central to Albany, and from that point over the Delaware and Hudson Railroad to Montreal.

This latter is a charming route, the road skirting the western shore of Lake Champlain for almost its entire length. The view eastward, taking in the mountains of Vermont in the distance, is almost unsurpassed, and is at its best at this season.

New Yorkers who wish to join the Philadelphia party here can no doubt make arrangements through Mr. C. A. Bragg or Mr. John Brill of Philadelphia.

The N. E. L. A. Exhibit.

Some of the gentlemen interested in holding an exhibition of electrical apparatus in conjunction with the next annual meeting of the N. E. L. A. have held a preliminary conference, and will soon submit a proposition to the committee of the Association appointed for the purpose.

The plan is to run a four weeks' show, making it the most complete exhibit of the kind ever under taken.

The opportunities are large, and if properly managed the affair ought to be a grand success.

New York State Street Railway Association.

The annual meeting of the above association was held at Albany on Tuesday, the 17th. The meeting was a lively one and the business subjects before the Convention received sharp attention. The question of admitting supply men was again settled in the negative.

The report of the Treasurer showed the following condition of the treasury for the year:

Receipts	$7,286.57
Expenses	6,299.76
Balance	$986.81

The following papers were offered:

"Are We Laying Too Many Miles of Track to Reach a Few People?" by Mr. W. W. Cole, of Elmira.

"Economical Equipment and Operation of Power House," by Mr. H. S. Newton, of Syracuse.

"Is a Freight or Mail Service Profitable or Unprofitable on Street Railways?" by Mr. Benjamin Norton, of Newburg.

"Car Heating by Electricity," by Mr. J. F. McElroy, of Albany.

"General Track Construction," by Mr. C. Loomis Allen, of Syracuse.

"Signals on Electric Railroads," by Mr. J. H. Barnard, of New York.

The following officers were elected for the ensuing year:

President, G. Tracy Rogers, Binghamton; First Vice-President, W. W. Cole, Elmira; Second Vice-President, John H. Moffitt, Syracuse; Secretary and Treasurer, Benjamin Frick, Brooklyn. Executive Committee: H. H. Vreeland, New York; John W. McNamara, Albany; Henry M. Watson, Buffalo.

The Association will next meet at Binghamton on the second Tuesday in September, 1896.

Those Present.

Allen, C. L., Civ. Eng., Syracuse St. Ry. Co., Syracuse.
Charles J. Bissell, Counsel Rochester Ry. Co., Rochester.
Cahoon, J. B., Supt. Elmira and Horseheads Ry. Co., Elmira.
Cole, W. W, Supt. Elmira St. Ry. Co., Elmira.
Clark, J. P. E., Gen. Man'r Binghamton St. Ry. Co., Binghamton.
Cleminshaw, Charles, Pres. Troy City Ry. Co., Troy.
Cooper, H. S., Supt. Schenectady St.Ry. Co., Schenectady.
Crouse, J. B., Crouse-Tremaine Carbon Co., Fostoria, O.
Frick, Benj., Sec. and Treas. Atlantic Ave. R. R. Co., Brooklyn.
Havens, Wm. E., Supt. Fishkill St. Ry. Co., Fishkill.
McKeever, R. T., Supt. Johnstown St. Ry. Co., Johnstown.
McNamara, John W., Treas. Albany Ry., Albany.
Meiklehan, T. M. R., Supt. B., Q. C. & S. Ry. Co., Brooklyn.
Morgan, Godfrey, Man'r Amsterdam St. Ry., Amsterdam.
Norton, Benj., Pres. Newburg Ry. Co., Newburg.
Newton, H. S., Elec. Eng. Syracuse St. Ry., Syracuse.
Rogers, G. Tracy, Pres. Binghamton St. Ry. Co., Binghamton.
Rusling, F. O., Supt. Buffalo Ry. Co., Buffalo.
Smith, Charles H., Supt. Troy City Ry., Troy.
Stedman, J. H., Transfer Dept., Rochester Ry. Co., Rochester.
Story, C. B., Sec. Hoosick Falls St. Ry. Co., Hoosick Falls.
Vickers, Albert, Electrician Syracuse Con. St. Ry. Co., Syracuse.
Wardwell, John S., Pres. Rome City St. Ry. Co., Rome.
Allison, Giles C., St. Louis Register Co., St. Louis.
Barnard, J. H., Interior Telephone Co., New York.
Barrett, Charles E., Hale & Kilburn Mfg. Co., Philadelphia.
Everts, Frank L., Supt. Utica & Mohawk Ry. Co., Utica.
Brady, Paul T., Westinghouse Co., Syracuse.
Cockey, Marston R., Roebling Sons' Co., New York.
Delaney, Wm. H., New York.
Dutton, W. S., Doerner & Dutton, Cleveland.
Estep, F. A., Nuttall Co., Allegheny.
Evans, H. C., Johnson Co., New York.
Everts, D. T., Simplex Co., New York.
Ewing, Geo. C., Electrical Specialties, Boston.
Fowler, F. H., Bemis Car Box Co., Springfield.
Ham, W. F., Johnson Co., New York.
Hanna, J. A., McGuire Car Truck, New York.
Issertel, H. G., H. W. Johns Co., New York.
Lawless, E. J., American Car Co., St. Louis.
Long, E. G., Peckham Motor Truck and Wheel Co., New York.
MacDuffie, R. L., Taunton Loco. Mfg. Co., Taunton.
McElroy, J. F., Cons. Car. Heating Co., Albany.
Medbery, H. J., Overhead Equipment, Mechanicville.
Mercur, R. J., New York Car Wheel Co., Buffalo.
Morse, George C., Rochester Car Wheel Co., Rochester.
Newkirk, H. R., Hoefgen, Moxham & Co., New York.
Ostrom, John F., Pennsylvania Steel Co., Philadelphia.
Packer, E., St. Louis Register Co., New York.
Pugh, D. W., Stephenson Co., New York.
Pugh, John S., Stephenson Co., New York.
Robert, Louis E., Johnson Co., New York.
Rose, R. M., Hughes Register Co., New York.
Russell, F. D., Rochester Car Wheel Co., Rochester.
Sharpe, D. W., Newark, N. J.
Silver, Wm. S., Graduated Car Spring Co., New York.
Vosburgh, A. C., New Process Raw Hide Co., Syracuse.
Wallace, J. E., Smith & Wallace, Boston.
Wardwell, F. S., Electric Ry. Construction, Danbury.
Wardwell, V. P., Electric Ry. Construction, Danbury.
Washburne, Wm. A., Cambria Iron Co., New York.
Wood, Charles N., Nuttall Co., Boston.
Yates, F. A., Trendley Brake Co., St. Louis.
Haskell, George, J. G. Brill Car Co., Philadelphia.
Beard, W. K., *The Car*, New York.
Crossman, T. E., Official Stenographer, Brooklyn.
Dickerson, J. W., *Electric Railway Gazette*, New York.
Goddard, Stephen H., *Electrical Review*, New York.
Greene, B. E., ELECTRICITY, New York.
Hunt, W. T., *Electrical Age*, New York.
Marvin, T. C., *Electrical Engineer*, New York.
McGraw, J. H., *Street Railway Journal*, New York.

British Association.

(From our Special London Correspondent.)

The President's Address.

Sir Douglas Galton, K. C. B., D. C. L., F. R. S., delivered his presidential address on Wednesday evening, September 11. The president's address is always, of course, a general dilation upon the thousand and one questions of interest to the scientific mind.

Sir Douglas devoted his address to a brief history of all branches of scientific effort since the formation of the Association in September, 1831, denoting the various discoveries and advances of consequence which these sixty-five years have brought forth. The president divided his delivery into a number of sections—geological and geographical, chemical, astronomical and physical; meteorology, biology; engineering; smoke abatement; mechanical engineering, and a number of general points of interest to the Association.

Velocity of Light in Rarefied Gases Through Which an Electrical Discharge is Passing, by Edwin Edser and S. G. Starling.

Lord Rayleigh has published the result of a research relative to the velocity of light in an electrolyte through which there passed an electric current. Dilute sulphuric acid was used, and the conclusion reached was that the velocity was unaffected by the passage of the current.

It seemed to us worth while to perform a similar experiment to the above, substituting a rarefied gas for the electrolyte. The conditions are somewhat different, for though it has been shown by Prof. J. J. Thomson that the ordinary stratified discharge can be assimilated to a current passing through an electrolyte by considering each stratification to correspond to a Grotthus chain, yet there is left still outstanding the phenomenon known as the cathode rays. Prof. J. J. Thomson considers these rays to consist of a number of atoms, each carrying its tubes of force, and moving with a velocity comparable with 2×10^5 cm. per second. If these tubes of force consist of or comprise a number of vortex filaments of the ether, we might reasonably hope to detect some difference in the velocity of the light according as it moves with or against this ether current.

The method used by us is essentially that employed by Prof. Michelson in re-performing Fizeau's experiment, two vacuum tubes with plane glass ends being substituted for the tubes, through which, in his experiment, water was caused to flow. A discharge was produced in these tubes by a Ruhmkorf coil and the interference bands were carefully observed. No alteration could be detected on the discharge being reversed. The experiment was repeated at various pressures (determined by the McLeod gauge) with the same result.

We wish this communication to be considered as only preliminary, as these negative results might be due to the intermittence of the discharge, the current only flowing for an inappreciable period a few times a second. It might therefore be possible with a continuous current to obtain a positive result.

Modern Applications of Electricity to Traction Purposes, by Mr. Philip Dawson.

Mr. Philip Dawson read a very lengthy paper, which was accompanied by some very elaborate table matter, detailing the lines now in operation in Europe and those in other parts of the world by European constructors. He sketched first the progress made during the past decade, dealing with the introduction of the underrunning trolley and earth return; the adoption of electrical motive power by the West End Street Railway of Boston, U. S. A., in 1888; the rapid increase in mileage and equipment in he United States; and reference to the first prominently successful line in Europe at Halle, Germany, in 1891. This was followed by a statement of the present European traction systems now under contract. After dealing with the especial adaptability of electric traction to tramways and light railways, and describing the three methods of electrical power transmission employed, and stating the objections raised to the overhead wire system compared with its compensating advantages, he dwelt at length upon the parts of an electric tramway installation, denoting the latest machinery, apparatus and methods of construction. He concluded his paper with further particulars regarding notable existing installations, and dilated upon the application of electricity to railway service with special reference to certain lines in England and America; also spoke of the economic results already obtained by, and the probable extension and development of, electric traction in the near future.

Deodorizing Sewage by the Hermite Electrical Process, by J. Napier, F. C. S.

This process consists of passing an electric current obtained from a dynamo through sea water or a dilution containing magnesium and sodium chlorides, whereby a portion of the chlorides is converted into hypochlorite, a substance which disinfects, deodorizes and bleaches similar to the active ingredient of bleaching powder, viz., calcium hypochlorite. This solution is called the electrolized or "hermite" solution, and may contain from half to one gramme of active chlorine per liter. The author gives a brief history of the sewering at Ipswich during the last twenty years, showing the present system. The deodorizing effects of the electrolized (hermite) solution on sewage are dealt with, and the results of trials made in August and September, 1894, and June, July and August, 1895, are given.

An Improved Portable Photometer.

BY W. H. PREECE AND A. P. TROTTER.

When light falls upon a surface that surface is said to be illuminated. The illumination depends simply upon the light falling upon the surface, and has nothing to do with the reflecting power of the surface, just as rainfall is independent of the nature of the soil. As a rain gauge receives the full amount of rain when it is placed horizontally (disregarding wind), and receives less when it is tilted, so a surface is fully illuminated when it faces the source of light, and is less fully illuminated when the light falls upon it at an angle. The proportion between the full rainfall or illumination and the measured rainfall or illumination varies as the cosine of the angle of incidence of the rain or of the light. This angle is 0° and the cosine is 1 when the rain gauge is placed horizontally or when the light falls perpendicularly upon the surface.

It would perhaps be unnecessary to call attention to these very elementary matters were it not that difference between the photometry of illumination and the ordinary photometry of candle-power is often confused.

The lighting of streets and of buildings may be specified by the maximum and minimum illumination. The primary purpose of an illumination photometer is to measure the resulting illumination produced by any arrangement of lamps, irrespective of their number, their height, or of their candle-power. Illumination photometers containing sub-standards of light have been designed by Prof. Weber,* Prof. Mascart,† and others. One of us described an illumination photometer before the Royal Society in 1883.‡ This consisted of a box blackened within. Over the end was stretched a Bunsen screen of paper, on the middle of which was a grease spot. At a distance of twelve inches was another screen, of drawing paper. The grease spot was so screened that no light fell upon it except that which was reflected from the drawing paper screen. At the end of the box opposite the Bunsen screen was an eyepiece, consisting of a plain tube, within the box a small glow lamp was fixed, and in order to make a measurement of the illumination of the drawing paper screen, the current through the lamp was varied through a rheostat until the grease spot was invisible. The readings were recorded in luces, a lux being suggested by one of us at the Paris Electrical Congress, 1889,‖ as the name for the illumination due to a carcel lamp at 1 meter, and equivalent to a British standard candle at 1.058 feet. The only defect of this photometer was the yellowish and reddish color of the lamp when dimmed for low readings.

In 1884 we designed a portable photometer,* in which the lamp could be moved towards or withdrawn from the Bunsen screen, and a mechanism was provided by which, when a pointer moved a certain distance over a uniformly divided scale the displacement of the lamp was as the square of that distance. The Bunsen spot was viewed by Rudorff mirrors, in the usual way. This instrument worked well, but the range was small and could not be easily increased. The lamp would have to be moved to a very considerable distance from the screen for measuring the feeble illuminations met with in street lighting.

Eight years later, one of us experimented with modifications of this instrument, and found that in ordinary street lighting the illumination is often only equal to that due to one candle at 14 feet distance. A large number of different methods of reducing the light were tried. Many combinations of lenses, the eclipsing device used in dissolving views, photographically shaded glass screens and other devices were used, and, finally, a white reflecting screen was inclined at different angles to a small electric lamp, and on this principle a photometer was constructed in February, 1892. It was found that the Bunsen screen could be replaced with advantage by a simple white cardboard diaphragm pierced with one or more holes.† The illumination of this diaphragm, generally in a horizontal position, was the illumination to be measured. Below this was the reflecting screen, enclosed in a box about 2 feet x 6 inches x 5 inches, with a pair of small glow lamps and a secondary battery. The screen could be inclined towards the glow lamps by means of a chain wound up on a cam mounted on a spindle, the cam being formed so as to give an open scale. A hand or pointer indicated readings on a dial. Many measurements and a number of photometrical surveys of different streets and public buildings in London were made in 1892, and are recorded by means of plans with isophotal contour lines and otherwise.‡

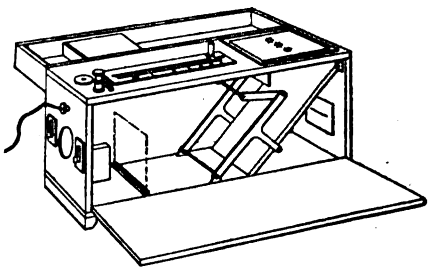

FIG. 1.

During the present year an improved form of this photometer has been constructed. The chain and cam, which allowed the instrument to be used only in a horizontal position, have been replaced by a system of levers. The object of these levers is to give an open scale. If the motion of the pointer were proportional to the angular movement of the screen, the scale would be approximately a scale of cosines. The instrument is shown in Fig 1, with the lid open, and the front let down. It measures 1 foot 3¾ inches by 5½ inches by 9½ inches high (400 mm. x 140 mm. x 242 mm.). On the end to the left there is a red glass window, and immediately within are two 12-volt lamps (one of which is shown in Fig. 2), one of about 1 candle power, and the other of 2 candle-power. It can be seen through the window if either or both of the lamps are alight. The lamps are held in special lamp-holders, capable of adjustment as to height by clamping screws. These clamping screws and the base of one of the lamp-holders are shown in Fig. 1. A switch on the top of the instrument enables either or both of the lamps to be turned on or off. At the other end of the box the reflecting screen is hung. The middle of the screen is about 11 inches (28 cm.) from the lamps. It is shown in Fig. 1 in its lowest position. In Fig. 2 the screen and one of the levers, together with one of the rollers on which the screen rests, and the handle by which it is moved, are shown with the screen in its highest position by full lines and in its lowest position by dotted lines. In its highest position the filaments of the lamps are a little below the plane of the screen. No direct light from the lamps reaches the screen, and it is only faintly illuminated to about $\frac{1}{16}$th of one candle at a foot, by stray light, which is excluded as much as possible.

The diaphragm is placed horizontally immediately above the hinged screen. Three small star-shaped holes are cut in and through them, the illuminated reflecting screen can be seen. A handle carrying a pointer, moving over a graduated scale, controls the inclination of the screen by means of the levers and links. A guide attached to the back of the screen (shown in Fig. 2) allows the instrument to be turned on its side without interfering with the working. In order to take a measurement, one or both of the lamps are turned on, and the handle is moved until the screen seen through the holes in the diaphragm matches the diaphragm in brightness. If the color of the light outside is about the same as that of the lamps, the middle hole may be made to disappear. The observer should stand approximately in the vertical plane passing through the three holes, so that he may see that part of the screen through them which lies immediately beneath them.

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* *Electrotechnische Zeitschrift*, 1884, p. 166. *La Lumiere Electrique*, Vol. XII., p. 468.

† *Bulletin* de la Soc. Inst. des Electriciens, 1888, p. 103.

‡ *Proceedings* Royal Society, Vol. XXXV., p. 39, 1883, and *Proceedings* Inst. C.E., Vol. CX., p. 98.

‖ The *Electrician*, Vol. XXIII., p. 478.

* *Proceedings* Inst. C.E., Vol. CX., p. 101.

† *Proceedings* Phys. Soc., Vol. XII., p. 355, 1893.

‡ *Proceedings* Inst. C. E., Vol. CX. pp. 42-51.

Various substances have been tried for the diaphragm and screen. Thin metal painted with a whitewash made of magnesia and isinglass is perhaps the best. The diffused reflection practically follows Lambert's cosine law, but the material is easily soiled and cannot be cleaned. Bristol board from which the glaze has been removed by a damp cloth, closely follows the cosine law within the angular range required in this case. It is important that there should be no glaze on the surface of the hinged screen, since the inclination of the lamp to the screen and of the screen to the eye for maximum illumination, is about 45°. But as the scale is graduated by experiment, a slight departure from the cosine law does not matter. On the other hand, it is of greater importance that the screen should be very smooth and flat. Under very feeble illuminations the light from the small lamp, making an angle of incidence very nearly 90°, minute irregularities are easily seen, and make accurate readings difficult. For ordinary street lighting and for general industrial photometry, a slight departure from the cosine law on the part of the diaphragm is of no practical consequence so long as there is no perceptible glaze, for it is always observed nearly vertically and never at a large angle.

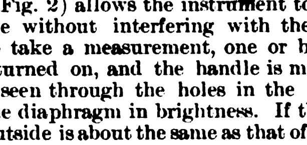

FIG. 2.

(*To be continued.*)

THE PROPOSED MAGNETIC UNITS.*—II.

University College, Liverpool, Jan. 15, 1895.

Dear Professor Lodge: In reference to the sizes of the magnetic units proposed by you, I find that the weber 10^8 C.G.S. would only be used in fractions. The largest dynamo that I know of has a magnetic flux, or, as you propose to call it, an induction of 0·5 weber. From this the value will go down to about 0·01 in small motors. These figures are, however, by no means inconvenient.

Transformers will be rather smaller. In these the weber-turn is a convenient size and an interesting quantity, as it is given by ¼ *of the mean volts per cycle*, or, more accurately expressed, *mean volts per unit frequency* ÷ 4. Its numerical value will lie between, say, ¼ and 50 according to the volts and the frequency; but it gives no indication of the size of the transformer.

The henry 10^9 C.G.S. is also large. The inductance of choking coils would in general be fractions of a henry. The inductance of the winding of a transformer has no very important meaning, but it has a convenient size. Measuring it as *mean volts per unit frequency ÷ four times the open circuit current in amperes*, the inductance of the primary coil on a 2 H.P. closed magnetic circuit 1,000-volt transformer would be about 40 henrys.

The inductance of pairs of cables would run from 100 to 1,000 microhenrys per kilometer, but the value would vary with the arrangement.

The induction per unit area is good; having a value in practical work from 1,000 to 20 000 C.G.S. units, it is given by 10 to 200 microwebers per sq. cm.

Gaussage would be about 50 in small transformers, up to 40,000 in large dynamos. The latter could be conveniently reckoned in kilogausses. To make the gauss = 1 ampere-turn appears to have great advantages in practice and connects it directly with its usual source.

The idea of permeance is very useful, and the identification of its dimensions with those of inductance is neat. But I think it is liable to cause confusion, for the permeance of the core of a coil will be a different number of henrys from the inductance of its wire. Moreover, the argument as to identical dimensions might equally be applied to the case of amperes and gausses. I would therefore have a new unit strictly connected with the henry, so that inductance $= n^2 \times$ permeance in a coil of n turns.

As to the units of permeance: with the above meanings of gauss and weber the permeance of a circuit would be $4\pi\ \mu\ A / 10l$, as you point out, instead of $\mu\ A / l$. I suggest a change in the method of reckoning, namely, still to retain the value of the permeance as $\frac{\text{webers}}{\text{gausses}}$, and permeability as $\frac{\text{webers per sq. cm.}}{\text{gausses per cm.}}$, therein giving up the convention of unit permeability of space, and giving it the value 1.2566×10^{-8} unit of permeance for a unit cube. In this way both the troublesome 10^{-8} and $4\pi / 10$ are dealt with in an easily intelligible way. To avoid the high power of 10 it may be measured in micro-units of permeance, so that permeability of space and air = 0.012566 micro-unit of permeance for a unit cube, and permeability of soft iron = up to 25 micro-units for a unit cube. Thus we have permeance $= A\mu / l$, where μ is to be obtained from tables of its value, which can easily be altered to this method. Inductance then becomes

$$\frac{\text{weber-turns}}{\text{amperes}}, \text{ or } n^2 \frac{\text{webers}}{\text{gausses}} = n^2 \text{ permeance.}$$

[Of course your phrase "weber-turns per ampere" means the same as the above webers ÷ amperes and does not necessarily mean the weber-turns caused by *one* ampere.]

It may be objected that the C.G.S. units of strength of field unit magnetic pole and intensity of magnetization do not bear any simple relation to these practical units. This is chiefly important in the use of the magneto-metric measurement of iron, and in the measurement of the mechanical form of attraction between two magnetic surfaces in contact. But the expressions are not in reality much complicated; *e.g.*, present C.G.S. unit of intensity of magnetization is given by $4\pi\ I = (\mu - \mu_0)\ H$, where μ = permeability of space = 1 and H = C.G.S. unit of magnetic force. This becomes $4\pi\ I = (\mu' - \mu'_0)\ H'\ 10^8$, where H' is the gauss-gradient in the magnetic substance, and $\mu'_0 = 0.012566$ micro-unit of permeance for a cubic centimeter.

As the single magnetic pole is unchanged, the force on it will be = strength of pole × gauss-gradient × 1·2566; but as this is not a calculation of frequent occurrence except in magnetic surveys, the complication will not be serious. Other magnetic relationships are almost entirely of academic interest only, and would be carried out in C.G.S. units. Also the transition would present no difficulties to people with a little scientific knowledge.

I am of opinion also that as the legal volt has no direct connection with induction and velocity of motion, it is not necessary to define the practical units as they are defined absolutely. That is, ohm and ampere are the starting points, volt is obtained from them, weber from volt, gauss from ampere permeance unit from weber and gauss, henry from weber and ampere or from permeance, and so on. This is much more easily explained to practical and unscientific men than the absolute derivations are, and it is the order in which they learn them. Yours very truly,

FRANCIS G. BAILY.

APPENDIX II.

Another subject for discussion is whether L had better not be defined as $d\,N / d\,C$; with permeability as $\mu = d\,B / d\,H$ to correspond.

This would make the three equations of page 7 stand thus:

$$(1)\ N = \int L\,d\,C,$$

$$(2)\ E = L\,\dot{C},$$

$$(3)\ W = C\,\dot{N}.$$

A letter just received from Mr. Heaviside indicates that he would probably favor this course, and there is evidently much to be said for it. I need hardly add that he contemns my temporizing method of dealing with the 4π nuisance.

O. J. L.

January 30, 1895.

According to the proposal of the Chicago Chamber of Delegates, the quantity which we call "inductance" and which is to be expressed in "henrys" is defined by the equation $E = L\ (d\,C) / (d\,t)$ for self-induction, or $E = M\ (d\,C) / (d\,t)$ for mutual induction, both being comprehended in one definition, the inductance L or M being calculated by dividing E in volts by $(d\,C) / (d\,t)$ in amperes per second. This implies that L or M is not to be defined as N / C, but as $(d\,N) / (d\,C)$. [redacted]

I think names are desirable both for N / C and for $(d\,N) / (d\,C)$. I would suggest that the former be called "the total inductance" and the latter "the differential inductance." The distinction would be somewhat analogous to the distinction between the "mean specific heat from 0° to t°" and the "true specific heat at t°." Both total and differential inductance should be expressed in "henrys," for they are quantities of the same kind and when there is no iron, etc., in the field they are equal.

I think that the above mode of definition, involving as it does no magnitudes except current and time, is more readily comprehended than Dr. Lodge's proposed definition, in which the magnitudes involved are current, flux of induction, and the number of convolutions of the coil through which the flux passes. In the definition proposed by the Chicago Delegates, the consideration of the number of convolutions does not enter.

For a circuit or two circuits not having iron, etc., in the field, we may define inductance (in henrys) as the E.M.F. (in volts) due to variation of current at unit rate (one ampere per second). When the field is modified by the presence of magnetic material, the above will be the definition of "differential inductance."

The "total inductance" for any specified strength of current will be the mean value of differential inductance for equal increments of current from zero up to the specified strength.

I would suggest similar nomenclature in the case of permeability; $(d\,B) / (d\,H)$ should be called differential permeability, and B / H total permeability. In some respects "mean" or "average" would be a more correct designation than "total"; but these words would be liable to be misunderstood as referring to an average taken over the different parts of the body or circuit. "Total" is to be understood as standing for "calculated on totals."

As regards the magnitude of the unit of inductance, while I agree with Mr. Heaviside and Dr. Lodge that the unit pole ought to have been so defined that the mutual force between two poles is equal to their product divided by the surface of a sphere whose radius is their distance, a definition which would have made the line-integral of H due to a current C equal to C itself instead of to 4π C, I deprecate a mixing up of the two systems. So long as we employ our present unit of intensity of magnetic field, which results from our present definition of the unit pole, we cannot consistently reckon the line-integral as equal to the ampere-turns. It must be reckoned as 4π times the ampere-turns, and the flux N must be reckoned as $4\pi\ \mu$ times the ampere-turns. The practical inconvenience of retaining the factor 4π cannot be considerable, for it is as easy to tabulate the values of $4\pi\ \mu$ as the values of μ.

Next as regards "permeance." I do not think it can conveniently be reckoned in henrys. I would rather reckon it in "webers per ampere-turn," which would be written "web. per amptu."; and there can be no possible doubt as to the meaning intended when once we have fixed the magnitude of the "weber." There seems to be no difference of opinion as to what this magnitude should be. It is fixed by the relation $E = (d\,N) / (d\,t)$, E being in volts, N in webers and t in seconds. This is in accordance with Dr. Lodge's proposal, but Dr. Lodge has not explicitly recommended any name for the physical quantity which is measured in webers. Shall we call it "weberage"? It greatly needs a name; for "induction" may mean B instead of the surface integral of B, besides having many other meanings.

When permeance varies according to the strength of current, I would distinguish between "total permeance" $N / (n\,C)$ and "differential permeance" $\frac{1}{n}\frac{d\,N}{d\,C}$.

As regards "gaussage" and "gauss fall," I think the names will be convenient in the senses proposed by Dr. Lodge; but I cannot agree with his selection of a unit of measurement. The present definition of the unit pole (on which the present unit current is based) requires us to equate the line-integral in question to $4\pi\,n$ C. To be consistent we must reckon "gaussage" as equal to 4π times the number of amptus. Dr. Lodge's proposal is to reckon C not in amperes but in C.G.S. units, thus introducing, as it appears to me, an awkward breach of continuity.

J. D. EVERETT.

(*To be continued.*)

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*From the *Electrician* (London).

The Electrical Device for Killing Weeds.

A correspondent (E. V.) wishes to know if the electrical weed-killing device described in ELECTRICITY, May 15, is patented, and if so, who holds the patent and where is the machine manufactured. Our description was based on a floating paragraph in a Western paper. If we are not mistaken, the Illinois Central Railroad experimented satisfactorily with some such device.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record

H W BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER XII.

The Faribault Plant.

The establishment of an electric lighting plant at Faribault, Minn., was one of the earlier operations of the Northwest Construction Company before the name of that company was changed to the Northwest Thomson-Houston Company.

The town of Faribault is situated in Rice county, and had in 1890 a population of 6,520. It has no special advantages over any other town of similar size in that section. The extent of the business done there may be fairly judged from the number of banks it has and their capital, which is as follows:

	Capital.
Citizens' National	$80,000
First National	50,000
Security Bank	50,000
Total capital	$180,000

This was the town chosen by Mr. E. R. Gilman and Mr. C. A. Coffin for the establishment of an electric light plant in 1887, and for one of their earliest stock and bond operations in partnership. No local capital was interested, and the entire scheme, as at Mitchell, was carried through by the Northwest Company, or by the officials of that company. A copy of the original ordinance granting to Mr. E. R. Gilman a ten-year franchise is given herewith, as is also a copy of the articles of incorporation of the Electric Light and Power Company which was to operate under the franchise. The incorporators, Daigh, Turner and Tayloe, were all salaried employés of the Northwest Construction Company.

It will be noted that the original capitalization was placed at $100,000. The books of the company show, however, that Mr. Gilman invested only $1,600 in the electric light plant. Even on this small investment the plant did not pay, and Gilman decided to buy the established gas plant and make a grand consolidation. He secured the money, paid $20,000 for the gas plant, and then formed the Faribault Consolidated Gas and Electric Company, the articles of incorporation of which appear herewith. Here again

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[COPY].

Number Seventy-Four (74).

An ordinance relating to electric lights.

The Common Council of the city of Faribault do ordain:

Section 1. E. R. Gilman or his assigns shall have for the period of ten years (10) years from and after the passage of this ordinance, the exclusive right and privilege of erecting and maintaining in and along the public streets, highways, alleys and squares of said city, in such manner and at such places as the Common Council of said city shall sanction and approve, the necessary poles, towers, wires and other conductors for supplying said city and its inhabitants with electric lights,

Provided that the said E. R. Gilman and his assigns shall have his or their works and apparatus in operation ready to supply said lights within one hundred (100) days from the passage of this ordinance, and

Provided further that the said E R. Gilman and his assigns shall keep said works in operation continuously, supplying said lights for and during the aforesaid full term of ten (10) years, except in case of accident to said works, in which case the same shall forthwith be put in full operation with all due diligence by the said E. R. Gilman or his assigns, and

Provided further that the said E. R. Gilman and his assigns shall, at all times during the aforesaid term of ten (10) years, furnish said lights to said city and its inhabitants at reasonable rates, regard being had to the price at which electric light of the same quality is or may hereafter be furnished in other cities under similar circumstances, and shall at all times during said term furnish said lights for the public lighting of said city, if requested by the city, at a rate not to exceed fifty (50c.) cents for each arc light for the whole of each night, and

Provided further that the said E. R. Gilman or his assigns shall, during said term, use upon and introduce into said works and apparatus all devices, inventions and improvements which the Thomson-Houston Electric Light Company now controls or uses elsewhere or which the said company, its assigns or successors in interest in such devices, inventions or improvements, may hereafter, during said term, control or use as soon as the said company controls or uses them elsewhere, and shall, during said term, operate said works as efficiently and furnish as good quality of light as the said Thomson-Houston Electric Company, its assigns or successors aforesaid, shall elsewhere, during said term, operate and furnish, and

Provided further that neither said E. R. Gilman or his assigns shall, at any time or in any manner, unnecessarily obstruct, impair or injure any of said streets, highways, alleys or squares, and that they shall immediately, after erecting their said poles, towers, wires and other conductors, or in making any extensions, repairs or improvements thereon, restore such streets, highways, alleys and squares to as good condition as the same were previously in, and shall so erect, manage and operate his or their said works, poles, towers and other apparatus as not to interfere with any rights or privileges heretofore granted by the Common Council of said city to any other individual, co-partnership or corporation and shall, during all said term, have an authorized agent in said city upon whom summons and process may be served, and shall be liable and respond for all damages caused or done by said E. R. Gilman and his assigns, and his and their agents and employees in constructing, repairing, extending, improving or operating any of his or their said works, poles, towers or other apparatus, or resulting therefrom, and shall save the said city harmless from all such damages and liabilities, and

Provided further that the said E. R. Gilman and his assigns shall, in all things, keep and perform each and every contract which he or they may hereafter enter into for supplying said city with said lights, and

Provided further that the said E. R. Gilman and his assigns shall extend their lines to and furnish electric light at such points within the limits of said city as the Common Council may direct, whenever there is a demand for not less than an average of six (6) arc lights per mile of wire.

Section 2. The construction of said works, poles, towers and other apparatus in said city by the said E. R. Gilman or his assigns, shall be an acceptance of this ordinance and of all the conditions and provisions herein contained. If the said E. R. Gilman and his assigns shall fail to fully keep, perform and comply with all and singular the provisions and conditions herein before contained, the rights and privileges hereby granted shall thereby determine and lapse forthwith without any act to be done by the said city.

Section 3. Ordinance No. 59, entitled "An Ordinance Relating to Electric Light," passed March 3d, 1885, and

Ordinance No. 65, with the same title passed March 8th, 1886, and

Ordinance No. 68, with the same title, passed March 3d, 1887, are hereby repealed.

Section 4. This ordinance shall take effect and be in force from and after its publication.

Passed July 26th, A.D. 1887.

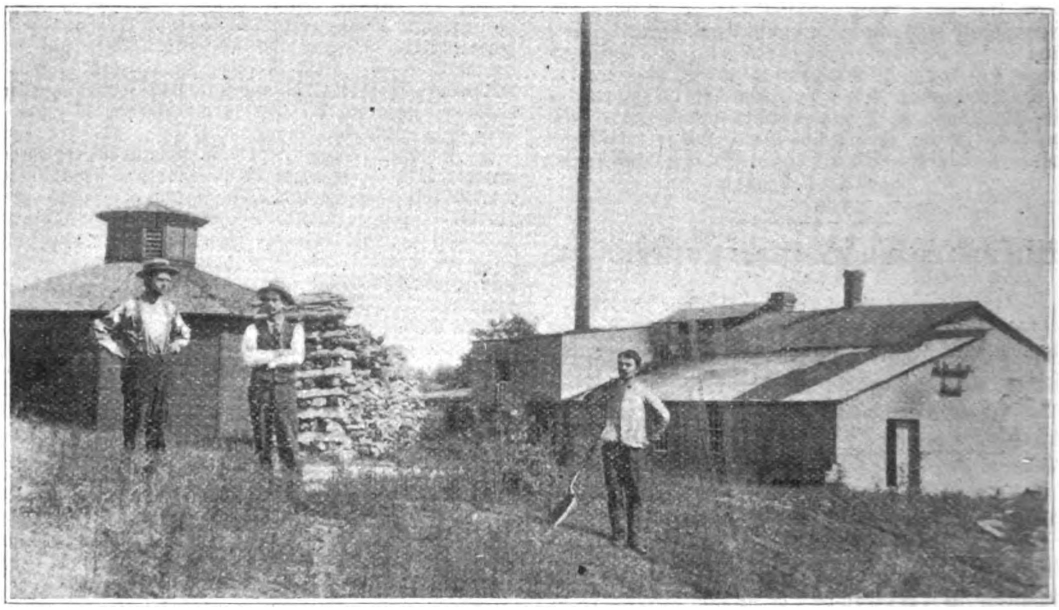
A. H. HATCH,
Acting Prest. Com. Council.

Attested:
A. A. MURPHY, Deputy City Recorder.
Approved July 28th, A.D. 1887.
A. H. HATCH, Acting Mayor.

I hereby certify that the foregoing is a true copy of the ordinance now of record in my office; that I have carefully compared the same and believe the same to be correct.

Witness my hand and official seal this 20th day of July, A.D 1889.

[Seal] D C. TURNER, City Recorder.



SUPT. JOHN HAUG. HERMAN POFFAHL.

VIEW OF STATION, FARIBAULT CONSOLIDATED GAS AND ELECTRIC CO. (CAPITALIZED AT $200,000).

[COPY.]

ARTICLES OF INCORPORATION

OF THE FARIBAULT ELECTRIC LIGHT AND POWER COMPANY.

In order to become a corporation under and by virtue of the laws of the State of Minnesota, the undersigned mutually agree and each hereby adopt and sign the following articles, herein stipulated, of incorporation:

Article First—The name of this incorporation, and under which it will trade, is the "Faribault Electric Light and Power Company," and its principal place of business shall be in the city of Faribault, in the county of Rice and State of Minnesota.

Article Second—The general nature of the business of this incorporation shall be to furnish electricity for light, heat and power, and all that pertains to said electricity, and to own property, real, personal or mixed, taken as security or on foreclosure, in payment of indebtedness, due or to become due, to the said corporation or otherwise, and wherever such property may be situate.

Article Third—The said corporation shall commence on the 1st day of January, 1889, and continue for thirty (30) years from date of incorporation; and the annual meetings shall be held on the 2d Monday in January in each year from and after date.

Article Fourth—The amount of capital stock of said corporation shall be fifty thousand ($50,000) dollars, consisting of five hundred shares of the par value of one hundred ($100) dollars each, and shall be paid in as subscribed and called for by the Board of Directors, but said corporation may go into operation and transact business pertaining to said corporation whenever 100 shares of stock shall have been subscribed for and actually taken. The highest amount of indebtedness and liabilities to which said corporation shall at any time be liable or subject shall be fifty thousand ($50,000) dollars.

Article Fifth—The names and residence of the persons forming said corporation are C. A. Daigh, residing in St. Paul, Minnesota; H. W. Turner, residing in St. Paul, Minnesota, and W. R. Tayloe, residing in St. Paul, Minnesota.

Article Sixth—The government of this corporation and the management of its affairs shall be vested in a Board of Three (3) Directors, to be chosen by the stockholders at the annual meeting, and such Directors shall hold office until their successors are elected and qualified. The Directors from their own number shall select a President, Vice-President, General Manager, Secretary and Treasurer, and any three offices may be held by the same person.

Article Seventh—The names of the first Board of Directors are as follows: C. A. Daigh, residing in St. Paul, Minnesota; H. W. Turner, residing in St. Paul, Minnesota, and W. R. Tayloe, residing in St. Paul, Minnesota.

In witness whereof we have hereunto set our hands and seals this 14th day of December, 1888.

C. A. DAIGH. [Seal]
H. W. TURNER. [Seal]
W. R. TAYLOE. [Seal]

Signed and sealed in presence of
M. R. JONES.
HAYDN S. COLE.

State of Minnesota, County of Ramsey, ss.

Be it known that on this 14th of December, A. D. 1888, before me, a Notary Public, duly commissioned in and for said Ramsey County, personally came C. A. Daigh, H. W. Turner and W. R. Tayloe, to me personally known to be the identical persons who signed and sealed the foregoing articles of incorporation, and each then and there severally acknowledged that he signed and sealed said articles as his free act and deed.

Witness my hand and official seal.

W. G. DE CELLE, Notary Public,
[Notarial seal] Ramsey County, Minnesota.

Office of Register of Deeds, Rice County, Minn.

This instrument was filed for record the 19th day of December, A. D. 1888, at the hour of 11 o'clock A. M., and was duly recorded in Book "D" of M. R., page 342.

JAMES HUNTER, Register of Deeds.

Filed in this office for record December 20, A. D. 1888, at 9:50 o'clock A. M.

H. MATTSON,
Secretary of State.

State of Minnesota, Department of State.

I, Albert Berg, Secretary of State of the State of Minnesota, do hereby certify that I have compared the annexed copy with record of the original instrument in my office of articles of incorporation of the "Faribault Electric Light and Power Company," as filed December 20, 1888, and recorded in Book "D" of Incorporations, page 351, and that said copy is a true and correct transcript of said record of said original instrument and of the whole thereof.

In testimony whereof I have hereunto set my hand and affixed the great seal of the State, at the Capitol in St. Paul, this 4th day of September, A. D. eighteen hundred and ninety-five.

ALBERT BERG,
[State seal.] Secretary of State.

we find only the names of the Northwest Company's *employés* as incorporators. The capitalization was increased to $200,000, and the gas plant was slightly remodeled to make room for the electrical apparatus.

[COPY.]

ARTICLES OF INCORPORATION

OF THE FARIBAULT CONSOLIDATED GAS AND ELECTRIC COMPANY.

Be it known that the undersigned do hereby associate themselves together for the purpose of forming a corporation under the provisions of title two (2) of chapter thirty-four (34) of the General Statutes of the State of Minnesota, for the year A. D. 1878, and the acts amendatory thereof and supplementary thereto, and to that end have and do hereby adopt the following articles of incorporation:

ARTICLE I.

The name of this corporation is the Faribault Consolidated Gas and Electric Company.

The general nature of its business shall be to manufacture, generate, transmit, furnish, rent and sell gas and electricity for light, heat and power, and for all that pertains to said gas and electricity for public and private use.

The principal place of transacting the business of said corporation is the city of Faribault, in Rice County and State of Minnesota.

ARTICLE II.

The time of commencement of this corporation shall be the first day of October, 1889, and its period of continuance thirty (30) years.

ARTICLE III.

The amount of capital stock of this corporation shall be one hundred thousand ($100,000) dollars and shall be issued and paid for in such manner and at such times as the Board of Directors may determine.

ARTICLE IV.

The highest amount of indebtedness to which said corporation shall at any time be subject shall be one hundred thousand ($100,000) dollars, and it may borrow money at such times and upon such collateral and security as its Board of Directors may deem best.

ARTICLE V.

The names of the persons forming this corporation are: Edward R. Gilman, Wilford G. De Celle, Haydn S. Cole, George C. Duffie and Harry W. Turner, and the place of residence of each of said incorporators is the city of St. Paul, State of Minnesota.

ARTICLE VI.

The government of said corporation and the management of its affairs shall be vested in a Board of not less than three (3) or more than five (5) Directors, each of whom shall be a stockholder and shall hold office for one year and until his successor is duly elected and qualified.

The Directors shall be elected at the annual meeting of the stockholders on the first Tuesday in October of each year, commencing with October, 1890.

The Board of Directors shall, on the first Tuesday in October of each year, commencing with October, 1890, immediately after the annual meeting of the stockholders, elect a President, Vice-President, Secretary, Treasurer and such other officers as may seem to them necessary, and more than one office may be held by the same person.

The powers and duties of the President, Vice-President, Secretary, Treasurer and other officers or agents shall be such as the by-laws shall prescribe, and the Directors shall have power to make all needed by-laws and regulations for the management of the affairs of said corporation.

The names of the first Board of Directors are: Edward R. Gilman, Haydn S. Cole and Wilford G. De Celle, and until the annual meeting of stockholders in October, 1890, the officers or agents shall be the persons whom the first Board of Directors shall elect at their first meeting, and the officers shall hold office for one year and until their successors are elected and qualified.

Vacancies in the Board of Directors or in any office may be filled by the Directors for the unexpired term.

ARTICLE VII.

The number of shares in the capital stock of said corporation shall be one thousand (1,000) and the amount of each share shall be one hundred ($100) dollars.

In testimony whereof the undersigned have hereunto set their several hands and seals this 21st day of September, A. D. 1889.

EDWARD R. GILMAN. [Seal]
WILFORD G. DE CELLE. [Seal]
HAYDN S. COLE. [Seal]
GEORGE C. DUFFIE. [Seal]
HARRY W. TURNER. [Seal]

In presence of
WM. CANBY.
A. S. HURST.

State of Minnesota, County of Ramsey, ss.

On this 21st day of September, A. D. 1889, before me, a Notary Public duly commissioned in and for said Ramsey County, personally appeared Edward R. Gilman, Haydn S. Cole, Wilford G. De Celle, George C. Duffie and Harry W. Turner, to me personally known to be the identical persons who signed and sealed the foregoing articles of incorporation, and each then and there severally acknowledged that he signed and sealed said articles as his free act and deed.

WM. CANBY, Notary Public,
[Notarial Seal] Ramsey County, Minnesota.

Office of Register of Deeds, Rice County, Minn.

This instrument was filed for record this 23d day of September, A. D. 1889, at the hour of 9 o'clock A. M., and was duly recorded in Book "D" of M. R., page 386.

JAMES HUNTER, Register of Deeds.

Filed in this office for record September 25, A. D. 1889, at 12 o'clock M.

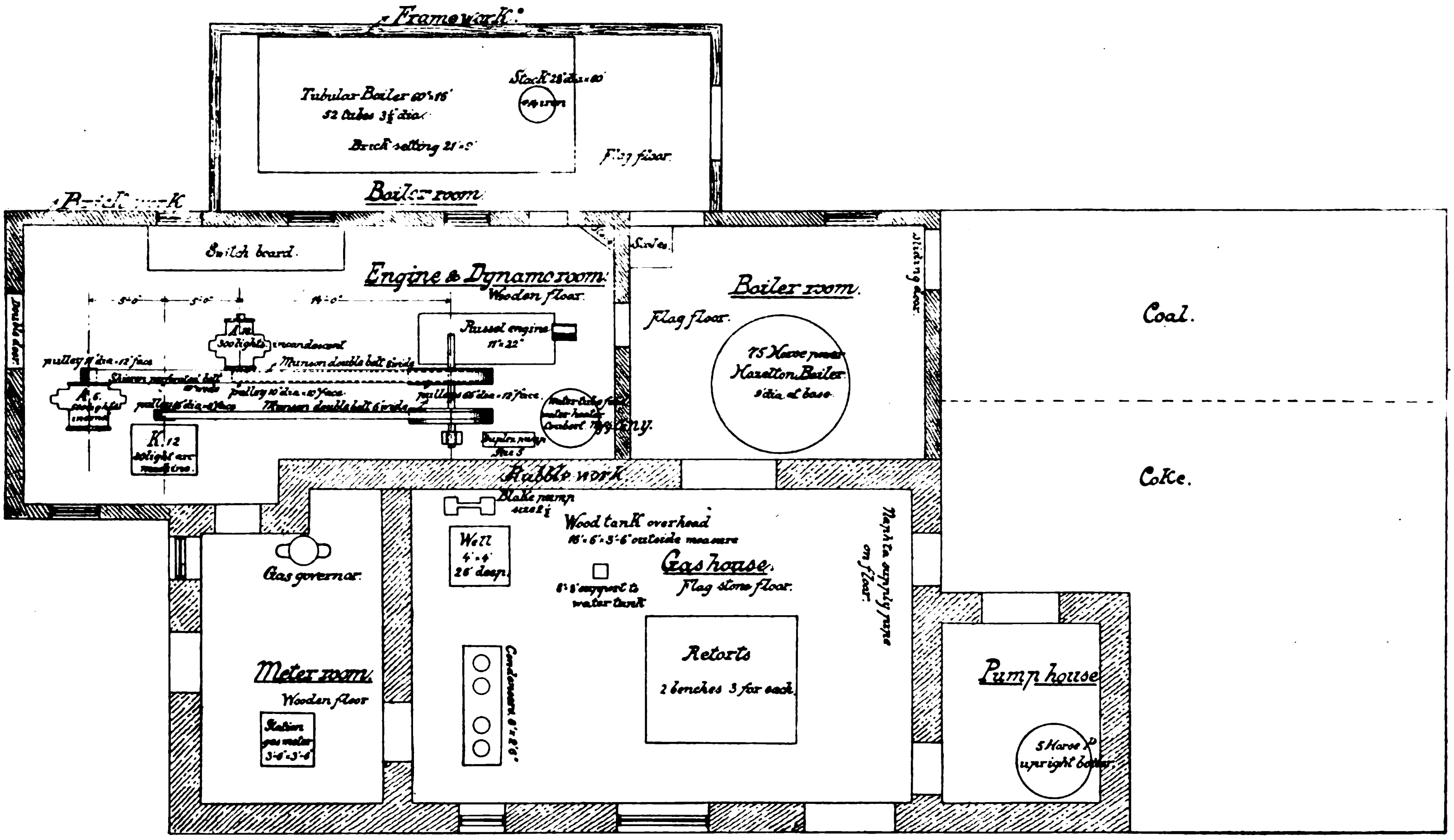
H. MATTSON,
Secretary of State.

State of Minnesota, Department of State.

I, Albert Berg, Secretary of State of the State of Minnesota, do hereby certify that I have compared the annexed copy with record of the original in my office of articles of incorporation of the Faribault Consolidated Gas and Electric Company, and that said copy is a true and correct transcript of said articles and of the whole thereof.

In testimony whereof I have hereunto set my hand and affixed the great seal of the State, at the Capitol in Saint Paul, this fourteenth day of September, A.D. eighteen hundred and ninety-five.

ALBERT BERG,
[State seal] Secretary of State.



Plan of Faribault Consolidated Gas and Electric Company's Plant.

Mr. Gilman "retained" all the stock and part of the bonds. Some of the latter were sold to Mr. Gilman's father at par and $20,000 to an old army officer in Baltimore who is supposed to still hold them. The magnitude of this consolidated plant is shown clearly by the accompanying reproduction of a photograph taken after all improvements were made. On the right is the electric light station and on the left appears the gasometer. We also give the plan of the station from the official drawings.

The gas plant was profitable in a small way, and Mr. Gilman managed to carry the thing along until he terminated his connection with the Northwest Thomson-Houston Company in the fall of 1890. The electric plant had never earned expenses, but of course all supplies needed were furnished by the Northwest Company from St. Paul, on credit.

Mr. Gilman's version of his connection with the enterprise is found in the following extract from a communication addressed by him to the directors of the Northwest Thomson-Houston Company under date of November 6, 1890:

> Sixth—I desire to call attention of the Board of Directors to the Faribault Consolidated Gas and Electric Company. This plant is one the writer became personally interested in in order, largely, to bring about a consolidation of the electric light company and the gas company. This company is the owner of the old electric light company, an institution which was constantly running behind and was of but little value to us until the consolidation was made. The plant is bonded for $75,000, an amount somewhat in excess of its actual cost to the new company, although an amount materially less, I am informed, than the plant originally cost. It was the intention of the parties purchasing the plant to add materially to the gas works.
>
> These plans have been partly carried out. A new steam plant has been added; the circuits have been extended and many improvements have been made. But it is also necessary to remodel the gas works, which will require an expenditure of about $20,000. It was the intention to sell these bonds and with the proceeds to largely pay for these extensions. Inasmuch as the contemplated extensions have not been made, however, and inasmuch as I am now in possession of the entire plant, I feel it no more than justice to the Northwest Company to place a few of these bonds with the trustee to be held to pay for these extensions when they occur. I also take pleasure in delivering to the Northwest Company $17,500 of the common stock of the Faribault Company without consideration. I think it no more than right that they should have this portion of the stock inasmuch as the stock has cost the original purchasers nothing, although the Northwest Company should well be satisfied with simply obtaining the bonds in place of the old electric plant which it had and which was of very little value to the company. Nevertheless, inasmuch as I now own the plant, I am desirous of doing what will be much more to the advantage of the company than to myself, so that it cannot be said but that the Northwest Company has made more out of the consolidation than any-one else, and for this reason I turn over this stock to the company without consideration, agreeing to put $15,000 of the bonds into the hands of the trustee to be held for extensions.
>
> Finally, regarding the plant, I will state that I shall be

glad to have the company purchase the same from me for the actual amount of money invested, plus 8 per cent. interest, as shown by vouchers.

This I do because I wish the company to understand that I have made nothing out of the plant, and that the main object I had originally in engaging in it at all was to better the security of the company. I would have had the company buy the gas works at the time, but they did not have the money to do so. I was obliged to get other parties to take an interest in the matter, and they afterward became dissatisfied with the investment, so they came back on me and asked me to take the investment off their hands, which, I regret to say, I felt obliged to do. In other words, therefore, I am in this investment against my wishes. I have heard incidentally that some of our stockholders have thought I ought not to be interested in any local plants, and I fully agree with them. I am interested in but two plants, however, one at Miles City, Mont., and the one at Faribault, and if the company will pay me what I have put in either or both of these deals I will gladly sell out.

The Miles City company I was interested in before my connection with this company at all, and the Faribault company I engaged in for the direct benefit of the Northwest Company, and by so doing I have given them a good piece of property for what otherwise would have been a worthless piece.

I make this explanation in order that it may be put upon the records of the company, and so that the matter may not be misunderstood.

The above was written at the time when the St. Paul directors of the Northwest Company were protesting against Gilman's mismanagement and while Mr. Coffin was trying to arrange some plan whereby Gilman might continue to give his valuable talents to the service of the company. Mr. Gilman's remark, that "the old electric light company was constantly running behind," bears out the official records. While his statement has the appearance of frankness it does not bear analysis. The steam plant *had been* renewed, as the original boilers had given out in less than three years. Mr. Gilman was "interested" in the sale of Hazleton boilers and had put them in wherever possible in all the Northwest stations. His offer to give $17,500 of stock to the Northwest Company was certainly generous, as it had no value, but was rather a detriment to the owners.

Just how "good" the property was which Mr. Gilman refers to in his closing paragraph will develop as we proceed with our analysis.

Mr. Gilman retired from the Northwest Thomson-Houston Company soon after the above was written, and a few months later Mr. Byllesby took charge of the fortunes of the company and of its many plants and bond schemes.

In the settlement with Mr. Gilman, all the stock of the Faribault Consolidated Gas and Electric Company was turned over to the Northwest Thomson-Houston Company, and nearly all of the bonds to Mr. C. A. Coffin, who still holds them. For some time after Mr. Byllesby came in the plant was so manipulated, getting credit from the Northwest Thomson-Houston Company, and actual advances of cash, that Mr. Coffin was enabled to draw interest on his bonds, which he did. It is thus seen that the original intention to unload $200,000 of the securities of this plant upon the public miscarried. Meantime the worthless plant has appeared as an asset on the books of the Northwest General Electric Company, supplies sold to it on credit, and never paid for, have gone to swell the gross annual business of the General Electric Company, and the "exploiting" work of Mr. Coffin and his assistants is again exemplified.

No records were kept of the operations of the plant until 1892. When the company needed money it was advanced by the Northwest Company, and when it needed supplies they were shipped. We present herewith a copy of the first trial balance made up after records were kept. As will be shown next week, the item of "Electric plant, $1,243.99," plus the item of "Notes payable, $12,360.87," covers the actual cost of the electric plant up to the date on which this trial balance was made, taking into consideration the losses in operation. The gas plant was not valued in this statement. The amount put down for "Interest on notes, $237.82," is the amount of interest actually paid, not what was due. It was the custom of the Northwest Company to add the amount of interest which its local companies were unable to pay to the new notes which were given from time to time and discounted. For the purposes of such discounts the Northwest Company had on its list no less than twenty banks scattered over the country, the total of its discounted paper, of this character, running up to over $2,000,000.

[COPY.]

FARIBAULT CONSOLIDATED GAS AND ELECTRIC COMPANY.

TRIAL BALANCE FOR TWELVE MONTHS ENDING APRIL 30, 1893.

Electric plant	$1,243.99	
Wiring	91.92	
Street lines and wiring	3,998.60	
Tools and fixtures	25.87	
Profit and loss	85.81	
Faribault Boot and Shoe Company	162.15	
Total	$5,608.34	
Total brought forward	$5,608.34	
Meters	1,335.17	
Transformers	1,234.83	
Accounts receivable	1,185.31	
Cash	598.46	
Salaries of officers and clerks	1,498.00	
" " engineer and fireman	1,241.32	
Fuel	2,224.28	
Coke	965.21	
Naphtha	489.55	
Lamps	253.57	
Taxes	275.97	
Legal expense	25.00	
Traveling expense	19.64	
General expense	428.14	
Oil and waste	48.82	
Repairs to steam plant	39.07	
" " electric plant	153.05	
" " gas plant	255.49	
Carbons	25.05	
Water	12.07	
Insurance	305.00	
Discount	72.00	
Rent	25.00	
Interest on bonds	4,500.00	
" " notes	237.82	
		$23,072.16
Credits.		
Notes payable	$12,360.87	
Earnings	10,711.29	
		$23,072.16

We shall leave for the succeeding chapter an analysis of the value of the property owned by the Faribault Company and a comparison of the amount of securities actually issued, $175,000. The trial balance above shows that in the four years up to April 30, 1893, the company had run up an indebtedness of over $12,000. The best record made for earnings was for the year ending April 30, 1893, and we present the official statement for that year.

[COPY.]

FARIBAULT CONSOLIDATED GAS AND ELECTRIC COMPANY.

STATEMENT OF EARNINGS AND EXPENSES FOR TWELVE MONTHS ENDING APRIL 30, 1893.

Earnings.

	Inc't.	Arc.	Gas.	
May	$181.37	$148.44	$404.80	
June	185.49	148.44	367.48	
July	187.79	163.77	307.38	
August	186.08	152.77	426.14	
September	225.60	152,77	326.67	
October	249.18	147.44	536.24	
November	268.71	143.44	585.49	
December	375.83	119.15	603.96	
January	445.91	100.00	646.23	
February	445.90	102.00	482.18	
March	444.00	102.00	420.48	
April	446.91	135.00	346.25	
	$3,642.77	$1,615.22	$5,453.30	$10.711.29
Net profit from wiring				456.65
Total earnings				$11,167.94

Expenses.

Salaries of officers and clerks	$1,498.00	
" " engineer and fireman	1,241.32	
Fuel, (less inventory)	2,223.03	
Coke, " "	709.21	
Naphtha, " "	311.71	
Insurance	305.00	
Taxes	275.97	
Lamps (less inventory)	167.32	
General expense	428.14	
Repairs to gas plant	255.49	
" " electric plant	153.05	
" " steam plant	39.07	
Oil and waste (less inventory)	31.81	
Carbons	25.05	
Discount	72.00	
Legal expense	25.00	
Traveling expense	19.64	
Water	12.07	
Rent	25 00	
		$7,817.88
Surplus for twelve months		$3,350.06

This shows an apparent surplus from operations of $3,350.06. The bonds of this company bore 7 per cent. interest, and the lowest rate obtainable for discounts was 10 per cent. We are able, therefore, to show what the full results of the year's operations were by the following table:

The fixed charges were:	
Interest on $75,000 bonds at 7 per cent	$4,500.00
Interest on notes, $12,360.87 at 10 per cent	1,236.08
Total	$5,736.08
Deduct surplus from operation	3,350.06
Deficit	$2,386.02
And to show how far the plant fell short of being a sound enterprise we must add:	
6 per cent. depreciation on cost of plant, $21,600	$1,296.00
6 per cent. interest on stock, $100,000	6,000.00
Total deficiency for one year	$9,682.02

(*To be continued.*)

An Electric Pen.

Mr. F. W. L. Sladen, of Riple Court, Ringwould, Dover, is the inventor of an electric pen which will, no doubt, be the forerunner of improvements enabling such inventions to be used in a greater variety of ways than the appliance before us is at present intended to accomplish. There are really two forms of pen—a coil pen, which consists of a loop of steel wire at the writing-point, round which is coiled ¼″ of the London Electric Wire Company's "Platinoid" wire, .002″ diameter. This is covered with insulating material, and the current heats the platinoid by passing through it, and the steel loop by conduction of the heat. With a small dry cell the resistance of this pen when working is about 6.1 ohms, and the current registered about 250 milliamperes.

The other pen-point consists merely of a steel loop, through which the current passes, warming it to the requisite point. This form requires about 3 amperes of current, and can be worked from the lamp wires.

Mr. Sladen has sent us some specimens of work done by his electric pen, both illustrations and reading matter produced being exceptionally clear. We understand from Mr. Sladen that his invention is not yet on the market, but that he is open to treat with manufacturers for its production and sale. The only public exhibition, so far, of the capabilities of the pen was given a few weeks ago in Edinburgh before a company of electrical experts, who recognized its value as an autographic duplicating agent. The modus operandi is as follows: An electric current passed through the pen from a small dry cell, has the effect of warming the steel loop to a temperature somewhat above the fusing-point of wax, and the pen, being then applied to a thin sheet of porous Japanese paper coated with wax, melts the wax as it is guided by the hand of the writer, and the sheet is thus transformed into a stencil open for the transmission of ink. The stencil sheet is then fixed in a frame, and by the aid of an inking roller in the usual way copies of the original writing may be taken to practically an unlimited extent. Lines of any thickness may be made without fear of limiting the number of copies which the stencil is capable of throwing off, and the invention is not confined to letter copying alone, as in the case of existing kindred processes, but may be used with great advantage for illustrations of all kinds. The whole apparatus is contained in a small compact box, and the cost of the article, it is claimed, is considerably below that of the ordinary stencil copyers. The experiments appeared to give the utmost satisfaction.—*Electrical Plant* (London).

LEGAL NOTE.

Patent Allowed on Flexible Mica.

The Board of Appeals of the United States Patent Office has just reversed the decision of the Primary Examiner and has granted the right to protection upon what is appropriately and conveniently termed "flexible mica" for insulation, recently introduced by the Mica Insulator Company, of 218 Water street, New York City.

Personal.

Mr. Frank Judson Pope, who graduated from Columbia College in the class of '95, has followed somewhat in the footsteps of his father and begins newspaper work on the staff of the *Evening Sun* of this city.

Mr. H. T. Richards, who is well and favorably known in this trade through his long connection with the *Electrical Review*, has taken a position with the New York Safety Insulated Wire and Cable Company.

Mr. F. H. Horne, one of the old-time salesmen, who is widely known in the East, left Chicago last week for Japan, sailing from Vancouver on the Empress of China of the C. P. R. Company's line.

Is a Freight or Mail Service Profitable or Unprofitable on Street Railways?*

BY BENJ. F. NORTON.

The simplest answer to this question is, yes, if it can be performed at a profit; and no, if it must be performed at a loss. Now, apparently, the question is solved, and I have no further need to discuss it. But as this is a subject which will eventually be taken up seriously by most electric railway companies, it is worthy of very careful consideration.

On a street railway which has no suburban outlet and no direct or close connection with some other line which operates or can conveniently operate a freight service, it might be a very unprofitable venture to undertake this class of traffic. To-day, however, there is hardly an electric railway (and we will speak of electric roads only now, since horse power is a thing of the past,) which does not have suburban outlets or chances for them. Therefore we may safely say that a freight service as a general rule ought to pay. Very few companies thus far have branched out into this field, and as I happen to be interested heavily in a line which has gone vigorously into the matter, I can tell briefly our experience, and can show you what a successful feature of our business the freight branch of it is; so much so that we have a regularly organized freight department, waybilling merchandise in regular steam railroad fashion and running regularly scheduled freight trains, all of which pays handsomely.

This line grew out of a tumble-down horse railroad in the city of Newburg, and after being rebuilt and extended and equipped electrically, we found ourselves tapping the rich Walkill Valley at Walden, twelves miles away, and terminating at the front door of one of the largest cutlery works in this country, running by all the stores and shops in town, and giving an opportunity besides to dairymen of Orange County to get their milk, butter and cheese to boats on the Hudson River at Newburg inside of an hour, when formerly they had carted it the distance over the rough country roads, the teamsters spending pretty much the day at it and returning home at night with their mule teams tired out and often a broken-down wagon.

This line to-day, because it is a short-cut in the first place, and because goods can be transported at low rates in the second place, is handling the dry goods and other merchandise for Walden merchants, shipped from New York to Newburg by boat; the raw material for the cutlery works, in the way of steel, brass, wood and other supplies, and bringing back manufactured material; in cases, hay, straw and fruit; and condensed milk in cans from the Borden condensery, only two miles from our terminus at Walden. The road runs along the highway in some portions, and at other points the line is set well back from the roadway on independent property; and the farmers hustle their hay and straw in bales out the side gate to the track and stop the freight car handily, saving (besides 50 cents to $1.00 per ton freight) a long drive to the steam road freight house.

In the month of August the operating cost for handling our freight was a trifle over 40 per cent. of the gross receipts. We ran three motor freight cars, carrying from 8 to 12 tons each, and four flat or gondola cars as trailers, carrying from 6 to 8 tons each. At Newburg the line runs alongside the stringpiece of the steamboat dock, so that everything can be easily skidded between the boats and cars. We also run close to the Erie and West Shore freight houses and tracks, ensuring an all year round New York connection, although as a rule the Ramsdell line of boats is out of service but one month in the year.

Some of our Walden friends remarked the other day that the Walkill Valley railroad people had soured on the trolley, because their freight trains in both directions were running through Walden without stopping, and they were discussing the notion of discharging their freight agent at that point. I may add that the past week we have hauled from Walden to the Hudson River, among other kinds of freight, about 75 tons of grapes, and the coming week we will do the same. The rate of 13 cents per hundred pounds net to us makes $2.60 a ton, which is a good rate, and requires but one trip per day of a motor freight car and trailer to get it. To earn the same amount of money with passengers would take the entire day and a regular full day crew besides.

The experiments now being made by the New Haven Railroad people on their Nantasket Beach road are probably not new to you, and it looks very much as though freight business on electric roads would not only be profitable in the near future, but generally adopted as a means of revenue by a large percentage of such companies.

As to mail contracts, while the Government compensation is comparatively small, the actual cost to a company for performing the service is so little that they must be profitable to a certain extent, but aside from this no large corporation in a large city where the circumstances call for such a contract should overlook a special safeguard in time of strikes. During my presidency of the Atlantic Avenue Railroad Company in Brooklyn, we undertook to serve the Government in this regard, and prepared special cars. Part of these cars was devoted to mail matter and mail clerks, and part to regular passengers; so that while they were on the line they were earning money for the company from passengers the same as other cars and at the same time the United States Mail sign always insured a clear track. Our experience during the strike of last winter proved conclusively the value of a Government contract for carrying the mails. The 19 cars on our Fifth avenue line, which by the contract were permitted to carry the legend "United States Mail," were not molested, and we were able to keep that particular line open throughout the whole trouble. In view of all the circumstances, I believe a mail contract for a street railway is one of the most profitable things for a small one that they can undertake.

General News.

What is Going on in the Electrical World.

Shreveport, La.—The citizens have petitioned the city council for an electric light plant.

Lansingburgh, N. Y.—A company is being formed here for the purpose of furnishing electric light.

Emmetsburg, Ia.—The council is considering the proposition of Walsh Bros., of Burlington, to put in an electric plant.

Garrett, Ind.—This city desires to put in water works and electric light plant and has adopted plans and specifications therefor.

Pottsville, Pa.—Ground has been broken for the extension of the Schuylkill Electric Railway from Pottsville to Schuylkill Haven.

Hanson, Mass.—The business men of Hanson are procuring subscriptions for stock for an electric railroad from Hanson to Whitman.

Union Springs Ala—The city desires to grant an electric light franchise, and correspondence is solicited by D. A. Sissiuns, mayor.

Jacksonville, Fla.—D. F. Jack has been elected president of the Jacksonville Electric Railway Company vice Col. H. S. Haines, resigned.

Bristol Conn.—The next Legislature will be asked to grant a charter for an electric road to connect Bristol with Terryville and Thomaston.

Menasha, Wis.—The Citizens' Electric Company of Menasha has been granted a franchise for a plant to furnish this city with electric lights.

Hammond, La—The Hammond Electric Light and Power Company are making preparations to put in an electric light and power plant in this place.

Pittston, Pa.—Senator James L. Slocum is interested in a scheme to build an electric railway to connect with the Wilkes-Barre and Scranton lines.

Gladstone, Mich.—The proceeds of the sale of $12,000 bonds issued by this town will be applied partly to the construction of an electric lighting plant.

Burlington, Vt.—The Military Post Street Railway Extension Company has filed a petition for the location of a trolley railway to be constructed in this city.

Watsontown, Pa—The company operating the Milton electric light plant have proposed to extend their service to this town if sufficient patronage is guaranteed

Mauch Chunk, Pa.—The town council of East Mauch Chunk Borough have under consideration the proposed borough electric light plant and electric road extension.

Cairo, Ill.—An ordinance is before the council calling for the granting of a franchise to E. W. Falliday to construct an electric railway in one of the streets of this city.

Asbury Park, N. J.—The Asbury Park and Belmar Street Railway Company has filed articles of incorporation for a double track electric railway from Asbury Park to Belmar.

Hubbard, O—The vote at the recent special election on the question of issuing $6,000 bonds for the purpose of erecting an electric light plant was largely in favor of the issue.

Jersey City, N. J.—The street and water board have directed Clerk Bouton to advertise for proposals for the street lighting of Jersey City for the fiscal year ending December 1, 1896.

Batavia N. Y.—The board of aldermen have decided to appropriate $1,000 for the purchase of an incandescent electric plant to be used for lighting the city buildings and hose houses.

Rome, N. Y.—G. T. Breckenridge & Company of Albany were the lowest bidders for the electrical work on the Rome State Custodial Asylum at Rome, N. Y. Their figure was $3,495.

Niagara Falls, N. Y.—There is a movement in progress to connect Niagara Falls to Toronto, Can., by an electric road. The Hamilton Radial Railroad Company has been formed with that end in view.

Mt. Clemens, Mich.—Mayor Donaldson has received a communication from the officials of the Rapid Railway Company in which they reject the franchise offered them by the common council of this city.

Tacoma, Wash.—The city electric plant is to be improved at a cost of $10,000. The plant is now supplying 580 arc and over 3,000 incandescent lights. The capacity of the incandescent plant is 4,250 lights.

Randallstown, Md.—At a meeting held here a few days ago in the interest of the proposed Grown Oak and Harrisonville Electric Railroad it was announced that $10,000 had already been subscribed toward the project.

Bay City, Mich—The council has adopted the recommendation of the streets and lighting committee granting the Bay City Electric Light Commission authority to do commercial lighting in West Bay City under certain conditions.

St. Louis—A survey has been made and measures adopted for the extension of the Houseman electric line from Brentwood out the Manchester road to the village of Des Peres, and from there northward up the valley to Creve Coeur Lake.

Franklin, N. H—The survey for the electric street railway has been completed and the estimate of cost made. A stock subscription book is in the hands of E. H. Sturtevant, the company's treasurer, andthe citizens are invited to subscribe.

Port Huron, Mich—The Mt. Clemens and Port Huron Electric Railway is now under construction. All the contracts for the construction of the thirty-two miles of roadway have been executed and call for the completion of the work by December 14.

Chester, Pa—The directors of the Aston (Delaware County) Trolley Company have voted to increase the capital stock from $30,000 to $150,000, and preparations are being made to build the line, which will tap the populous towns along Chester Creek.

Homestead, Pa.—Sealed proposals, accompanied by certified check or bond to the amount of $500, will be received by O. S. Swisher, chairman of fire and light committee, until September 28, for lighting the streets of this borough with 60 or more 2,000 candle power arc lamps, for a term of ten years.

Los Angeles, Cal.—The ordinance granting to W. S. Hook, manager, and his assigns the right to construct and operate an electric street railway along certain streets of the City of Los Angeles, as adopted by the city council and approved by the Mayor, has been published in the city papers.

Elizabeth, N. J.—The executive committee of the board of trade is negotiating with a syndicate that has in view the extension of the East Jersey street horse car line to Rahway and Summit, and the changing of the motive power to the trolley system. About $300,000 will be spent in the undertaking.

Hempstead, N. Y.—The Long Island Electric Company has made application to the town board for a franchise to erect poles and run wires on the streets, avenues and highways in the villages of Freeport, Merrick and Wantagh for the purpose of furnishing arc and incandescent lights to the inhabitants of said villages.

Millbury, Mass.—The directors of the Blackstone Valley Electric Railway went to Boston last week and laid before the Railroad Commissioners the facts and figures in regard to their proposed line, showing the necessity of the new road and the advisability of a speedy charter for its construction and operation.

Brooklyn, N. Y.—The Rogers avenue trolley road which will form a new line to Manhattan Beach, Coney Island, is approaching completion. Albert L. Johnson, one of the builders of the road, states that the company has given an order to the Brill Car Company of Philadelphia for 400 open cars for next summer's business.

New York.—At a recent meeting of the stockholders of the United States Electric Forging Company the following directors and officers were elected: Directors: Geo. D. Burton, A. B. Bright, A. C. Garcia, B. J. Fredericlis and David Pfeiffer. Officers:

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* Paper read before the New York State Railway Association, Albany, September 17, 1895.

THE TELEPHONE WORLD.

Not Bluffed by the Bell Company.

The Washington *Star* states that within a short time the Commissioners will install in the District of Columbia a telephone service for the exclusive use of the municipal government. They have decided that the instruments furnished by the Manhattan Electrical Supply Company, N. Y., are the equal of the Bell, and they will purchase a number of them and set up a telephone line of their own. This was decided some time ago, but the protest of the Chesapeake and Potomac Telephone Company against the use of these instruments, which it claimed, was a direct infringement of the Bell patents, set them to thinking, and before finally closing with the Manhattan company they required an indemnity bond to insure the District against infringement suits. This has been furnished, and the attorney for the District has declared it in good form and properly executed. All that now remains is for the Commissioners to close the deal and set up the instruments. It is understood, however, that the local telephone company will not submit to this new system without a vigorous protest, and may bring suit for infringement.

Future Development of the Telephone.

Emile Berliner in a recent interview said: "The next step in the development of the telephone will enable a number of persons to talk over the same wire simultaneously, and by this means the cost of long-distance telephoning will be much reduced. Experts are working on this problem now.

"The Bell Company spends $100,000 a year for experiments. In the Boston laboratory thirty experts are constantly engaged in working on telephone problems. An invention that is even now approaching perfection is the theatrophone. This contrivance will make it possible for people to step into a public office, and listen to grand opera, comic opera, or the songs and funny dialogues of a variety show, choosing among such attractions as please their fancy. Of course, such a device may be turned to account as a household convenience, so that the well-to-do citizen will be able to listen to a play or opera without leaving his dwelling."

Progress in Wisconsin.

The independent telephone companies now operating in Wisconsin are reported to be making considerable progress. In La Crosse a local company has recently opened an exchange and now has about 150 subscribers, but expect before long to have 300. The Waukesha line, which was built by the National Telephone Construction Company, is said to be doing a good business and now has a number of telephones in use. Negotiations are being carried on in Kenosha, Sheboygan and Ashland for the construction of exchanges which are to be operated in opposition to those of the Wisconsin Telephone Company.

One Way of Getting Even.

A short time ago the City Council of Wichita, Kan., ordered the Missouri and Kansas Telephone Company to reduce its rates, as is being done in other cities where rival companies have been started. The Telephone Company refused, and the Council proceeded to get even by enacting a telephone license ordinance. Under this ordinance the telephone company was to be compelled to pay a license of $12 a year for every telephone operated in the city and a penalty was fixed for a violation of the ordinance. W. G. Chipchase, manager of the telephone company, has been arrested for violation of the ordinance.

A Telephone Newspaper.

Budapest is the only city in the world that can as yet boast of a telephone newspaper. The idea of diffusing unwritten news was originated by the Hungarian, Theodor Albert Puskas, and the *Telephone Hirmondo* (Herald) has now been working successfully for over two years. The 6,000 subscribers are served by one wire, measuring 168 miles in length, and running along the windows of the subscribers. Each subscriber forms a station, and a separate line is connected with each station by means of a special apparatus, so that the main line is not affected if there is a block at one of the stations.

The bulletins are carefully edited and arranged in an orderly programme. The staff is on duty from 7:30 in the morning until 9:30 in the evening, during which time twenty-eight editions are spoken into the transmitter. Ten men with strong voices and clear articulation act as speakers, and take their turn in shifts of two at a time. One of these speaks a series of items, but for no longer than eight or ten minutes, and every new item is introduced by the word "new."

Toward evening, when news is growing scarcer, the subscribers are entertained with vocal and instrumental concerts. Connection has been made with the opera house and music halls, so that operas, as well as concerts, given in different parts of the town, are transmitted to the subscribers, who are often lulled to sleep by the strains of some favorite melody. The same arrangement has been made with the principal churches for Sundays and saints' days, especially for the Easter festival. The Budapest concerts are sometimes listened to throughout the whole dual monarchy, and even beyond its borders.

The Mutual Standard Telephone Company, which has secured control of the stock of the Mutual Automatic Telephone Company of Philadelphia, has been organized by electing Gen. James S. Clarkson, of Iowa, as president, and Robert M. McWade as general manager. The full capital, $1,500,000, has been paid in, and a contract has been made with Thomas Hurley, a contractor at Fort Worth, Tex, binding him to have fifty miles of the system constructed by next January. The Standard Telephone and Telegraph Company, which it was supposed had succeeded to the franchise of the Mutual Automatic Company, is in fact nothing but the construction company which will build the proposed Philadelphia plant. City Solicitor Kinsey has decided that the Mutual Automatic Company has no right to transfer the franchise already obtained.

The Newark Telephone Company has asked for a franchise at Newark, N. J., offering to furnish exchange service for $4 per month. The company has already secured upwards of 4,000 three-year contracts. The officers of the company are Franklin Noble, president; John M. Gwinnell and Wallace Somers Risley, vice-presidents, and Geo. H. Atkinson, secretary and general manager.

The new telephone exchange at Ocala, Fla., will consist of one hundred instruments to be installed in that place and Marti City. The officers of the company are J. B. Carlisle, president; D. W. Davis, secretary, and A. H. Birdsey, J. V. Burke, U. R. Warterman, and W. V. Newsom, directors.

The Superior Telephone Company has secured a twenty-five-year franchise at Superior, Wis. The rates will be $24 and $36 per year. Connections will be made with Duluth and the Twin Cities. John Goodnow, of Minneapolis, will be general manager of the new company.

The directors of the Bell Telephone Company have declared the regular quarterly dividend of $3 per share, payable October 15 to stockholders of record September 30. The matter of sale by auction of the stock unsubscribed for by stockholders was referred to the executive committee.

M. R. Thomas, Markleysburg, Pa., is president of the Somerfield Telephone Company, which has been chartered to construct and operate a telephone line connecting Petersburg, Markleysburg, Confluence, Uniontown and other towns in Somerset and Fayette counties, Pa.

Negotiations are about completed for the building of a new telephone line from Trempealeau, Wis., to Centerville, five miles distant, which will connect with the Luce-Veitch line, the Northwestern Telephone Company and the long-distance 'phone to Chicago.

The telephone line connecting Tarkio and Rockport, Mo., has been completed and is now in operation. The line is owned by Jesse L. and John Davis, of Rockport, and W. F. Rankin and Frank Travis, of Tarkio.

Beginning October 1 the Missouri and Kansas Telephone Company will cut rates at Leavenworth, Kan., to $1 and $2 per month. This is to overcome the opposition of the new People's Telephone Company.

R. E. Lowry, W. C. Morgan and John Hoschar, of Seymour, Ia., are interested in the proposed telephone line to be built from Seymour by way of Promise City to Corydon, Ia.

The Carolina Mutual Telephone and Telegraph Company has been organized to establish a new telephone system in Charleston, S. C. E. M. Bailey is interested.

G. W. Williams, of Olivet, S. D., has been granted a franchise to construct 100 miles of telephone line in Hutchinson County, that State, connecting the various towns with Parkston, the county seat.

The Louisiana Telephone Company is making arrangements to extend its system through all the towns along the line of the Chicago and Alton Railroad to Mexico, Audrain County, Mo.

The Luce-Veitch Telephone Company has been granted a twenty-year exclusive franchise by the city council of Galesville, Wis.

The Northwestern Telephone and Electric Company of Milwaukee has received a franchise to build an exchange at Sheboygan, Wis.

A telephone line has been projected from Center, the county seat of Cherokee County, Ala., to Gadsden, about thirty miles

The city council of Vermillion, S. D., has granted a franchise to J. C. Tomlinson, W. A. Cottrell and the Clark Electric Telephone Company.

The failure of the Detroit Harrison Telephone Company to deposit $25,000 as a guarantee has been construed by the City Council of Detroit as a forfeiture of its franchise. Accordingly, the ordinance granting similar rights to the Brown Loud Speaking Telephone Company has been passed over Mayor Pingree's veto. It is announced by the representatives of both telephone companies that work on the plants will begin within 60 days.

T. J. Roberts & Son are erecting a telephone to connect their plantation at Centerville with Tallahassee, Fla.

The American Telephone and Telegraph Company has secured a franchise at Grand Rapids, Mich.

Marshall & Toby have decided to extend their telephone line from Reynolds to Rock Island, Ill.

The Logansport Mutual Telephone Company has secured a franchise at Logansport, Ind.

Knoxville and Chattanooga, Tenn., are now connected by long-distance telephone.

An effort is being made to organize a telephone exchange company at Bedford, Ia.

A telephone line is to be constructed between St. Elmo and Portersville, Ala.

The local Bell Company has cut rates to $16 per year at Cheboygan, Mich.

There is talk of organizing a local telephone company at Marlboro, N. Y.

A telephone line is proposed to connect Jasper and Kirbyville, Tex.

New Companies Incorporated.

The Huntington Phœnix Telephone Company, Huntington, Ind., has been incorporated with a capital of $15,000.

The Manchester Telephone Company, Manchester, N. H. Capital stock, $125,000. Incorporators' names not given.

The Beaumont Telephone Company, Beaumont, Tex. Capital stock, $10,000. Incorporators: E. L. Bacon, J. F. Keith and Minnie King.

The Menominee Telephone Company, Menominee, Wis. Capital stock, $12,000. Incorporators: James B. Hills, Sanford J. Heafield and Elmer J. Newson.

The Montgomery County Telephone Co., Hillsboro, Ill. —to construct a telephone line to Coffeen, Ill. President. Jacob J. Frey; secretary and treasurer, Charles A. Ramsey.

The North Argyle Union Telephone Company—to connect Argyle and North Argyle, Washington County, N. Y. Capital, $250. Directors: William D. Stevenson, Alexander S. Cuthbert, Rodney Van Wormer, Robert B. Scott, and others, of Argyle.

The Humboldt Telephone Company, Ferndale, Cal. Capital stock, $5,000. Directors: H. H. Moller, George M. Brice of Ferndale, Charles A. Eastman of Fortuna, G. C. Barber, Grisley Bluff, Frank W. Luther, Alton.

The La Grande Telephone Company, La Grande, Ore.—to build a telephone line from La Grande to Union and Elgin, Ore. Capital stock, $3,000. Incorporators: J. W. Scribner, F. D. McCully and W. W. Hinman.

The Baraboo Telephone Company, Baraboo, Wis., recently incorporated with a capital stock of $3,600, has elected the following officers: President, Dr. Charles Gorst; vice-president, E. P. McFutridge; secretary, A. F. Fisher; treasurer, Henry Marniott.

The Harford Telephone Company, Harford County, Md. —to erect and operate telephone and telegraph lines throughout the State of Maryland. Capital stock, $5,000. Incorporators: Wm. B. Baker, T. Littleton Hanway, Wm. H. Reasin, Robert C. Richardson and Walter W. Finney.

The Citizens' Telephone Company, Grand Rapids, Mich. Capital stock, $10,000. Directors: James M. Barnett, Ernest B. Fisher, Cyrus E. Perkins, Phillip Graham, Samuel B Jenks, Charles R. Sligh, Gaius W. Perkins, Edward Fitzgerald, Charles F. Rood, William J. Stuart, Ernest A. Stowe and Amos S. Musselman.

The Matfield Green and Bazar Telephone Company. Matfield Green, Kan.—to build a line of telephone between Matfield Green, Chase County, and Bazar. The capital stock of the company is placed at $1,000, and the directors named in the charter are John Carnes, B. F. Talkington, P. J. Heiz, Levi Jones, R. F. Sargent, W. F. Dunlap and O. H. Lewis, all of Matfield Green.

The Delaware River Telephone and Telegraph Company of Liberty, Sullivan County, N. Y.—to construct telephone lines through Sullivan, Orange, Ulster and Delaware Counties in New York, Wayne and Pike Counties, Penn., and Sussex County, N. J., connecting Deposit, Hancock, Port Jervis, Honesdale, Milford, Middletown, Bloomingburg. Wurtsborough, Ellenville, Grahamsville, Livingston Manor. New Beach, Roscoe Trout Brook, and Walton. Capital. $25,000. Directors: Charles Homer and E. H. Pinney of Jeffersonville, George Christians, Wallace M. Kilburn, and others of Liberty, and John H. Scofield of New York City.

ELECTRICITY.

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EDITORIAL NOTES.

The Case of John L. Martin. Mr. John L. Martin, who held an important position in the Chicago offices of the Thomson-Houston and General Electric companies for nearly ten years, was arrested in New York last week. He had called at the stationery store of Corlies, Macy & Co., No. 97 William street, and said he was J. B. Moore, cashier of the Merchants and Manufacturers' Bank of Chicago. He explained that he had opened an account with the Central National Bank of this city. He desired some checks and gave an order for 4,000 to be printed in black ink. A thousand of them were to be printed for the Central National Bank and the remainder for the Merchants and Manufacturers' Bank. It was learned that Martin had no account at the Central National Bank, and that there was no such bank in Chicago as he claimed to represent. He was therefore taken into custody, although there was no direct charge against him here. Martin had been living at the Astor House and had been able to pay his way out of winnings at the race tracks and small amounts raised from negotiating bogus checks.

Martin's habits had become well known, and his arrest will cause little surprise. He had been arrested in July at Detroit, but in that case also there was no specific charge against him.

Ordinarily the downfall of any one man creates small interest and should be passed over in charity. But the case of John L. Martin is full of lessons which need to be taught over and over again, and to which the press may well devote some space.

Martin was well known and well liked. He had friends without number, every one of whom would have given him a lift when he needed it. He has good business abilities and could have earned a decent living for himself and family.

Most people will say, Why should he turn swindler? To which it is proper to answer, Why should he not turn swindler when he needed money? For years he had been accustomed, in the line of his official duties, to assist in covering up the swindling operations of his superior officers. He had been one of the earliest pupils in Mr. Charles A. Coffin's school of crime at Boston, and was taken to Chicago and placed in charge of the Central Station department by Silas A. Barton. He had seen territory farmed out systematically so that Mr. B. E. Sunny's favorites could obtain illegitimate commissions from their employers. He had seen the spoils divided. He had been an eye-witness of the many rascalities in the Chicago office. He had seen the thieves advanced in position while honest men were discharged. He had known that the stealings were not all retained at Chicago, but that a portion of them went to Boston to his superiors. He had been fully aware of the carefully laid plans of Coffin and Sunny to rob the public by the sale of bogus stocks and bonds. He had seen the employees of the Thomson-Houston Company, from Coffin and Sunny down, enter into various outside trades and deals whereby all the profits were to be divided among the individuals at the expense of the company they had agreed to serve. He had seen original memorandums over the signature of Mr. C. A. Coffin, informing district agents what price they could have apparatus for, and that they could "retain" anything over this amount which they could get from the public. He had seen Sunny, directed by Coffin, raise over $2,000,000 on worthless paper at Chicago banks. He had known of a half-dozen detailed reports of the stealings in the Chicago office, sent to Mr. Coffin, thrown into the waste basket without attention and the men making them either discharged or told to mind their own business. He had seen his employers deliberately conspire to rob the public, guided within the law by their eminent counsel.

Why should he, a weak-minded man, not follow in their footsteps as nearly as he could, and try and make something from nothing? Why should he hesitate to rob his friends or the general public? That this was the proper thing to do had been hammered into him for ten years.

Mr. Martin's case should make Mr. C. A. Coffin shudder. And no matter how callous Mr. Coffin may seem to be, we doubt not that many times in the silent hours of the night, when honest men sleep, his rest is disturbed by visions of a procession of young men whom he has debauched, a mournful company, saying, "You made us what we are. We were honest men till you taught us to commit crime."

If Mr. Coffin's dreams are not thus troubled, why does he leave his hotel at 4 or 5 o'clock morning after morning and walk the streets, unable to sleep longer?

Mr. Martin's conduct should create no surprise. We make no apology for him. He is guilty of serious offences against the law, and punishment will overtake him. Yet he no doubt fails to see where he is any worse than his old employers, and laments the lack of money which prevents his hiring expert counsel like F. P. Fish to advise him what forms of swindling are legal and what are not. He can see little difference morally between his crimes and those of his superiors, and works within his capabilities, forging a $50 or $100 check with as little compunction as Coffin showed in planning, through his attorney, to spend $65,000 in buying votes at Albany for the charter of the General Electric Company.

On Thursday Martin was held upon a charge of petty larceny until the New York authorities could learn whether or not he was wanted in other cities, Nothing was found against him, and he was subsequently discharged.

His old acquaintances here, whom he had swindled out of sums up to $100, would not appear against him. They did not share the spirit of Mr. Sunny, who induced the *Western Electrician* to expose him and who said that "Martin ought to be in the penitentiary, and I would be glad to put him there."

If all the employees of the Chicago office of the General Electric Company who ought to be in jail were actually sent there, Martin would have plenty of company.

No doubt Martin should go to the penitentiary. He is an enemy of society, a rebel against established law. Yet he is a much less dangerous enemy of society than C. A. Coffin, his instructor and his prototype.

* * *

"Electricity" and the British Association. It has happened so frequently that ELECTRICITY has distanced its contemporaries that it has become an old story. There are, however, some stories that bear repetition, and it is with pleasure that we refer to our presentation in advance of all of our contemporaries of the reports of the recent British Association meeting.

By special arrangements we have thus far been nearly always at least a week in advance of any other American publication in presenting important English news, and in the case of the British Association the electrical portion has been reported with nearly the same promptitude and completeness that is our wont in the case of the meetings of American Electrical Societies.

While several of our enterprising (?) confreres are quarreling over their relative senilities, ELECTRICITY with its young blood steps in and "gets there."

Would it not be better for our friends the enemy to stop their quarreling and attempt some genuine newspaper enterprise?

* * *

Faint-Hearted Telephone Manufacturers. It is a law of business, as wel as of love, that faint-heartedness does not win. That the adage most fittingly applies to the more tender relation, few of those qualified by experience to judge will deny. But in its application to the sterner and more real, yet none the less vexatious relation, there are many to whom experience has taught nothing.

Of the latter class there are many in the electrical trade—some even in the field of electrical journalism—but the most conspicuous, just now, are certain telephone manufacturers. Until recently these rejoiced in the distinction of "independent," which term, by common consent, has been the designation applied to all telephone manufacturers outside of the Bell Company's fold. So long as the Bell Company remained outwardly inactive these supposedly and so-called independent competitors of the great New England corporation made bold to say that they were in the business to stay and that they were anxiously waiting for an opportunity to meet the Bell Company in the legal arena.

In the agitation and discussion leading up to the organization of the Telephone Protective Associations these zealous members of the craft were heard early and often. They were as prolific in suggestion as they were profuse in promises. But when the real business of organization had reached the point of calling upon members for dues and contributions to the defence fund, they were found to be wanting. No sooner had the Milk Street Giant begun to arouse himself than these Liliputians of the trade began to vanish into thin air. With each succeeding step taken by the Bell Company in its attempt to retain and prolong the monopoly that is slowly but surely slipping from its grasp, the number of the weak-kneed telephone manufacturers has increased.

The strength of the independent telephone movement is not impaired by these defections from the ranks. On the contrary it is increased and made more effective. With the timid and frightened out of the way, those who are in the trade, not to sell out or to sneak out, but to stay, will know what to do and upon whom to depend.

There are in New York, in the East, in the West, and in other sections of the country a number of earnest, capable and honest men who have gone into the telephone business for legitimate purposes. They understand the situation, appreciate all the difficulties, but they are not scared, neither are they disheartened or dismayed. On them will devolve all the labor, expense and effort necessary to reach a solution of the perplexities which have, but temporarily, retarded the growth of the independent telephone business.

They are ready to fight, and they mean to do it. They will win, because not faint-hearted.

* * *

European vs. American Lamps. It is so often thrown up to Americans that they give less attention to quality than to quantity that it is gratifying to know that such is not always the case.

Some weeks ago we published a somewhat extended article by Prof. Thomas of the Ohio State University upon some incandescent lamp tests, and this week we publish an elaborate article by Mr. Paisley on tests of foreign lamps, which show them to be so far inferior to what are manufactured in this country as to excite some suspicion that they are not fair samples of foreign manufacture. Mr. Paisley assures us, however, that the lamps under test were fair samples of those purchasable in the open market, and his method of selecting them would seem to preclude any injustice having been done.

In this country the lamp competition has been so strong that our manufacturers have felt that their only hope of success lay not only in a cheap lamp, but in a good one. Therefore, while some manufacturers have pursued the suicidal policy of selling too cheaply, they have not at the same time sacrificed quality as our foreign brethren seem to have done.

* * *

"The Electrical Engineer" Imposed Upon. It is safe to say that every one of the electrical journals uses every endeavor to avoid imposition, but notwithstanding all these endeavors, the best of us sometimes fail, and when such failures occur they excite sympathy rather than ridicule among their contemporaries. A noteworthy instance of failure of this kind occurred last week with the *Electrical Engineer*, which published a well written albeit a ridiculous article from the pen of Geo. D. Burton on "Smelting Refractory Ores in the Electric Furnace."

Not one of the staff of the *Electrical Engineer* being a metallurgist, chemist or mining engineer, it is scarcely to be supposed that it should be able to discriminate between the probable and improbable in metallurgical practice, so that we pity rather than censure it for having given space to Mr. Burton's article.

For Mr. Burton, however, who has imposed upon the credulity of our contemporary, we have no words too strong to express our contempt. The whole article from beginning to end is a tissue of absurdities such as seem to us ought to be apparent to the most superficial lay reader. Our first impulse was to reprint the article in full and specify the leading falsities, but on second consideration we deem our space too valuable for this purpose.

What is Insanity?

(A Sane Man's Letter From a Madhouse, in "A Terrible Temptation.")

"Taking the people here as a guide, the insane in general appear to be people with very little brains and enormous egotism. . . . There are, I think, all forms of that morbid egotism which is at the bottom of insanity. So is their antipathy for each other. They keep apart; because a madman is all self, and his talk is all self; thus egotisms clash and an antipathy arises; yet it is not, I think, pure antipathy, though so regarded, but a mere form of their boundless egotism."

Under the Searchlight.

Views and Opinions on Timely Topics.

THE ST. PAUL AND WHITE BEAR RAILROAD AND WILDWOOD PARK.

In our issue of August 7 we devoted considerable space to the affairs of the above railroad and park, the latter a resort established by Mr. H. M. Byllesby to tempt the populace of St. Paul to ride over the eleven miles of road owned by the railroad company, which was capitalized for $500,000.

A representative of ELECTRICITY on a recent visit to St. Paul had the pleasure of making a trip over this great railroad system, and of enjoying the beauties of Wildwood Park for a few hours.

One car was then being run every half hour from the terminus of the East Seventh street line in St. Paul, which latter has extended its tracks to make connection with the White Bear road.

The White Bear line's terminus is at the extreme eastern limit of the built-up portion of the city. Between this point and North St. Paul, a distance of some three miles, about twelve residences were counted, mostly farm houses. North St. Paul looks like what it is—a boom town gone to pieces. Mr. Ralph Beach's old wagon factory, with broken windows and decaying roof, is one of the monuments still left to remind the visitor of what might have been but was not. Here the rolling stock of the steam dummy line which Mr. Byllesby bought for $75,000 is seen standing on side tracks, rusting and rotting in decay. There are two small engines and three cars. They will, no doubt, lie where they are, as they could not now be moved without falling in pieces.

Between this point and the lake there are less than a dozen houses, the road running through the fields the entire distance of eight miles. The roadbed is in bad condition, the rails are light and badly used up, and anything like speed is out of the question.

At the park there were perhaps 50 to 75 people. Mr. Byllesby's resort has not proved a success. There was a ball game in progress, the players doing their best in a field where the grass was about 6 inches high, not having been cut this season. There was a dancing hall, about 40 feet square, where a blonde young lady of athletic training played the piano, and a one-legged fiddler in a sweater did the rest of the duty of an orchestra. He had a one-quart tin pail beside his chair for a spittoon, and when this was unavailable he visited at intervals a reserve pail of the same size which stood behind the piano. Four large signs, warning guests not to spit on the floor, adorned the walls of this pavilion. The dancers were three times, in number, the size of the orchestra—six people. Adjoining the dancing pavilion was a little restaurant, where sandwiches, beer, etc., were sold, and there was one stand displaying stick candy and peanuts.

A hundred feet away is a diminutive roller skating rink, around the walls of which hangs a roller coasting track which would give a Coney Island fakir a stroke of heart disease, and will certainly cause Chimmie Fadden to say "Wat t'ell," if he ever sees it. No iron tracks were laid, the car rolling down upon basswood boards 6 inches wide and 1 inch thick. The ties, of similar material, are about 18 inches apart, and the "track" is worn and rotted so that a collapse may be looked for on any trip with reasonable expectation that it will take place. At the end there is a little tunnel, 20 feet long, over which is hung the sign, "No kissing in the tunnel." There is no danger of a violation of this rule. Even the most amorous couple would be thanking their stars at that point that they were still alive, and would not be in the right humor to do any kissing.

All the buildings are of the cheapest frame construction. A few rowboats and two or three sailboats are offered for hire, and there are a few bath-houses. In the water there is one toboggan slide about 15 feet high. The bathing sign reads as follows: "Bathing 15 cents with suits; 25 cents without suits." This seemed to put too small a penalty on *nudity*.

Mr. Byllesby's two bears have disappeared, as *they* were not drawing cards. A few tables were provided at one end of the park for the impecunious with basket lunches. No lawns were laid out or hard paths made. The soil is composed of a species of loamy sand, about 6 inches deep when dry and bottomless when wet. Through this the few visitors wallow.

We believe we have now chronicled all the amusement features of Wildwood Park, which Mr. Byllesby thought were sufficient to draw a throng of visitors from St. Paul in spite of the many really elegant resorts within their reach. The bondholders may form from this a good idea of the value of their investment.

Returning to St. Paul by a different route, crossing the lake to White Bear Beach, one finds a charming resort there, around which a large number of pretty cottages have been built, with nice grounds and appointments which would be creditable to any locality.

* * *

The subject of "Induced Travel" has come to be quite a study for a great many of our street railway men. Among the inducements for the public to visit Lake Como, near St. Paul, have been this summer the performances of Prof. Dugay, which are thus described in placards hung in the street cars of that city:

> "Professor A. J. Dugay will walk across Lake Como on a high wire. The Professor will also take a wheelbarrow and a stove out on the wire, where he will cook and eat his dinner. He will also stand on his head."

This ought to fill the cars.

* * *

At the opening meeting of the New York Electrical Society at Columbia College, on Friday evening last, Mr. T. C. Martin delivered a popular lecture on "Niagara on Tap."

It is to be regretted that Mr. Martin did not confine himself entirely to facts, instead of giving figures as to what it will cost the Niagara Company to send power to Buffalo. The lines have not yet been built, and there is no prospect that Niagara power will be sent to Buffalo in the near future. Moreover, every official estimate on the cost of delivering this power twenty miles away has been proved to be wildly inaccurate. This was notably the case with the Houston-Kennelly estimate, which Mr. Martin's paper still fathers, even though Mr. Kennelly has since confessed his error. A popular lecturer, even though a humorist like Mr. Martin, should not assist in promulgating misinformation.

* * *

Why So Many Failures?

The failure of such concerns as that of which Mr. Henry B. Cutter of Philadelphia was at the head, and many others that have occurred in the past three years, are signs of the times which others in this trade cannot afford to ignore. They prove as conclusively as we could desire the superior foresight of Electricity in 1892, and the correctness of our views on the general situation. Mr. Cutter is a man respected by all who know him; his concern was conservatively managed; they made good goods, and tried to do a square business. They have failed because the kind of business methods prevailing in this trade are such as few honestly managed companies can survive in competition; because so many companies are being managed without regard to the interests of stockholders; because goods are sold too cheap. It is with regret, but with perfect composure, that we remember that the Cutter Company never saw fit to give any encouragement to Electricity, the only paper in the field working conscientiously to eradicate the evil features which have forced so many decent concerns to the wall. We shall still win our fight. It is nearly won now. But we could fight with more effectiveness if every honest company in the United States would extend the right hand of fellowship. We need their support, but not half as much as they need Electricity, and dozens of concerns, apparently prosperous now, will yet have particular reason, as the Cutter Company has, to appreciate the logic of our arguments.

* * *

It is in evidence, over Mr. C. A. Coffin's own signature, that he at least never expected the G. E. Company to make any money out of the sale of apparatus. In the last week of May, 1892, just before the formal realization of the consolidation arrangement, he wrote to Mr. H. M. Byllesby a personal letter in which he says among many other interesting things: "Please advise me as soon as possible how many stocks and bonds you will be able to turn in during the coming year. Whenever we lend financial assistance to local companies we should get a large bonus in stocks and bonds in addition to the stocks and bonds taken for territorial licenses. We expect to take in enough stocks and bonds as bonuses to pay all our dividends, leaving whatever profits there may be from manufacture to apply to surplus account."

Was this also Mr. J. P. Morgan's expectation when he was advising his friends to buy G. E. shares above par? Did this kind of a business seem to Mr. Morgan to possess the elements of soundness?

* * *

Prof. Forbes is now in Africa, but we do not think he is on the same errand that took Prof. Garner there. Forbes has no need to study the monkey language.

* * *

About the worst fault that a newspaper can have is the use of slovenly English, and there is no greater offender on our exchange list than the *Electrical Engineer*. It is not enough that it drivel and drone in its efforts to fill space without saying anything, it does worse and ignores its grammar and its dictionary. Last week in an editorial on standardizing lamp sockets it uses such jumbles as "miscellaneity" and standardization"—words which are not found in Webster and which mean nothing.

* * *

No writer ever made more kinds of a fool of himself in one article than George Forbes.

* * *

We suppose at least 5,000,000 people have had their ears glued to their telephones for a week waiting to hear the results of Mr. James E. Keelyn's efforts to have the Bell Telephone Company abolished on account of its violation of anti-trust laws. They will not have much longer to wait for startling news. They are likely to hear any moment that Molony has begun quo warranto proceedings and that Altgeld has declared that U. S. patents do not go in Illinois.

* * *

A special committee of the Lynn, Mass., Board of Trade has reported, upon the authority of Mr. C. A. Coffin, that unless that town makes special inducements to retain them the General Electric shops may be moved to Schenectady.

* * *

The Metropolitan Elevated Railway Company in Chicago has issued orders that hereafter any employee burning his hands on the third rail will be discharged. This is not a joke. So many employees have disabled themselves in this way, and been carried on the payroll while their hands were healing, that it has become a burden. Hereafter we suppose the employees will risk dropping to the street in case of a misstep rather than grab the third rail.

* * *

A story of last week is that Mr. Coffin, expecting to be forced out of the General Electric Company at an early day, called one of his old-time favorites to his office and said: "We want you to promise to stick to *me* no matter what happens, will you do it?" The story says that the young man recalled former ill-treatment to Mr. Coffin's mind, that when he had been in the very shadow of the penitentiary Mr. Coffin deserted him, and declined to make any such promise. This story cannot be *all* truth. If Mr. Coffin had made any such request, the answer would have been: "Why, certainly, Mr. Coffin; you have been the best friend I ever had, have done more for me than anyone else, and if I can serve you in any way you can count on my doing so."

FORBES'S APOTHEOSIS OF FORBES.

I am the only Engineer in the World;
I do things impossible to other men.
The blawsted American Bounder
May blow his bazoo,
But I'm blowed
If he can beat
Me.
I invented Electricity,
I discovered the Universe,
And I expect to make a New Earth,
If My Millionaires
Put up the stuff.
I can draw plans as easy
As I can draw my breath,
Or my $400 a month salary.
I can design dynamos with my eyes shut,
But nobody can build them.
I went to the States
Because I was the Only Man
Who could Tap Niagara,
Or build any other
Great Work.
My plans did not suit any one
But Me,
And I had some trouble
To keep
My president
My vice-president. and
My directors
In hand,
But I used tact and judgment,
Likewise forbearance,
And soon they thought there was nobody
Like Me.
Kelvin, Tesla, Turrettini, Rowland, Mascart and Sellers
Thought they knew something about
Low frequencies, ohms and volts, but
They never touched Me,
Not Me.
I am mostly a modest man,
But I was born with a Great Brain.
I have a Big Head,
And I know it.
I never brag about what I know,
But when I open my mouth
And begin to spout language
About what I have done,
Niagara isn't in it
With Me.
When I curb my reticence
And address the vulgar crowd
My Countrymen blush for shame,
The average American profanely laughs;
But what's that
To Me.
I have dined with Barlow and Conkling, and
I want the world to know it.
Conkling I adored, because
His bump
Of vanity and Mine
Were twins.
I can tolerate the
Potters, the Bruzes, the Lorillards, the
Delafields, the Fishes, the Kents, the Rushmores, the
Prestons, the Van Courtlandts, the Van Nests, and
Allen Lathrop,
Who tolerated me for the sake of my
Father and my brother.
But the rest of the
Sixty Million Americans are
All beneath
Me.
And if there is one species I
Can't endure, it is
American bagmen or drummers,
Because
They refused to recognize
My Greatness.
History may fail to give me any place,
But I make my own place.
When I want to be heard I speak—
Even my clothes speak.
I need no monuments,
Not I.
I am the megacephalous Man,
I am the Master Mind,
I am the only Creative Genius,
I am the only man with New Ideas,
I am the Harnesser of Niagara,
I am Superlative Muchness,
I live in London,
I have preserved my Englishness,
And my name is
Forbes—
George Forbes, C. E.

Brooklyn Edison Co. Rebels.

REFUSES TO BUY MONOCYCLIC GENERATORS.

Stanley Company Secures the Contract.

At the last meeting of the N. E. L. A., at Cleveland in February of this year, Dr. Louis Bell read an interesting paper on the Monocyclic System of Transmission. The paper was a strong one, and was intended to leave no doubt in the minds of central station men as to the superiority of this system over the Westinghouse or Stanley two-phase systems. Again, at the annual meeting of the Edison licensees in August, Mr. Emmet, for the General Electric Company, endeavored to show conclusively that the monocyclic was the only system for the licensees to adopt in conjunction with the Edison three-wire system.

It is apparent now that both these gentlemen labored in vain, as did Prof. Steinmetz when he spent so many months in his work (either original or imitative) upon the monocyclic system.

After a thorough examination of the three systems (General Electric, Westinghouse and Stanley), the two leading Edison licensee stations, New York and Brooklyn, have decided that the monocyclic system does not meet their requirements, and have purchased other apparatus.

Last week the Brooklyn Edison Company contracted with the Stanley Electric and Manufacturing Company for two 350 K. W. machines with accessories. The General Electric Company made every effort to prevent the Brooklyn Company from making the purchase. Every possible argument, both commercial and technical, was used. On the commercial side there was little to say, as the purchase was made through the Citizens' Company, lately absorbed by the Brooklyn Edison Company, hence there was no direct violation of the licensee contract. On Thursday a delegation of General Electric people, composed of Messrs. Steinmetz, Greene, Rice, Emmet and Hughes, spent several hours with President Ethan Allen Doty, Secretary Royal C. Peabody and Manager W. S. Barstow, of the Brooklyn Company. Every point was gone over, and even Mr. Steinmetz was compelled to admit that for the purposes of an Edison three-wire station the monocyclic system is inferior.

The New York Edison Company, it is understood, have also bought Stanley apparatus for the Manhattan Station.

ELECTRICITY's often expressed opinion, that the entire body of Edison licensees must soon break away completely from the General Electric Company is materially strengthened by these events. The General Electric Company has fallen behind in the race, and can no longer give the licensees what they need.

It is improbable that any Edison licensee company in the country will again be foolish enough to pay over any percentage of increases in capital stock as a bonus to the parent company under the old licensee contract. At the time of the last increase of the Brooklyn Company that company compromised by paying over about 7 per cent. instead of the 30 per cent. called for in the contract.

The question as to whether the rank and file of the Edison licensees will adopt the monocyclic system as an adjunct is pretty thoroughly settled in the negative. It has been carefully investigated by the managers of the leading stations in the East and found wanting. Other stations will accept the conclusions of these managers as correct.

Ohio Electric Light Association.

The annual meeting of the Ohio Electric Light Association will be held at Piqua, Ohio, beginning at 2 P. M. Tuesday, October 8, 1895. Arrangements have been made with the Hotel Plaza for the accommodation, at reasonable rates, of all who may attend.

SOCIETY NEWS.

The American Institute of Electrical Engineers.

The first of the fall meetings of the Institute in New York was held in the banquet hall of the Hoffman House on Wednesday evening, September 25, the paper of the evening being one by Mr. Charles S. Bradley on "Phasing Transformers." The paper itself, which will be found elsewhere in this issue, was one of absorbing interest. Mr. Bradley is original in everything—in his methods of thought as well as in his methods of expression and action—and it was therefore rather to be expected that the occasion of the reading of his paper would be attended by something out of the ordinary. The announcement that the paper would be read at the Hoffman House instead of at the usual place of meeting, was in itself sufficiently out of the ordinary to satisfy expectations, but Mr. Bradley had another treat in store for his guests besides his excellent paper. After the discussion, which by the way was all too brief, President Duncan requested, on behalf of Mr. Bradley, that the members remain for a while. At a given signal a number of spike-tailed waiters appeared and the quondam banquet hall resumed its appropriate function, and the members of the Institute found themselves the guests of Mr. Bradley at an elegant lunch, such as few besides Mr. Bradley could have planned and few besides the Hoffman House could have carried out.

The remainder of the evening was spent in social intercourse which was most enjoyable, and the event is one that will be long remembered by those who were so fortunate as to be present.

At the regular monthly meeting of Council, held at the rooms of the Institute September 25, the following associate members were elected: Sydney B. Austin, Sidney, N. Y.; Geo. H. Blaxter, Pittsburg, Pa.; Elmer E. Boyer, Lynn, Mass.; Byron T. Burt, Charleston, S. C.; Henry S. Carhart, Ann Arbor, Mich.; John B. Cornell, Hamilton, O.; Maurice Coster, Chicago, Ill.; David Francis Crawford, Fort Wayne, Ind.; Philip Dawson, London, Eng.; Lewis Degen, Rio de Janeiro, Brazil; Will Knox Dunlap, Pittsburg, Pa.; Thomas C. Fremyear, Gloversville, N. Y.; Carl Harold Hakonson, Schenectady, N. Y.; Russell B. Harrison, Terre Haute, Ind.; Robert R. Harvey, Wilkes-Barre, Pa.; Chas. E. Hewitt, Hanover, N. H.; Chas. R. Huntley, Buffalo, N. Y.; D. W. Irvine, Chambersburg, Pa.; W. Wallace Ker, Jersey City, N. J.; Paul M. Lincoln, Niagara Falls, N. Y.; Robert Bruce Mann, Milwaukee, Wis.; Josiah L. Merrill, Schenectady, N. Y.; Chas. H. Merz, Newcastle-on-Tyne, Eng.; James Mitchell, Rio de Janeiro, Brazil; Edgar L. Morley, New York City; Evan Parry, East Dulwich, London, S. E.; Andrew Pinkerton, Appolo, Pa.; Percy Howard Powell, Hempstead, N. Y.; Dwight Parker Robinson, Chicago, Ill.; David B. Rushmore, Plainfield, N. J.; John F. Skirrow, Brooklyn, N. Y.; Henry G. Stott, Buffalo, N. Y.; Gustav Adolph Wiese, Alameda, Cal.; Chester P. Wilson, Philadelphia, Pa. Total, 34.

PROPOSED SETTLEMENT.

The proposal of the Cutter Electrical and Manufacturing Company of Philadelphia for settlement with creditors shows nominal assets of about $42,000, of which $14,000 is in accounts receivable; liabilities are about $28,000. There are attachments aggregating about $8,000. It is proposed by the company to give notes to these secured creditors, with outside endorsement, and thus release the property; to pay all bills of less than $20 in cash within 60 days, and to give unsecured notes without interest to other creditors, to run 6, 12, 18, 24, 30 and 36 months, equally divided.

If this settlement is satisfactory the company will proceed at once.

Boss-Rittle.

Mr. John C. Boss, president of The Lakon Company, Elkhart, Ind., was married on the 25th inst. to Miss Anna Rittle of that city.

European Incandescent Lamps.

BY D. PAISLEY.

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It is generally known that the Edison & Swan Company's master patents of glow lamps expired in England in November, 1893, and it may be interesting to the readers of ELECTRICITY to learn the results of the expiry of the monopoly held so tenaciously in that country by the company just mentioned.

Up to a month or two before the lapse of the patent, the price of an ordinary "Central Station" lamp, of say 8 to 25 candle power, 50 to 110 volts, was 90 cents, when it was suddenly reduced to 40 cents, owing doubtless to the fact that many European Continental makers were offering their lamps for sale in England, for forward delivery, the day after the expiry of the patent, at a fourth of the then current Edison & Swan Company's price. This price of 40 cents is still in force for the lamps mentioned above, that is nominally, but it is an open secret that for even small quantities the price to favored parties, or parties who can make their own terms, is now as low as 28 to 30 cents, while the fact that the Ediswan factory is now working overtime, in view of the already large stocks still held by the factory at the numerous depots, points to a still greater reduction on the present price. The reason for this latter action is not far to seek, for the total requirements of the United Kingdom for central station lamps alone this winter will be quite three millions, while considerably over one million will be necessary for independent installations, not to mention the very large number of lamps of special voltages and shapes, more particularly for decorative purposes. Of this large number of lamps, the Edison-Swan Company, under ordinary circumstances, without reduction in prices, would not secure more than 750,000 of the class known as central station lamps, leaving the remainder to be covered by the European Continental manufacturers. The company therefore seems determined to reduce its price to the level of the best quality competitors in the hope of being able to retrieve its position as monopolizers of the British trade. If it fail in its endeavor, the question becomes a serious one, as it is impossible to exist with a capital of about $2,500,000 on a sale of say 1,200,000 per annum with a net profit of 3 to 4 cents per lamp.

One result of the expiry of the monopoly in Great Britain was the flooding of the market with lamps of all sorts and conditions, and consequently a rapid fall in the prices. The two worst sinners in this latter respect, one in Hamburg and the other in Berlin, have gone the way of all price-cutters, and the London market knows them no more. Others are likely to follow, but at the moment the trade in the hands of its present possessors seems stable and settled down to an ordinary business. It is not at all surprising that these Continental makers rushed headlong into the English trade; the only trademark known was that of the old monopoly, and the only recommendation needed to sell lamps was a low price, the question of life and efficiency being relegated to a second place.

Now that the excitement has quite calmed down, it will be interesting to know the quality of the lamps now on the English market, and to this end the writer purchased the lamps enumerated below at the prices noted, they having been sold to him "over the counter," in no way specially chosen, the special purpose for which they were intended not having been mentioned.

The figures show the results of the time trials of the lamps run at the voltage marked on the lamps, which was in all cases 100 volts. The trial was conducted perfectly unbiased, the best instruments were employed for the readings, and these were compared several times during the trial with other standard instruments. The readings were taken every week, but the space at disposal of this article would be insufficient to give the weekly results, and as the average useful life is less than 600 hours, the two tables comprise the results at the beginning of the run, at 350 hours, and at 600 hours, notes being given of the life of such lamps as burned out before the end of the 600 hours.

The tables given are sufficiently explanatory; each lamp of each manufacturer is noted as having consumed so much of an ampere, run at a voltage of 100, and the product of the voltage by the amperage divided by the candle-power at the various stages of the trial gives of course the watts expended per candle-power produced:

RESULTS OF TIME TRIALS OF GLOW LAMPS OF 17 EUROPEAN MAKERS, RUN AT MARKED VOLTAGE.

			Lamps marked 16 c. p., 100 volts, at starting.																	
Number of Maker	Price paid in London	MAKERS' NAMES.	No. 1.			No. 2.			No. 3.			No. 4.			No. 5.			No. 6.		
			Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.
1	25c.	Allgemeine Company	.67	14½	4.65	.65	13	5.00	.65	14	4.65	.66	13	5.10	.62	13½	4.60	.65	16	4.05
2	25c.	Brush Company, Vienna	.51	11	4.65	.52	13	4.00	.50	11½	4.30	.53	11½	4.60	.54	11½	4.70	.51	13	3.90
3	15c.	Constantia	.51	17	2.98	.51	16	3.18	.51	19	2.68	.51	16	3.10	.51	16½	3.08	.51	18¾	2.71
4	24c.	Daylight	.47	12½	3.76	.49	14	3.50	.49	14¼	3.44	.48	11½	4 15	.48	12¾	3.75	.50	16	3.12
5	26c.	Fleischhaker & Co	.55	18¾	2.93	.58	18	3.22	.70	24	2.90	.64	14	4.55	.54	15½	3.46	.54	13½	4.00
6	25c.	Gabriel & Angenault	.50	17	2.99	.44	12½	3.50	.49	16	3.04	.52	19	2.72	.49	16	3.04	.49	15½	3.14
7	20c.	Hard	.51	11½	4.44	.52	13½	3.86	.51	11½	4.42	.51	14½	3.50	.52	14	3.07	.54	14¼	3.77
8	18c.	Phaeton	.57	15	3.80	.53	17¾	2.98	.72	15½	4.65	.70	22	3.18	.72	21	3.42	.72	18½	3.90
9	25c.	Gebruder Pintsch	.56	17	3.28	.60	19	3.14	.60	19	3.14	.61	19¼	3.14	.58	16½	3.50	.62	19½	3.13
10	19c.	Pope & Goosens	.52	14¼	3.64	.55	16¼	3.38	.53	15	3.50	.51	14	3.63	.51	12¾	4.00	.54	15½	3.47
11	28c.	Robertson, London	.57	14½	3.94	.55	16	3.42	.57	16	3.55	.56	14	3.98	.54	13	4.15	.55	15½	3.54
12	25c.	Siemens & Halske	.59	17½	3.36	.56	13	4.30	.55	14¼	3.84	.59	15	3.96	.60	16	3.75	.52	15	3.45
13	27c.	Sunbeam Company	.65	18½	3.50	.62	18	3.44	.61	12½	4.90	.55	9½	5.75	.62	16	3.88	.65	19	3.38
14	16c.	Sturm & Co	.55	12½	4.37	.55	10	5.50	.55	12½	4.37	.54	11¾	4.60	.54	11¾	4.60	.53	11½	4.60
15	23c.	Stearn	.54	17	3.16	.52	14½	3.60	.53	14¾	3.60	.50	13¾	3.62	.50	14	3.57	.54	16	3.36
16	25c.	Svea Company	.53	15¼	3.44	.51	17½	2.90	.51	15½	3.28	.50	15½	3.22	.50	15½	3.25	.50	15½	3.22
17	30c.	Edison & Swan. Old manufacture	.62	16¼	3.83	.60	16½	3.65	.62	16	3.83	.58	15¾	3.70	.60	15½	3.89	.60	15½	3.89
18	30c.	New manufacture	.56	14¾	3.80	.56	14¾	3.80	.56	15½	3.63	.56	14¾	3.80	.56	14¾	3.80	.56	15	3.74

			Lamps marked 16 c. p., 100 volts, at 350 hours.																	
Number of Maker	Price paid in London	MAKERS' NAMES.	No. 1.			No. 2.			No. 3.			No. 4.			No. 5.			No. 6.		
			Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.
1	25c.	Allgemeine Company	.69	16¾	4.14	.68	14	4.87	.66	14	4.72	.70	16	4.40	.63	13½	4.67	.68	16½	4.40
2	25c.	Brush Company, Vienna	.52	11¼	4.63	.54	12¼	4.25	.52	11	4.72	.54	12¼	4.40	.56	12¼	4.58	.52	13½	3.86
3	15c.	Constantia	.53	15¾	3.37	.54	15	3.60	..	1a.	..	.54	15	3.60	.53	15	3.54	..	2a.	..
4	24c.	Daylight	..	3a.	..	.58	15¼	3.46	.53	15½	3.13	.51	13	3.93	.52	15¼	3.41	.55	17	3.24
5	26c.	Fleischhaker & Co	..	4a.	..	..	5a.	..	..	6a.	..	.67	14	4.80	..	7a.	..	.55	12¾	4.32
6	25c.	Gabriel & Angenault	.50	14½	3.46	.44	10¾	4.10	.49	13½	3.63	.52	15½	3.36	..	8a.	..	.49	13½	3.64
7	20c.	Hard	.52	14¼	4.16	.58	15½	3.75	.54	12¾	4.25	.53	14¼	3.72	.54	14½	3.73	.59	15½	3.82
8	18c.	Phaeton	.58	14	4.15	..	9a.	..	.75	14¾	5.10	..	10a.	..	.73	18½	3.96	.74	18¾	3.96
9	25c.	Gebruder Pintsch	.59	15¾	3.76	.64	16½	3.90	.63	17	3.72	.64	17½	3.67	.60	15¼	3,94	.66	17¾	3.74
10	19c.	Pope & Goosens	.57	15	.3.81	.58	15	3.88	.57	14½	3.94	,56	14	4.00	.58	15	3.88	.58	16	3.64
11	28c.	Robertson, London	.58	14½	4.00	.56	16	3.50	.58	15½	3.81	.58	14½	4.00	.57	13¼	4.30	.56	15¼	3.68
12	25c.	Siemens & Halske	.61	17½	3.50	.58	13½	4.30	.58	15¾	3.50	.58	14	4.25	.58	16½	3.53	.54	15¾	3.44
13	27c.	Sunbeam Company	.69	12¾	5.42	.65	12¾	5.10	.61	11¼	4.52	.60	10	6.00	.64	11¼	5.70	.69	11½	6.00
14	16c.	Sturm & Co	.62	15	4.15	.56	8	7.00	.58	12½	4.65	.57	11¾	4.36	.60	13¾	4.40	.61	14¼	4.30
15	23c.	Stearn	.54	12¾	4.25	.53	13¾	3.86	.53	13¼	4.00	.52	12¾	4.10	.51	12¼	4.15	55	13½	4.08
16	25c.	Svea Company	.53	10½	5.05	.51	12¼	4.10	.52	9¾	5.32	.50	12	4.16	..	11a.	..	.48	8¾	5.46
17	30c.	Edison & Swan. Old manufacture	.63	15¾	4.00	.60	15¾	3.83	.62	15½	4.00	.59	15	3.95	.61	15	4.08	.60	15¼	3.95
18	30c.	New manufacture	.57	14½	3.95	.57	14	4.08	.57	15	3.80	.58	15	3.88	.56	14¼	3.94	..	12a.	..

			Lamps marked 16 c. p. 100 volts, at 600 hours.																	
Number of Maker	Price paid in London	MAKERS' NAMES.	No. 1.			No. 2.			No. 3.			No. 4.			No. 5.			No. 6.		
			Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.
1	25c.	Allgemeine Company	.69	15	4 60	.67	13	5.30	.67	13¾	4.87	.70	15½	4.54	.63	13	4.85	.66	15	4.40
2	25c.	Brush Company, Vienna	.52	10½	4.82	.54	12½	4.33	.52	11¼	4.63	.54	12	4.50	.56	12	4.65	.52	13	4.00
3	15c.	Constantia	..	13a.	..	.54	13¾	3.94	..	1a.	..	..	14a.	..	..	15a.	..	..	2a.	..
4	24c.	Daylight	..	3a.	..	.53	14½	3.68	.52	14¾	3.53	.52	13	4.00	.53	14¼	3.72	.55	15	3.68
5	26c.	Fleischhaker & Co	..	4a.	..	..	5a.	..	..	6a.	..	.66	13½	4.90	..	7a.	..	.55	12	4.60
6	25c.	Gabriel & Angenault	.49	13½	3.64	.45	11	4.10	.49	12½	3.92	.52	14½	3.60	..	8a.	..	.49	12½	3.92
7	20c.	Hard	.52	12	4.33	.58	15	3.38	.55	12½	4.40	.53	13½	3.92	.55	13¾	4.00	.60	15	4.00
8	18c.	Phaeton	.58	14	4.15	..	9a.	..	.75	14	5.36	..	10a.	..	.72	14½	5 00	..	16a.	..
9	25c.	Gebruder Pintsch	.58	14	4.15	.62	14¼	4.30	.60	14¼	4.22	.62	14	4.44	.58	12	4.85	.64	15	4.28
10	19c.	Pope & Goosens	.67	14	4.07	.57	13¾	4.15	.57	13¾	4.14	.55	13½	4.07	.57	13¾	4.15	57	14½	3.94
11	28c.	Robertson, London	.58	14½	4.00	.56	16¾	3.80	58	15½	3.75	.58	14½	4.00	.57	13¼	4.30	.56	14½	3.86
12	25c.	Siemens & Halske	.60	14½	4.15	.57	12¾	4 50	.57	14	4.10	.55	10¾	5.10	.49	7¼	6.72	.53	13¾	3.86
13	27c.	Sunbeam Company	.69	11¼	5.70	.64	11	6.80	.61	10¼	5.95	.60	9¼	6.47	64	10	6.40	.68	10½	6.47
14	16c.	Sturm & Co	..	17a.	..	.56	8	7.00	.58	12¾	4.55	.57	12	4.75	6a	13½	4.45	.61	13½	4.54
15	23c.	Stearn	.54	11¼	4.80	.53	12½	4.25	.53	12½	4,25	.52	11¼	4.50	.50	11½	4.35	54	12	6.50
16	25c.	Svea Company	.53	9½	5.57	.50	10½	4.77	.51	7½	6.80	.50	10	5.00	..	11a.	..	.48	7¾	6.16
17	30c.	Edison & Swan. Old manufacture	.66	14½	4.70	.63	14½	4.34	.65	14½	4.49	.64	14	4.57	.64	14¼	4.49	.63	14	4.50
18	30c.	New manufacture	.60	13	4.61	.63	14	4.29	.60	14¾	4.07	.59	13	4.54	.59	14	4.21	..	12a.	..

REMARKS ON SUCH LAMPS.—1a., burnt out at 179 hours; 2a., burnt out at 250 hours; 3a., burnt out at 73 hours; 4a., burnt out at 244 hours; 5a., burnt out at 116 hours; 6a., burnt out at 300 hours; 7a., burnt out at 290 hours; 8a., burnt out at 245 hours; 9a., burnt out at 320 hours; 10a., burnt out at 275 hours; 11a., burnt at 199 hour4; 12a., burnt out at 263 hours; 13a., burnt out at 550 hours; 14a., sealing point broken at 513 hours; 15a., burnt out at 484 hours; 16a., burnt out at 586 hours; 17a., burnt out at 405 hours.

RESULTS OF TIME TRIALS OF GLOW LAMPS OF 15 EUROPEAN MAKERS, RUN AT MARKED VOLTAGE.

			Lamps marked 8 c. p., 100 volts, at starting.																	
Number of Maker	Price Paid in London	MAKERS' NAMES.	No. 1.			No. 2.			No. 3.			No. 4.			No. 5.			No. 6.		
			Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.
1	25c.	Allgemeine Company	.30	8¼	3.43	.29	9¼	3.25	.30	8	3.75	.25	7	3.57	.28	8	3.50	.25	7½	3.33
2	25c.	Brush Company, Vienna	.29	8	3.64	33	9½	3.50	.29	7	4.14	.33	8½	3.87	.30	8	3.75	.30	9	3.33
3	15c.	Constantia	.29	9¼	3.12	.27	8½	3.18	.29	7	4 14	.28	9	3.11	27	9	3.00	.26	9¼	2.73
4	24c.	Daylight	.29	5¾	5.05	.30	6¼	4.80	33	8¾	3.77	32	9	3.55	30	7	4 28	.30	10¼	2.92
5	16c.	Fleischhaker & Co	.41	14½	2.82	.38	9	4.20	.37	8	4.62	.40	12	3.33	.39	8¾	4.46	.35	10¼	3.40
6	25c.	Gabriel & Augenault	.34	12	2.84	33	10½	3 15	.31	7¾	4.00	.32	10	3.20	.30	10	3.00	30	10	3.00
7	20c.	Hard	.32	6½	4.90	.30	5¼	5.50	.30	8	3 75	.31	7	4.43	.29	8	3 62	.28	8	3.50
8	18c.	Phaeton Company	.40	8	5.00	.40	9	4.45	.36	5¾	6.22	.36	6	6 00	35	7½	4.67	.35	7	5.00
9	25c.	Gebruder Pintsch	.35	10	3 50	36	12	3 00	.35	10¾	3.25	.34	8¾	3.10	.33	10	3.30	.34	9	3 77
10	19c.	Pope & Goosens	.30	7	4.30	.30	7	4.30	.33	7½	4 44	.34	9	3.77	.30	8	3.75	.30	9	3.33
11	28c.	Robertson, London	.32	7	4.60	.35	9¾	3.58	.36	8	4.50	.33	8¼	3.10	.33	8	4.12	.33	10¼	3.22
12	25c.	Siemens & Halske	.38	13	2.92	.38	11	3 46	.37	8	4.62	.32	8	4.00	.33	9	3.66	.34	9¼	3.67
13	27c.	Sunbeam Company	.40	7½	4.35	.40	8½	4.70	.40	8	5.00	.38	9	4.22	.36	7¾	4 64	.37	9	4.11
14	23c.	Stearn	.34	10½	3.25	34	10½	3.25	32	9½	3.60	30	10¼	2.92	.30	9	3.33	.30	9½	3 15
15	30c.	Edison & Swan. Old manufacture	.41	9	4 55	.40	8	5.00	.41	9¼	4.42	.40	7¼	5.50	.42	10	4.20	.39	7½	5.20
16	30c.	New manufacture	.37	7¼	5.10	38	8½	4.47	37	7¼	5.10	.37	7¼	5 10	37	7½	4.90	38	7½	5.05

			Lamps marked 8 c. p., 100 volts, at 350 hours.																	
Number of Maker	Price Paid in London	MAKERS' NAMES.	No. 1.			No. 2			No 3.			No. 4.			No. 5.			No. 6.		
			Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.
1	25c.	Allgemeine Company	.37	6¾	5.45	.27	6¼	4.30	.31	8	3 88	.26	6¼	4.15	.30	7½	4 00	.28	6½	4.30
2	25c.	Brush Company, Vienna	.27	6½	4.15	.33	9	3 66	.29	7	4.14	.34	8¼	4.12	..	1b.	..	.32	8½	3.76
3	15c.	Constantia	..	2b.	..	29	7¼	4.00	.30	6¾	4 43	..	3b.	..	.29	7¾	3.73	.29	7¾	3.73
4	24c.	Daylight	.34	8¾	3.87	.32	5¾	5.55	.34	8½	4.00	.33	8¾	3.77	.31	6½	4.76	.33	8¾	3.77
5	16c.	Fleischhaker & Co	.37	8	4.62	..	4b.	..	.39	8	4.85	..	5b.	..	..	6b.	..	.38	8¼	4.60
6	25c.	Gabriel & Augenault	.31	7¼	4.26	.31	8¼	3.75	.32	7¾	4.12	.33	9¼	3 56	33	9½	3.47	.33	8¾	3.77
7	20c.	Hard	..	7b.	..	.31	8½	4.10	.32	7¾	4 12	.32	6½	4.90	.33	7	4.70	.31	6½	4.75
8	18c.	Phaeton Company	.47	9	5.20	.40	6¼	6.35	.38	5¼	7.23	.37	5½	6.70	38	6	6.30	.38	5½	6.90
9	25c.	Gebruder Pintsch	.36	9¼	3.88	.36	9¼	3.88	.38	10¼	3.10	.36	8¼	4.35	37	9½	3.90	..	8b.	..
10	19c.	Pope & Goosens	.32	6¾	4.72	.33	8¼	4.00	.33	7½	4.90	.36	8½	4.23	33	7½	4.90	.32	8¼	3.87
11	28c.	Robertson, London	.35	7½	4 65	.30	7½	4.00	.36	7¾	4 63	.35	7½	4.90	..	9b.	..	.36	9¼	3.88
12	25c.	Siemens & Halske	.38	10	3.80	.37	6¾	5 45	.37	7¾	4.75	.37	7¼	4 95	.35	8¼	4.23	.36	7¾	4.62
13	27c.	Sunbeam Company	.40	8¼	4.83	.41	8¼	4.95	.41	7¾	5.26	.42	8½	4 93	.40	7	5 70	.41	8¼	4.95
14	23c.	Stearn	.34	8½	4.00	.33	8¾	3.77	.34	9¼	3.67	.33	9¾	3.38	.35	8½	4.10	.33	8	4.12
15	30c.	Edison & Swan. Old manufacture	.42	9	4.66	.39	7¼	5.35	.41	8½	4.80	.39	7¼	5 35	.41	9	4.55	.40	7¼	5.50
16	30c.	New manufacture	.37	7¼	5.10	..	10b.	..	.37	7¼	5 10	37	7¼	5.10	37	7	5.27	..	15b.	..

			Lamps marked 8 c. p., 100 volts, at 600 hours.																	
Number of Maker	Price Paid in London	MAKERS' NAMES.	No. 1.			No. 2.			No. 3.			No. 4.			No. 5.			No. 6.		
			Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.	Amperes	Candle power	Watts per C. P.
1	25c.	Allgemeine Company	.26	5¼	4.52	.27	5½	4.90	.30	7	4.30	.24	5¼	4.57	.29	6½	4.45	.28	5¾	4.85
2	25c.	Brush Company, Vienna	.27	6¼	4.30	32	8	4.00	.29	6¾	4.28	33	7¼	4.54	..	1b.	..	.32	8¼	3.88
3	15c.	Constantia	..	2b.	..	..	11b.	..	.29	6½	4.45	...	3b.	..	.29	7	4.14	.28	7	4.00
4	24c.	Daylight	.33	8¼	4.00	.32	6¼	5.10	.34	7	4.85	.33	7¾	4.25	.32	6¼	5.10	.33	7¾	4.25
5	16c.	Fleischhaker & Co	.36	7¾	4 62	..	4b.	..	..	12b.	..	...	5b.	..	..	6b.	..	.37	8	4.62
6	25c.	Gabriel & Augenault	.30	7	4.26	.31	7½	4.13	.32	7¼	4.40	.32	8	4.00	.33	8	4.11	.32	7¾	4.11
7	20c.	Hard	..	7b.	..	.35	7¾	4.50	.32	7¾	4.12	.32	6½	4.80	.33	6½	4.07	.30	6½	4.60
8	18c.	Phaeton Company	.47	7½	5.45	.39	6	6.47	.38	5½	7.20	.37	5	7.40	.38	5½	6.90	.38	5	7.60
9	25c.	Gebruder Pintsch	.34	7½	4.52	.34	7½	4.52	.32	7¾	4 53	.34	6¾	5.00	.37	8	4.60	..	8b.	..
10	19c.	Pope & Goosens	.32	6¼	5 10	.32	7½	4.25	.32	7	4.56	.34	7¾	4.36	.32	7	4.55	.32	7½	4.25
11	28c.	Robertson, London	.34	7¼	4.67	.30	6¾	4.42	.35	7¾	4.50	.37.	7½	5.07	..	9b.	..	.35	8½	4.10
12	25c.	Siemens & Halske	.38	8½	4.45	.35	6½	5.36	.36	6¾	5.30	.34	7	4.85	..	13b.	..	.36	7¼	4.95
13	27c.	Sunbeam Company	.40	7½	6.30	.41	7½	5.45	.40	7	5.70	.41	7¾	5.26	.40	7	5.70	.43	7½	5.80
14	23c.	Stearn	.33	7¼	4.54	.33	7¾	4.25	..	14b	..	.33	7½	4.40	.33	7¼	4.54	.33	7½	4.40
15	30c.	Edison & Swan. Old manufacture	.45	8½	5.30	.42	9	4 66	.44	8	5.50	41	7	5.85	.44	8½	5.18	.42	7	6 00
16	30c.	New manufacture	.40	7	5.71	..	10b.	..	.40	7	5.71	.38	7	5 43	.39	6½	6.00	..	15b.	..

. MARKED VOLTAGE REMARKS ON SUCH LAMPS.—1b., burnt out at 197 hours; 2b., burnt out at 206 hours: 3b., burnt out at 198 hours; 4b., burnt out at 151 hours; 5b., burnt out at 151 hours; 6b., burnt out at 287 hours; 7b., burnt out at 280 hours; 8b.

British Association.*

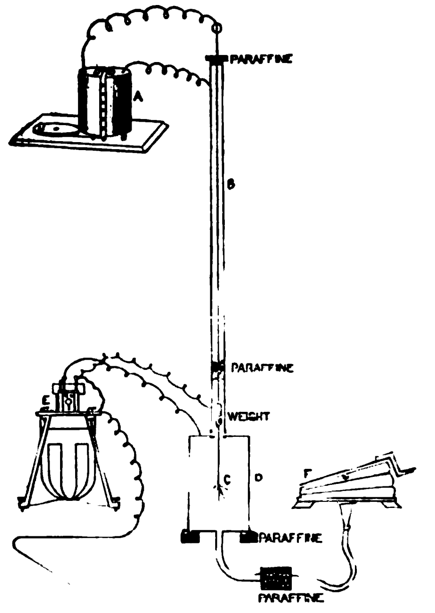
ELECTRIFICATION AND DISELECTRIFICATION OF AIR AND OTHER GASES.

BY LORD KELVIN, MAGNUS MACLEAN, AND ALEXANDER GALT.

[*Abstract.*]

§ 1. The experiments were made for the purpose of finding an approximation to the amount of electrification communicated to air by one or more electrified needle points. The apparatus consisted of a metallic can 48 cms. high and 21 cms. in diameter, supported by paraffine blocks, and connected to one pair of quadrants of a quadrant electrometer. It had a hole at the top to admit the electrifying wire, which was 5·31 meters long hanging vertically within a metallic guard tube. This guard tube was always metallically connected to the other pair of quadrants of the electrometer and to its case, and to a metallic screen surrounding it. This prevented any external influences from sensibly affecting the electrometer, such as the working of the electric machine which stood on a shelf 5 meters above it.

§ 2. The experiment is conducted as follows: One terminal of an electric machine is connected with the guard tube and the other with the electrifying wire, which is let down so that the needle is in the center of the can. The can is temporarily connected to the case of the electrometer. The electric machine is then worked for some minutes, so as to electrify the air in the can. As soon as the machine is stopped the electrifying wire is lifted clear out of the can. The can and the quadrants in metallic connection with it are disconnected from the case of the electrometer, and the electrified air is very rapidly drawn away from the can by a blowpipe bellows arranged to suck. This releases the opposite kind of electricity from the inside of the can, and allows it to place itself in equilibrium on the outside of the can and on the insulated quadrants of the electrometer in metallic connection with it.



Connected with guard screen (not shown in diagram).

Fig. 1.

§ 3. We tried different lengths of time of electrification and different numbers of needles and tinsel, but we found that one needle and four minutes of electrification gave nearly maximum effect. The greatest deflection observed was 936 scale divisions. To find from this reading the electric density of the air in the cans, we took a metallic disk, of 2 cms. radius, attached to a long varnished glass rod, and placed it at a distance of 1.45 cm. from another and larger metallic disk. This small air condenser was charged from the electric light conductors in the laboratory to a difference of potential amounting to 100 volts. The insulated disk thus charged was removed and laid upon the roof of the large insulated can. This addition to the metal in connection with it does not sensibly influence its electrostatic capacity. The deflection observed was 122 scale divisions. The capacity of the condenser is approximately $\frac{\pi \times 2^2}{4\pi \times 1{\cdot}45} = \frac{1}{1{\cdot}45}$. The quantity of electricity with which it was charged was $\frac{1}{1{\cdot}45} \times \frac{100}{200} = \frac{1}{4{\cdot}35}$ electrostatic unit. Hence the quantity to give 936 scale divisions was $\frac{1}{4{\cdot}35} \times \frac{936}{122} = 1{\cdot}7637$.

The bellows was worked vigorously for two and a half minutes, and in that time all the electrified air would be exhausted. The capacity of the can was 16,632 cubic centimeters, which gives, for the quantity of electricity per cubic centimeter, $\frac{1.7637}{16{,}632} = 1{\cdot}06 \times 10^{-4}$. The electrification of the air in this case was positive; it was about as great as the greatest we got, whether positive or negative, in common air when we electrified it by discharge from needle points. This is about four times the electric density which we roughly estimated as about the greatest given to the air in the inside of a large metal vat, electrified by a needle point and then left to itself, and tested by the potential of a water-dropper with its nozzle in the center of the vat, in experiments made two years ago and described in a communication to the Royal Society of date May, 1894.*

§ 4. In subsequent experiments, electrifying common air in a large gas-holder over water by an insulated gas flame burning within it with a wire in the interior of the flame kept electrified by an electric machine to about 6,000 volts, whether positively or negatively, we found as much as $1{\cdot}5 \times 10^{-4}$ for the electric density of the air. Electrifying carbonic acid in the same gas-holder, *whether positively or negatively*, by needle points, we obtained an electric density of $2{\cdot}2 \times 10^{-4}$.

§ 5. We found about the same electric density (2.2×10^{-4}) of *negative* electricity in carbonic acid gas drawn from an iron cylinder lying horizontally, and allowed to pass by a U-tube into the gas-holder without bubbling through the water. This electrification was due probably not to carbonic acid gas rushing through the stopcock of the cylinder, but to bubbling from the liquid carbonic acid in its interior, or to the formation of carbonic acid snow in the passages and its subsequent evaporation. When carbonic acid gas was drawn slowly from the liquid carbonic acid in the iron cylinder placed upright, and allowed to pass, without bubbling, through the U-tube into the gas-holder over water, no electrification was found in the gas unless electricity was communicated to it from needle points.

§ 6. The electrifications of air and carbonic acid described in Sections 4 and 5 were tested, and their electric densities measured by drawing by an air pump a measured quantity of the gas† from the gas-holder through an indiarubber tube to a receiver of known efficiency and of known capacity in connection with the electrometer. We have not yet measured how much electricity was lost in the passage through the indiarubber tube. It was not probably nothing; and the electric density of the gas before leaving the gas-holder was no doubt greater, though perhaps not much greater, than what it had when it reached the electric receiver.

§ 7. The efficiency of the electric receivers used was approximately determined by putting two of them in series, with a paraffine tunnel between them, and measuring by means of two quadrant electrometers the quantity of electricity which each took from a measured quantity of air drawn through them. By performing this experiment several times, with the order of the two receivers alternately reversed, we had data for calculating the proportion of the electricity taken by each receiver from the air entering it, on the assumption that the proportion taken by each receiver was the same in each case. This assumption was approximately justified by the results.

§ 8. Thus we found for the efficiencies of two different receivers respectively 0.77 and 0.31 with air electrified positively or negatively by needle points: and 0.82 and 0.42 with carbonic acid gas electrified negatively by being drawn from an iron cylinder placed on its side. Each of these receivers consisted of block tin pipe, 4 cms. long and 1 cm. diameter, with 5 plugs of cotton-wool kept in position by 6 disks of fine wire gauze. The great difference in their efficiency was no doubt due to the quantities of cotton-wool being different, or differently compressed in the two.

§ 9. We have commenced and hope to continue an investigation of the efficiency of electric receivers of various kinds, such as block tin, brass and platinum tubes from 2 to 4 cms. long and from 1 mm. to 1 cm. internal diameter, all of smooth bore and without any cotton-wool or wire gauze filters in them; also a polished metal solid, insulated within a paraffine tunnel. This investigation, made with various quantities of air drawn through per second, have already given us some interesting and surprising results, which we hope to describe after we have learned more by further experimenting.

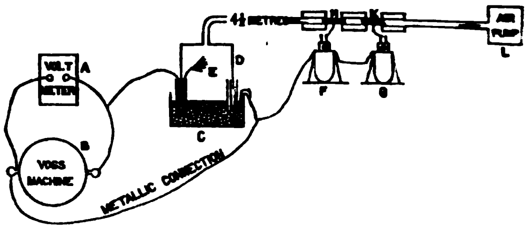


Fig. 2.

§ 10. In addition to our experiments on electric filters we have made many other experiments to find other means for the diselectrification of air. It might be supposed that drawing air in bubbles through water should be very effective for this purpose, but we find that this is far from being the case. We had previously found that non-electrified air drawn in bubbles through pure water becomes negatively electrified, and through salt water positively. We now find that positively electrified air drawn through salt water has its electrification diminished but not annulled, if the primitive electrification is sufficiently strong. Negatively electrified air drawn in bubbles through pure water, and positively electrified air drawn through salt water, has its electrification augmented.

§ 11. To test the effects of heat we drew air through combustion tubes of German glass about 150 cms. long and 2½ or 1½ cms. bore, the heat being applied externally to about 120 cms. of the length. We found that, when the temperature was raised to nearly a dull red heat, air, whether positively or negatively electrified, lost little or nothing of its electrification by being drawn through the tube. When the temperature was raised to a dull red heat, and to a bright red, high enough to soften the glass, losses up to as much as four-fifths of the whole electrification were sometimes observed, but never complete diselectrification. The results, however, were very irregular. Non-electrified air never became sensibly electrified by being drawn through the hot glass tubes in our experiments, but it gained strong positive electrification when pieces of copper foil, and negative electrification when pieces of carbon, were placed in the tube, and when the temperature was sufficient to powerfully oxidize the copper or to burn away the charcoal.

§ 12. Through the kindness of Mr. E. Matthey, we have been able to experiment with a platinum tube 1 meter long and one millimeter bore. It was heated either by a gas flame or an electric current. When the tube was cold, and non-electrified air drawn through it, we found no signs of electrification by our receiver and electrometer. But when the tube was made red or white hot, either by gas burners applied externally or by an electric current through the metal of the tube, the previously non-electrified air drawn through it was found to be electrified strongly positive. To get complete command of the temperature we passed a measured electric current through 20 centimeters of the platinum tube. On increasing the current till the tube began to be at a scarcely visible dull red heat we found but little electrification of the air. When the tube was a little warmer, so as to be quite visibly red hot, large electrification became manifest. Thus 60 strokes of the air-pump gave 45 scale divisions on the electrometer when the tube was dull red, and 395 scale divisions (7 volts) when it was a bright red (produced by a current of 36 amperes). With stronger currents, raising the tube to a white-hot temperature, the electrification seemed to be considerably less.

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*Papers read at the British Association Meeting, September 11-17, 1895.

* "On the Electrification of Air," by Lord Kelvin and Magnus Maclean.

† The gas-holder was 38 cms. high and 81 cms. in circumference. Ten strokes of the pump raised the water inside to a height of 8.1 cms., so that the volume of air drawn through the receivers in the experiments was 428 cubic centimeters per stroke of the pump. This agrees with the measured effective volume of the two cylinders of the pump.

AN IMPROVED PORTABLE PHOTOMETER.

BY W. H. PREECE AND A. P. TROTTER.

[The first part of this paper appeared in last week's issue.]

The color difficulty is reduced, in the first instance, by the freedom of motion of the levers. The handle may be quickly moved to and fro on each side of the true reading, and the middle position may be estimated. In measuring the illumination due to arc lamps, the color difficulty becomes troublesome. The color of the glow lamp in the photometer should be approximately a mean between the color of the standard of light wherewith the instrument is calibrated and that of an arc lamp. This halves the difficulty, which can never be entirely removed, since differently colored lights are not physically comparable; it may, however, be relegated entirely to the laboratory by the use of a colored screen and diaphragm.

If the hinged screen be painted pale blue, some of the yellow rays of the lamp in the photometer are absorbed, and the reflected rays approximate to gray, that is, to feebly illuminated white. On the other hand, if the diaphragm is tinted yellow, the white light from electric arcs or of daylight may be reduced to approximately the same color as that of the lamp in the photometer. In the first case the illumination of the hinged screen is reduced, and a brighter lamp would have to be used to restore the true value of the scale readings, and in the second case the illumination of the diaphragm would be reduced, and the scale readings would be too high. But by tinting both screens the calibration of the instrument need not be disturbed. The screen being colored pale blue and the diaphragm pale yellow, there is no difficulty in obtaining disappearance of the hole in the diaphragm when illuminated by arc light, or even by daylight. The selection of the colors suitable for obtaining a true measurement is based upon the mean of a number of measurements. White screens are used, and a dull day should be chosen. If the measurement is made at midday, the color will not alter appreciably during the calibration. A number of measurements are made with quick oscillations of the handle, and the mean is taken. Several screens and diaphragms of different tints being in readiness, pairs are tried, and a selection is made of a pair which give a good color match, and, if possible, the mean reading given by the white screens. A slight departure from the mean could be corrected by the use of a coefficient. It is not suggested that strongly colored lights can be scientifically compared in this manner, but only that the yellowish light of a glow lamp can be compared with the whitish light of an arc or of subdued daylight. We employed this device in 1884, and Messrs. G. W. and M. R. Patterson, the translators of Palaz's "Industrial Photometry," who have used it in connection with a Lummer-Brodhum photometer, remark* that "it can, of course, give no additional absolute accuracy to the photometric measurements; it, however, adds greatly to the comparative accuracy of the results, as it makes it possible to measure relative intensities under various conditions with great precision." But it should be observed that the selection of the tints may be made at leisure, and under favorable laboratory conditions, and by thus avoiding all color trouble during ordinary use of the photometer a very considerable gain in precision is secured.

The scale is 5¼ inches (137 mm.) long, and is shown in Fig. 3. With the smaller of the two lamps, the highest reading is equivalent to one candle at a foot, with the larger lamp it is twice this illumination. The oscillations of the handle generally extend, at first, over two scale divisions, and after three or four oscillations their amplitude may be reduced to about one scale division. The half of a scale division may be estimated except at the highest part of the scale, which is slightly contracted. The precision is about 2 or 3 per cent. The contraction of the upper part of the scale is intentional, and is caused by the arrangement of the levers.

In case of renewal of the lamps, it is very important that other lamps should be placed in exactly the same optical position in the photometer; otherwise the scale would have to be re-calibrated. In order to fix the height of the lamps, which is the only adjustment necessary, a sheet metal screen, shown by dotted lines in Fig. 1, is placed in a holder attached to the floor of the photometer. Two small holes are drilled in this screen, and a white paper screen having a black horizontal line is fastened to the end of the box (see Fig. 1) opposite to the lamps. The hinged screen being lifted by the levers out of the way, "pin hole images" of the filaments are thus thrown on to this screen, and the lamps being set (see Fig. 2) so that the single horseshoe filament appears nearly closed up, the dark line between its two limbs is made to fall on the black horizontal line. The images being magnified, considerable accuracy is possible.

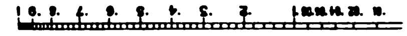

FIG. 3.

Although the principal object of this photometer, as of those which preceded it, is the measurement of illumination, it is sometimes desirable to measure the candle-power of a lamp in the street without removing it from its position. By the use of a graduated arc, such measurements can be made with the present photometer. A quadrant is fastened to the side of the photometer, and a pin at the center, from which the quadrant is struck, acts as a gnomon. A spirit level on the top of the instrument being adjusted, the angle of incidence may be read in degrees on the quadrant, and at the same time the cosine of this angle may be read on an adjacent scale. It is necessary to find the slant height or direct distance from the source of light to the photometer.

To measure the vertical height of the light, set the photometer so that the shadow falls on 45°. Measure the distance from the pin to the lamp horizontally, and from the pin to the ground vertically. The sum of these distances is the height of the actual source of light. This can be measured to about 2 per cent., say 3 inches in 12 feet 6 inches.

To find the slant height at any distance, the height of the light being known, divide the height of the lamp above the photometer by the cosine of the angle of incidence, the quotient is the slant height required; or the horizontal distance may be measured, and the square of this distance added to the square of the height of the light. This gives the square of the slant height.

To find the candle-power, the illumination in units of a candle at a foot being observed, the light from other lamps being carefully screened, the slant height being known: Multiply the illumination by the square of the slant height, and divide by the cosine of the angle of incidence.

On hilly ground it is necessary to know the height of the lamp above the photometer at each point of measurement. It is best, in that case, merely to record the angles, and afterwards to find the tangents. The horizontal distance between the photometer and the lamp-post, divided by the tangents, gives the required height.

It may be observed that when the square of the slant height in feet is equal to the cosine of the angle of incidence, the scale graduated in units of a candle at a foot becomes a scale of candle-power, and when the square of the distance in feet is ten 100 or 1,000 times the cosine, the multipliers ten 100 or 1,000 may be used to convert it into a scale of candle-power. The square of the slant height being known, the photometer may be tilted until the required cosine is indicated by the shadow of the pin. If the slant height is measured by the sum of the squares of the horizontal distance and of the height, the square is at once obtained.

We have calibrated our photometers, either by standard candles or by sub-standard glow lamps supplied from secondary batteries, or by the amyl-acetate standard lamp or Hefner unit. This standard, which is well recognized in physical work, is 0·877 of a standard candle, or a standard candle is 14 per cent. more than an amyl-acetate lamp. Placed at 1 foot distance from and perpendicular to the diaphragm, the photometer being placed on its side, the illumination is 0·876 of a candle at a foot. If it is brought to a distance of 11¼ inches ($\sqrt{0.877 \text{ foot}}$) it is equivalent to one candle at a foot. But this distance and position is inconvenient. If it is placed at a distance of 1 foot, and at an angle of incidence of 55° 10′, the illumination on the diaphragm is one-half of a candle at a foot, since cos 55° 10′ = ·57 and ·57 × ·877 = ·5. A mark is therefore made at this angle on the quadrant, and is inscribed H.U.= ½ C. P. Considerable experience with the use of small glow lamps supplied from portable secondary batteries has given us great confidence in this kind of secondary standard of candle-power. The battery is always freshly charged before each evening's work, and is discharged for half an hour before use. The lamps are only turned on while an observation is being taken.

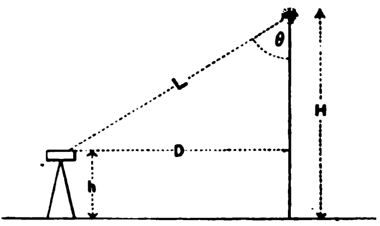

FIG. 4.

The 1883 photometer was arranged to be held in the hand; our 1884 photometer stood on a tripod about 2 feet 6 inches from the ground. The street measurements made in 1892 were all made with a photometer placed on the ground, the diaphragm being about 6 inches from the pavement. The proper height for an illumination photometer is a matter of opinion. When the photometer is placed on the ground, the large number of measurements required for a thorough photometric survey of a street or empty building can be quickly made. For some purposes—for example, an exhibition or a church—a stand is necessary; the calculations of candle-power become rather more tedious.

The various observed and computed quantities may be expressed as follows:

D = horizontal distance from photometer to lamp post.
L = slant height from photometer to light.
H = height of light above the ground.
h = height of the photometer diaphragm from the ground.
θ = the angle of incidence.

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* "A Treatise on Photometry," Palaz, American translation, Appendix, p. 312.

c.f. = illumination of units of a candle at a foot.
c.p. = candle-power.

$$\mathrm{H} - h = \mathrm{D} \div \tan\theta.$$

$$\mathrm{L} = (\mathrm{H} - h) \div \cos\theta.$$

$$= \sqrt{\mathrm{D}^2 + (\mathrm{H} - h)^2}.$$

$$c.p. = \frac{c.f. \times \mathrm{L}^2}{\cos\theta}.$$

The following is an example of the measurement of the illumination and candle-power in the case of a street-lamp:

D	θ	c.f.	tan θ	cos θ	H − h	H	L	L²	c.f. × cos θ	c.p.
20	66°	0·025	2·25	0·407	8·9	11·3	21·8	475	0·0614	29

OTHER PAPERS READ AT THE BRITISH ASSOCIATION MEETING.

Lord Kelvin's Portable Electrometer.

Professor Schuster described some observations with Lord Kelvin's portable electrometer.

The instrument used had, after ten years' usage by students, been subjected to all the rough treatment experienced on a Continental journey, including such things as glissading down snow slopes; it was nevertheless in working order, and had thus established a claim to the title "portable." In using it he had found difficulties from bad fuses and alterations of zero due to temperature. His object had been to estimate the atmospheric potential near the earth's surface at various points, in order to discover the laws of its variation with the configuration and nature of the surface, and the influence of disturbing causes. At Pontresina he found a mean potential of 30 volts in the valley (all the charges given are positive); at a higher but more protected place the potential was 62 on the same day. On ascending to the top of the pass a reading of 147 was obtained at a place with rocks on either side, while on descending slightly to a more exposed situation the potential was only 116. At an altitude of 12,000 feet above the sea level a reading of 816 was obtained; on descending 200 feet to 300 feet below the summit the value fell to 170. Above Pontresina, on an open plain, a potential of 357 was obtained. These figures did not appear to follow any obvious law, and the protective action of surrounding rocks in screening a point from electric charge did not seem to be very great. He found that the wind from a waterfall or glacier was invariably negative, and that the normal positive electrification at the foot of a glacier was increased by a strong wind blowing down the glacier. He wished to inquire whether Lord Kelvin had investigated the effect of the presence of one's body on the indications of the instrument.

Lord Kelvin said he had shown, at the Aberdeen meeting in 1858, how two instruments might be used to determine the effect of the body.

Professor Michie Smith said he had observed in India as high as 8,600 feet, always finding a positive electrification, the magnitude of which depended on the amount and direction of motion of the mists. He found the portable electrometer difficult to manage in the tropics, as the excessive moisture spoiled the insulation. Like Professor Schuster, he had found a temperature error, variable both in amount and sign.

Professor Ayrton thought the instrument ought to work in the tropics. He attributed temperature errors to unequal expansion of the various metals used in the instrument.

Indian Thunderstorms.

Professor Michie Smith read a paper on "Indian Thunderstorms," describing the results of his observations made at Madras. Here, he said, sheet lightning occurs every evening for several months, always near the horizon and directed towards the southwest. The time of occurrence varies from day to day, but is always evening, and generally not later than 9 P. M. It is not a reflection of distant lightning flashes, but consists of an actual discharge of electricity from cloud to cloud, or between two portions of the same cloud, and it takes place in the upper portions of low-lying clouds. When morning lightning occurs its direction is northeast. Hence the lightning is always to be looked for in the regions of still air, where the land and sea breezes meet. The time of occurrence depends on the hour when the sea breeze sets in, the display being about three hours later than this. Cumulus clouds rise together in pairs, and the discharge takes place between them, sometimes possibly within them. He thought the electrical conditions of the clouds might be accounted for by the fact that the sea breeze is moist and dustless, while the land breeze is dry and dusty. It is known that the air is negatively electrified relatively to the ground when the air and earth are both dusty, while the sea breeze brings a strong positive electrification. The equalization of the electric conditions of these clouds will result in sheet lightning. The presence of dust in the clouds is shown when they sink rapidly; the dust is then seen at their edges, and gives the iridescent or nacreous appearance frequently observed.

Mr. John Aitken said his observations on the Rigi confirmed Professor Michie Smith's theory. He believed thunderstorms resulted from an influx of pure air into dusty regions; the thunderstorm was the effect of purifying the air, not the cause of it. In support of this view he gave an instance of thunderstorms occurring for several days in succession without any apparent purification of the air; eventually the air was purified and the thunderstorms ceased.

Professor Schuster said he had counted 25 new theories of thunderstorms, all put forward during the past twelve years; in some years as many as four or five theories had been proposed. In connection with the electrification of air he thought Lenard's observation of the electricity of waterfalls was important. Lenard found that the air coming from the spray of a fall of pure water was charged negatively; that from salt water, on the other hand, is positively electrified. This accounts for the positive charge of the sea breeze. He thought the dust in air was generally gathered up locally, excepting that at high levels as in the case of the Krakatoa eruption. He supposed Professor Michie Smith would not deny the possibility of nacreous clouds being due to a current of air rising through the stationary cumulus cloud. He had often observed nacreous clouds in England, when the light was favorable, but he had connected them with cirrhus rather than cumulus clouds, and attributed their iridescence to ice particles instead of dust.

Professor Michie Smith, in reply, said that the iridescence of nacreous clouds occurred so near the edge of the cumulus and fitted it so closely that he regarded the phenomenon as produced by it.

The Telephone in Europe.

Two papers were read on telephonic matters, one by Mr. A. R. Bennett, comparing the systems of various Continental countries with those operating in England. He considered the services provided in Great Britain as being far behind many European cities both in matters of size, efficiency and rentals. He stated that the United Kingdom came tenth on the list he had prepared. It appeared with 59,569 exchange telephones with 636 persons to each telephone. He sums the characteristics of the service of the United Kingdom as follows: "High rates with regulations unfavorable to development outside towns, local management in part, practically no competition."

He divided the countries of Europe into three groups: (1) well telephoned, (2) indifferently telephoned, (3) badly telephoned. He presented with his paper a table showing that telephonic prevalence is proportional to the prevalence of the following features: (1) low rates, (2) local management, (3) facilities for rural intercourse, (4) dompetition.

The other paper was by Major-General Webber, who took as his subject "The Development of the Telephone Service in Agricultural Districts." He drew attention to the probability that the telephone, as well as light railways, might be beneficial to rural districts. He exhibited a map of Suffolk, in which every town, village, or hamlet where a post office was situated was marked. At each of these he suggested that a telephone call office should be established, and at twenty-nine towns it was proposed that there should be telephone exchanges. It was not proposed that these lines should be constructed with so costly material as that used by the post office. If carried out by the county council the whole of the work could be tendered for and the poles supplied locally, and very little special labor would be required. The telephone would offer means of communication with salesmen, farmers, bailiffs and workmen. Small tradesmen would be able by it to keep trade in local hands, regulations of transport and carriage of all kinds would be assisted, and economies would be effected in distribution of perishable agricultural produce of all kinds. He suggested a charge of 2d. per "talk" within one exchange area; beyond and inside the county it would be 3d.

The meetings at Ipswich concluded on Wednesday, September 17, after a very successful gathering. Sir John Lister was appointed president for the next meeting of the Association, which is to be held on September 16, 1896, at Liverpool. The Association has accepted the kind invitation of Toronto to hold its 1897 meetings there.

PHASING TRANSFORMERS.*

BY CHARLES S. BRADLEY.

On account of the large number of single-phase plants in existence which were built for lighting, and with no thought at the time of running motors from these systems, it has seemed to the electrical engineer very necessary to produce a single-phase motor. Many talented men have labored and studied upon this subject, and, so far, the results have not been at all satisfactory.

During the last few years the rapid progress of the polyphase motor has been the only success. The evolution of electrical art seems to be toward the production of apparatus which shall make all systems mutually convertible; so that we may be able to convert the phases produced into a greater or lesser number; starting with a generator of three phases, we shall be able to produce from it two or one. Again, generating two phases, we shall be able to convert it into three phases or one. Again, starting with a single-phase generator, we shall be able to convert it into two or three phases.

The polyphase motor is so good as to need but very little if any improvement, but this is so familiar to the Institute that I need not go into details. I think the time is not far distant when we shall be able to fill out with the alternating currents any engineering problem that may be required of us. We will be able to take old plants and modify them to do any work which may be necessary. One of the important links to round out the art seems to be the phasing transformer, so that we can take a single-phase alternating current and convert it into polyphase of any desired number.

I have chosen for my work the conversion of single phase to three-phase, because the three-phase motors which we have been able to construct give us very much less trouble than the two-phase. In a series of experiments, I have found that the two-phase motor would run at a number of speeds, especially when supplied with current from a phasing transformer. I supposed the trouble arose from harmonics, but of this I am not certain. The triphase motor never has given us any of this trouble. These experiments, however, were carried out before the transformers had been refined; and, now that we are getting more perfect results, I think it is very probable that we could return to the two-phase motor and get much better results than when first tried. The following is a description of an arrangement of condensers and cores to produce polyphase and single phase alternating currents. Many different arrangements of condensers and inductances have been tried, and all have failed to keep their phases at a working relation, except the one I am about to describe.

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* A paper presented at the Ninety-ninth Meeting of the American Institute of Electrical Engineers, New York, September 25, 1895.

A diagram of the phasing transformer and connections with the generator and motor will be found in Fig. 1, A being the generator, B the simple section of the transformer, D the condenser, and M the motor; *r*, primary of the simple section of the transformer; *n* and *l*, primary of the compound section; *g*, *h* and *i*, secondaries of the simple section of the transformer, and *j* and *k*, secondaries of the compound section. The primary of the simple section of the transformer is in series with the compound section and condenser. By the proper adjustment of capacity and inductance, the magnetic flux in the core of the compound section is approximately 90 degrees in phase behind the simple section; then, in order to get three phases from the two, I resort to resultants in the secondaries: *g* and *k* constitute one phase, *h* and *j* a second, and *i* the third. The essence of this invention rests in the arrangement of the compound section of the transformer and condenser. There are, undoubtedly, several ways of explaining the theories involved in this device, and most people would prefer the mathematical description, but, as I did not hit upon the invention by that method, I shall follow in the explanation the same method of reasoning as I used to arrive at the result. In order to explain the theory involved in this, refer to Fig. 2, in which A is the generator, E the inductance, D a condenser or capacity; *l* and *n* represent the leads to the inductance E and to the capacity D. If the generator is generating an electromotive force in the direction of the arrow, Fig. 2, a current will flow through the lead *l* and the inductance E, as represented by the arrow prime, and through *n* into D, in the direction of the arrow second, as indicated by the curves in Fig. 3; that is, during the rise of the electromotive force through the machine from the point *o* to the top of the wave at *p*, the current will flow in parallel into or through the inductance E and the capacity D, Fig. 2. As soon as the wave of the electromotive force commences to decline from the point *p*, the condenser will begin to discharge, and the current flowing from it will be in the direction of the arrow third, Fig. 2. Also, at the same time, the inductance will discharge its energy by a current in the direction of arrow third, so that the current represented by arrow third will cross the zero line at point *t*, Fig. 3, or is delayed by a time equal to 90 degrees. Thus we see that the current represented by arrow third will be lagging in its time period considerably behind that in the lead *r*, represented by curve *o-p*. Now, if we wind the lead *l* and the lead *n* upon an iron core, as shown in Fig. 4, in opposite directions and of the same number of turns, and have the inductance E bear a proper relation to the capacity D, so that the currents represented by arrow prime and arrow second shall be equal, no magnetic flux will be produced in the core during the rise of the potential of the machine from *o* to *p* on the curve, but during the fall of the electromotive force of the machine and during the discharge of the inductance and condenser which is represented by arrow third, Fig. 2, the currents flowing through *n* and *l* will be in series and flowing in the same direction; consequently, the magnetic flux will be approximately 90 degrees later than it would be if charged directly from the machine. I have represented in Fig. 2 a section of lead by *r*, and it will now be clearly seen that the current in the lead *r* will have a phase difference from the combined or resultant phases in the leads *l* and *n*. Furthermore, a current in the lead *r* will be in lead of the electromotive force of the machine, because the inductance and the condenser, previously described, cut off the flow of the current before the machine has reached the zero point and when the lead *r* is placed upon an iron core, as shown in Fig. 4, it has a tendency to lag, which counterbalances the lead and leaves the main line current somewhere near the phase with the E. M. F. of the generator.

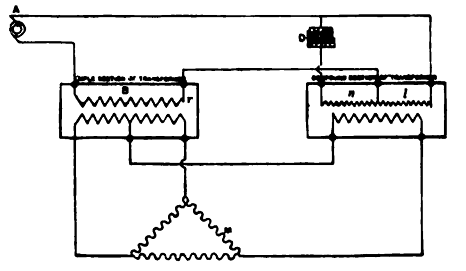

FIG. 1.

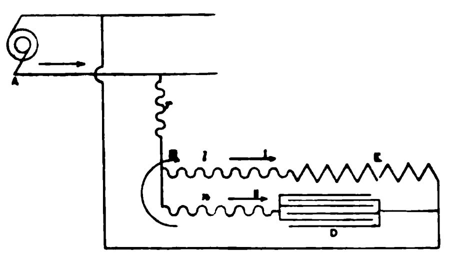

FIG. 2.

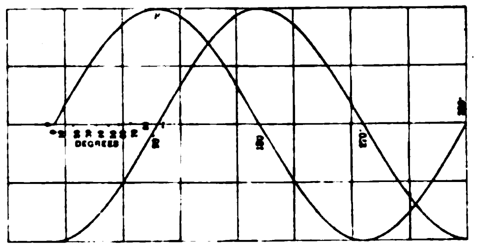

FIG. 3.

Please refer now to Fig. 4, where the leads *l* and *n* are wound in opposite directions, and completely interlaced upon the iron core L, the generator, inductance and capacity being indicated by the same symbols as in previous Figures. The lead *r* is here wound upon the second iron core, which constitutes the primary of the simple section of the transformer as shown at B, Fig. 1. In reducing to practice and applying the transformer to an induction motor, we find that the inductance E can be dispensed with, as the apparent inductance produced by the motor furnishes all the lag necessary; and it will be noted that in Fig. 1 the extra inductance which we used in our first experiments is left out of the combination. The lead from the simple section of the transformer, it will be noted, goes to the center of the compound section. This diagram does not represent the true condition of the compound section, for the winding *n* and *l* are together, or, as before mentioned, interlaced upon the core. The magnetic flux in the two sections of the transformer are approximately 90 degrees apart. The secondaries are, therefore, wound each partially upon the two cores, so that the three resultant phases may be produced from two, this being in accordance with Mr. Fred. S. Hunting's invention for changing two phases to three. For the description of this I will quote Mr. Hunting's own words, and the plan is in Fig. 5.

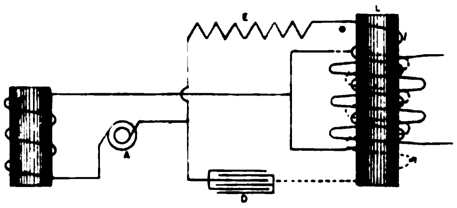

FIG. 4.

"If P^1 and P^2 represent two primary circuits supplied respectively with alternating currents differing in phase, or disposed in any other suitable manner so that the fluctuating magnetic impulses developed in the cores M^1 and M^2 differ in time, then the secondary currents developed in circuits S^1 and S^2 will differ in time period. If other circuits, as S^3 and S^4, be so arranged that part of their convolutions will enclose one magnetic core and part another, there will be developed in these circuits a resultant current due to the combined action of both magnetic cores, and this current may be given any desired degree of phase displacement with reference to the current in primary coils P^1 and P^2, accordingly as the number of convolutions surrounding the respective cores are varied. For example, if, as shown in circuit S^4, an equal number of convolutions is placed around each core, then there will be developed in circuit S^4 a resultant current having its phase half way between the phase of current in coils P^1 and P^2. If the number of convolutions on the two cores vary in the proportion of three to two, and be joined together as indicated by the coils S^3, the resulting current produced by these coils will be closer in phase to the current flowing in P^1, providing the larger number of convolutions be placed as indicated in the diagram upon the magnetic core controlled by coil P^1. Thus, by varying the relative proportions of the two coils inclosing the two magnetic circuits, a resulting current of any desired phase displacement with reference to the phase of coils P^1 and P^2 may be developed. It will thus be seen that by means of two magnetic circuits or cores in which magneto-motive forces differing in phase are developed, we may produce any desired number of currents of differing phase, and may produce a definite degree of phase displacement, and the resultant current may in any case be shifted closer to the phase of magneto-motive force in either core by increasing the inductive influence of said core upon the circuit carrying the resultant current.

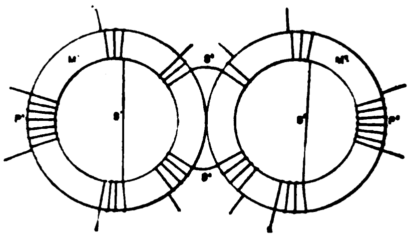

FIG. 5.

"In the organization shown in the diagram we will have four secondary currents developed from the primary coils P^1 and P^2, and assuming that the currents flowing through these coils differ in phase, all of said secondary currents will differ in phase."

Mr. Scott's invention for changing two phases to three may also be used, and is shown in Fig. 6. Making the resultants in this manner by means of the secondary windings contributes also to steadiness of phasing. If desired, two secondaries having a proper two-phase relation may be used on the motor.

The experimental work, in which I have been greatly assisted by Messrs. Hulse and Chapman, has occupied a long time and has passed through a great many stages. The results represent a great deal of patience, and we have chased the phases from zero to 180 degrees, back and forth, until there is a well-worn path between these two points, but finally we have a set of beautiful results, and the electromotive force curves will be found in Fig. 7, taken from the transformer, in connection with a half-horse-power motor, running at full load, and Fig. 8 gives the current curves of the same. This motor gives powerful starting torque, and it gives me pleasure to show it to you here in operation. I want to bring to your attention one feature of the compound coil

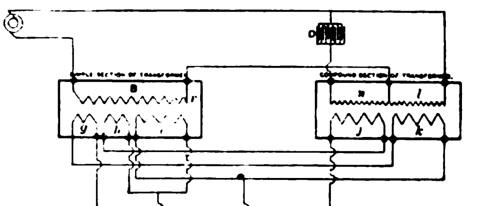

FIG. 6.

used in combination with the condenser, which will be found in Figs. 9 and 10. If we suppose a direction of motion, as shown by the arrow and the current in the condenser branch, leads by 90 degrees, which is represented at *b*, and the current in the inductance branch lags by 90 degrees, as indicated at *c*, and the wires carrying these currents are wound in opposite directions upon the core, we will have a resultant current which is represented by extension *d*. Increase of load changes the phase relation of the individual branches, but not the resultant secondary, and this is explained by reference to Fig. 10, where a 75 degree lead and a 75 degree lag are represented by the respective branches, and as the branches are wound in opposite directions we find that when *b* is turned over it becomes a lag of 105 degrees, and the resultant of 75 degrees and 105 degrees again produces 90 degrees lag, and the value again represented by the extension *d*; the value of the current is slightly less, but its resultant phase is the same as is represented in Fig. 9. This explains the steadiness of phasing which we are able to obtain. This may be explained by another method of diagramming as is shown in Figs. 11 and 12, where curve *a* represents the fundamental current, curve *b*, Fig. 11, a lead of 90 degrees, curve *c* a lag of 90 degrees, and then *b* being turned over unites with *c* to produce the resultant *d*, which is 90 degrees in lag of fundamental curve *a*. Now, in referring to Fig. 12, where the fundamental current is again represented by *a*, curve *b* represents a lead of 75 degrees, and full line curve *c* represents a lag of 75 degrees; then, when curve *b* is turned over in the windings, as shown in the dotted line, the coils being wound upon the same core, a resultant effect is represented by the curve *d*, which is 90 degrees in phase from fundamental curve *a*. Thus we see by increase of load, which tends to decrease the lead of the condenser circuit, and also decreases the lag of inductance circuit, our resultant is still in the same phase relation to the fundamental current.

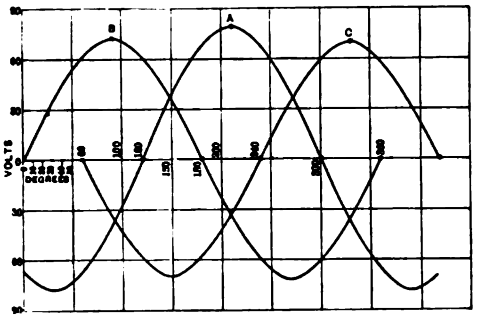

FIG. 7.—E. M. F. CURVES.

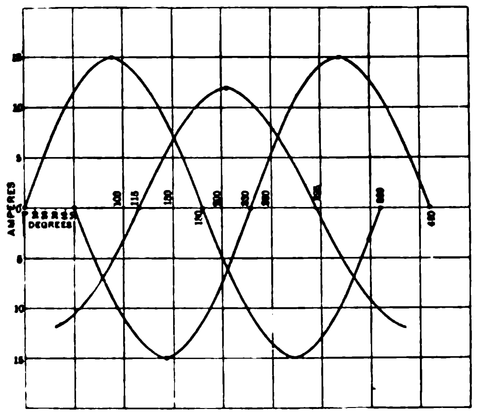

FIG. 8.—CURRENT CURVES.

The power factor is found to be very good, the current in the main line feeding the transformer varying from 10 degrees lead at full load to 35 degrees lag at no load, and the motor at starting producing the same effect as when working at full load; so that we have very good phasing for starting and full load, as well as a good power factor, it being 82 per cent. even at light loads, and the probability is that we will have very much better results upon larger-sized transformers.

The condenser in this combination fills two very important functions, first assists in the phasing and second prevents the lag upon the line. This arrangement does not prevent the idle currents flowing in the motor circuits and the secondaries of the phasing transformer, and we find in small motors with the high period of 140 cycles that the apparent energy in the motor circuits is sometimes two and one-half times the apparent energy in the main line. The capacity of condenser for a one-half horse-power motor when 1,000 volts are supplied to the transformer is about 2.4 microfarads. Our condenser for this size, without connections, occupies a space of a cube four inches on each side, and capable of enduring 3,000 volts, or a factor of safety of four, as the voltage on the condenser is about 700. Of course, it will be understood by those familiar with the designs of induction motors that it is impossible to design a small motor with small power factor, as the air-gap necessary for mechanical construction has to be so large in proportion to the size of the motor.

Many attempts have been made by placing the condenser in direct connection with motors to produce rotary fields, but have so far been attended with little success; as the trade requires the motor to be of comparatively low voltage, which calls for a large capacity in the condenser, and as the output of the condenser of a given capacity is proportional to the square of the voltage, it will be seen how advantageous it is to place the condenser in combination with the primary of the step-down transformer.

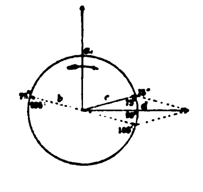

FIG. 9.

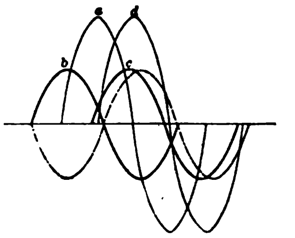

FIG. 11.

It may seem trite to call your attention to the fact that the transformer reduces the voltage at the same time it does the phasing, but I think it is so important that I wish particularly to emphasize the fact. It is also of great importance that the device has no moving parts.

Upon reference to the cuts showing the curves obtained of the electromotive force and current, it will be readily seen that they are all of true sine form. The current for this work was obtained from a 75 K. W. Slattery alternating machine. This machine has a surface winding on the armature, and, therefore, gives practically a sine wave. Just what the transformer may do on all the various dynamos that are in the market, giving all sorts of complex waves, it is difficult to say with our present experience, but so far as we know now, the transformer tends to smooth out all the irregularities.

While the principal use for this device at present seems to be the application of polyphase motors to single-phase lighting systems, many new ones undoubtedly will be found. It may seem bold to think of applying this to long-distance trolley railroads, but I am hoping to have it done.

It is much more simple to have one trolley wire with track return than to have two trolley wires which would be required by the direct application of polyphase systems. A large amount of power requires either a large current or high voltage, in order that the resistance of contact of whatever device is used to make connection to line need not be too great. As viewed at present, it seems as if the alternating current must be used for this work. If so, and unless the traffic is extremely frequent, it will take many more transformers, if they be placed along the line, than if the transformation is made upon the car or locomotive, because the transformers along the line having no trains or cars near them would be idle.

If the voltage is stepped down on the car or locomotive, it is just as economical to do it by the phasing transformer, with the exception of the added weight of condensers, which for a 1,200 H. P. locomotive will be about two tons, and this is not of consequence on so large a power.

These condensers are very compact and efficient, and will stand from three to four times their working voltage without puncturing the dielectric. I am sorry I cannot show you the condenser in all its details, but for certain reasons I cannot do so at present, but will present it to the Institute at the first opportunity.

A brief description of the motor may be in order, although it does not belong strictly to this subject.

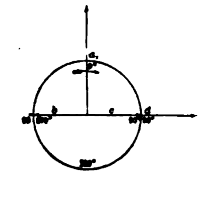

FIG. 10.

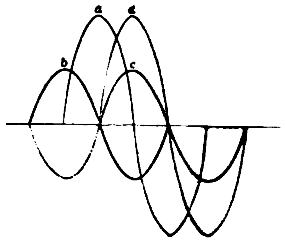

FIG. 12.

We met with much difficulty in developing a motor for so high a periodicity as 140 cycles. It is necessary to keep the density so low, and it is always such a temptation to try to get all the power from a given piece of apparatus, that they are always heating much more than they should.

With a large number of poles and slots, we found that any use of wide bars in the armature was out of the question, for the eddying currents in the copper were too serious. *We also looked for difficulties which we never found.* At times we thought the heating was due to higher harmonics produced from the phasing transformer; but the fact is, we never found any, unless it was in the experiments upon the two-phase motor. As mentioned before, the waves are all of the true sine form.

Cuts of the motor are shown in Figs. 13 and 14, the rotary field being the exterior or stationary part, and the secondary or induced constituting the armature. The armature is composed of two sections, or practically two armatures end to end upon the same shaft, one of the armatures having a low resistance winding and the other a comparatively high resistance; the field is placed over a high resistance for starting, and shifted by means of a lever over the low resistance, when it has nearly attained speed. Of course, this arrangement is for securing the starting up of the motor, and has nothing to do with the phasing transformer, and the motor might have rings for connecting the starting resistance to the armature and operate quite as well. The sliding of the field gave trouble, as the air-gap has to be small, and the play at the sides (noted 1*a* and 2*a*) allowed the armature to strike against the field, and when a tight fit was made, which would work easily when cold, it would stick fast when the motor rose in temperature; the writer therefore decided to give it quite a clearance at these points, and give it a guide at the bottom of the field shown at 3*a*. This being central and comparatively thin, the expansion is not sufficient to cause sticking, also the guides at 1*a* and 2*a*, being thin vertically, they may fit close and still slide easily. The lever for moving crown back and forth is shown at 4*a* Fig. 14, and 5*a* Fig. 13. It fits loosely, having a fulcrum at 6*a*.

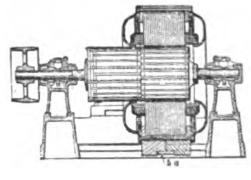

FIG. 13.

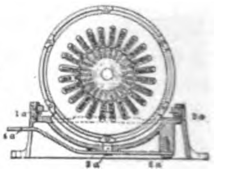

FIG. 14.

The Phoenix Telephone Company of Indianapolis, Ind., has refused to accept the ordinance recently passed by the council of Terra Haute, Ind.

Emanations from an Egoist.

PROF. FORBES SURVEYS HIMSELF AND IS FULLY SATISFIED.

How He "Harnessed Niagara."

The pest of society is egotists. . . . In the distemper known to physicians as chorea the patient sometimes turns *round* and continues to spin slowly on one spot. Is egotism a metaphysical varioloid of this malady?—*Emerson.*

Prof. George Forbes, C. E., has contributed an article to the current number of *Blackwood's Magazine*, in which he settles forever a great many disputed points in regard to the Niagara transmission scheme and the work of those connected with it. There is no longer any doubt as to who did it at all. The master mind was that of Forbes. Forbes has confessed it in 9,000 words, of which 200 are personal pronouns. Kelvin, Turrettini, Mascart, Sellers, Unwin, the Westinghouse Company, and the rest were never in it from start to finish except as disturbing elements to annoy the Master Mind.

Yet the creation of the great Niagara plant is not the Professor's crowning achievement. His glory of glories must forever be the *Blackwood's* article. We print such of it as is of especial interest to Americans, with a few brief comments, which are offered in a spirit of abject humility, as becomes an editor who at one time in his life was an American bagman:

There is no class of professional men who travel so much as engineers. Their experiences are often full of interest, and at times not devoid of excitement. Yet how seldom it is that any account of these travels is found in print. This is partly due to the fact that it all seems to the principal actor to be all in the day's work, and hardly worth committing to paper. But there is also a certain pleasure in having a store of experiences to relate to one's more intimate friends, which the vulgar crowd cannot read in a book.

At the present moment I am tempted to curb this natural reticence with the object of narrating my experiences of the last few years, which I believe are unique in our profession.

How can any one curb a natural reticence?

Our engineers are often called upon to travel in difficult countries, and to accomplish what look like impossibilities. But it is by no means an everyday occurrence for the financial men in a great country like the United States, who are not in the habit of minimizing the capabilities of their fellow-countrymen, to invite a foreigner to carry out one of the greatest works of modern times in that country. Some people say that the Americans are perhaps too much inclined to look upon their countrymen as the inventors of Electricity. It is, then, all the more surprising that the work about which the English engineer was asked to advise them was the electrical utilization of Niagara Falls. It must, however, be remembered that this work involved entirely new problems and designs, while the American electrician has less capability of evolving entirely new plans, or designing entirely new machinery, than of adapting his past experience, exactly as it stands, to new conditions. It was for this reason that one of the ablest of American engineers said in public three years ago that it was impossible to transmit the power of the Falls to Buffalo, some twenty miles, so as to make it pay; whereas we have now established the fact that the limit of distance is to be counted by hundreds of miles.

The remark of the American engineer must stand as truth until the contrary is proved. Power has not yet been sent to Buffalo. The statement that "the limit of distance is to be counted by hundreds of miles" is contrary to experience.

There are two great mistakes commonly made as to Americans. One is, that they are original inventors; the other is, that they are humorous. Neither of these propositions is true.

We yield both points to Forbes; he is the greatest inventor and the most humorous humorist of the age; and thank God he is not an American.

. . . Invention and humor require a gift of imagination, the same gift that shows itself in poetry and letters, in music, painting, and sculpture; and in no one of these directions has this gift of imagination been found to predominate amongst Americans.

In no one of these directions, save perhaps in poetry, does the Anglo-Saxon race lead; and in poetry America has no cause to be ashamed of her productions. In fact, more copies of Longfellow have been sold in England than of Tennyson.

I have given these reasons why it was perhaps natural to have recourse to a European to take hold of this great and entirely novel problem. Another reason is that all their electricians who may have had a wide practical experience are tied to manufacturing companies, and cannot be looked upon as independent either in thought or action; and since it was pretty certain that any plans that might be adopted would have much of novelty in them, and would be opposed in the first place both by scientific men and by the manufacturers, it required that the man selected should have nothing to gain or lose by the friendship or hostility of these two classes of men.

When I had finished my work at Niagara Falls the chairman (or president, as he is there called) of the company wrote me a letter, in the course of which he incidentally mentioned some of the reasons why I had been invited to carry out this work. . . .

Passing now from these digressions, let us come to the Falls themselves. I have no talent for pictorial description. . . .

Forbes is too modest. His whole article is a word-picture, a living picture, and when one finishes it the image of Forbes is fixed on his mind never to be effaced.

The village or town of Niagara Falls on the American side of the river is built of wood. It is dirty, and the streets are bad. Its industry is the catering to excursionists. Cheap restaurants, merry-go-rounds, itinerant photographers, and museums of Indian and other curiosities are the chief features. The last are mostly impostures, always excepting the world-famed "Katie & Libby's Stores," where genuine curios are to be found, and many pleasing souvenirs.

Who would dream that Forbes could have been taken in by our old friends Katie and Libby?

This village is remarkably conducive to the concoction of lies, and the Falls lend themselves to the art. . . .

We fear the Professor stayed there too long.

To me the great charm of the Falls is their immutability and change.

The drifting spray and varying light give the changes of a kaleidoscope, but the volume of water pouring over never varies. They remind me of the face of a dear friend, always the same but never two moments alike. I suppose there is nothing to compare with them in size or grandeur except the Victoria Falls of the Zambesi; and Livingstone, who never exaggerated, said that these were the finer.

. . . The old mills which used to be in the stream above the American Fall have been removed for æsthetic purposes and the land laid out with some attempt at good taste.

To what æsthetic purposes have they been devoted?

On the Canadian side the same thing was done, but I regret to say that the rapacity of the Legislature of Ontario has not proved equal to withstanding the blandishments of the greedy capitalist. Two lines of rails traverse the whole of the National Park at the edge of the gorge. After the land had been confiscated by the Government, and the owners had been paid only a fraction of its true value, it is now turned into a source of revenue by the Government, and a gold mine to the capitalists, at the expense of the visitors, who can no longer enjoy the peaceful quiet which Lord Dufferin tried so hard to give them. . . .

In 1889 the Niagara Falls Power Company was formed to carry out this work, and their first act was to buy up all the land in the neighborhood. The capital subscribed was wholly American, and amounted to £2,000,000, about one-half of which has been spent. The acting committee consisted of railway men and lawyers. The chairman, as usual, is called a president. They like giving big names to things in America. A pond is a lake, and a hill is a mountain; they never speak of the sea, it must be called the ocean; a meeting is a convention, a dictionary is a "speller and a definer."

How many Americans knew this before Prof. Forbes told them?

A town is a city, a chairman is a president, and so on. The only exception I know of is that the wealthy people who own those charming country residences at Tuxedo and Lenox call them cottages. But these are not average Americans, and in that country the manners and customs, as seen by the ordinary traveller, are governed by the average man, who is not a good specimen. He is apt to be a most awful "bounder," has no taste, and does not know the meaning of the word "repose"; but you need never meet this type except in railway trains and hotels. His ideal, as one of them told me, is to spend his nights "on the cars" and his days in getting the better of his fellow-men. But the refined American is quite different. These are mostly met in Washington and the South, and, of course, Boston is a thing apart; and as you approach this town you are told that the humming you hear is the noise of the people reading Browning. Tuxedo also is a great exception, where you can have congenial society. It is a large estate with woods and lakes and forty miles of well-laid roads. Country houses or cottages have been built all over it, and there is an excellent residential club—into which, however, the female element has progressed so far as to have introduced even babies into the bedrooms!

I must really ask to be excused for such digressions, but I must tell my story in my own way or leave it alone.

And not even the "average American" would stop you, Professor. You are a peach.

The chairman of the company which has utilized the Falls is Mr. E. D. Adams, well known as a banker and a reorganizer of railways. The first vice-president is Mr. F. L. Stetson, a lawyer who has also had much experience in the finance of railway companies. Mr. Cleveland, the U. S. A. President, is a partner in his law business. The second vice-president is Mr. E. A. Wickes, also a railway-man. The secretary and treasurer, Mr. W. B. Rankine, is one of the most able and energetic and charming men I met in the States. I only hope he will not utterly ruin his health by overwork. All these are very able business men, though not engineers, and the affairs of the company could hardly be in better hands——

Unless Forbes took charge again.

In October, 1889, the Niagara Falls Power Company was formed to carry out the great work of utilizing the Niagara Falls on so gigantic a scale that all previous attempts to use water-power at once sank into insignificance. The Cataract Construction Company was at the same time formed by the same people to carry out the work. . . .

In order to obtain more definite ideas they invited certain engineers to prepare plans of any methods they might think best. These were to be laid before a Commission of engineers and physicists from England, France, Switzerland, and America, with Lord Kelvin as chairman.

At first I declined this invitation on the grounds that the method of competition is contrary to my professional practice, and also that with so novel a problem I would not accept any man, or combination of men, to adjudicate upon the project which I might decide upon.

Having learnt, however, accidentally, that any electrical plans to be submitted would not be of a satisfactory nature, I withdrew my refusal in order that a plan, as I conceived on proper lines, might be at least in evidence. . . .

Now let me say, without explanations, that there are two kinds of electric current—a "continuous current," always flowing in the same direction, and an "alternating current," in which the direction of flow is reversed, it may be hundreds of times in a second.

I soon realized the fact that not only could the latter current be more easily obtained at high pressures, but that it could easily, and without moving machinery, be transformed to any required pressure at any spot when it was wanted.

Up to that date, **1890**, both kinds of electric current had been used for electric lighting, but the alternating current had never been used for giving mechanical power except in an experimental way. For this reason it seemed to most people absurd to suggest its use for Niagara Falls. I would have shared this view were it not that for several years I had visited the United States and the continent of Europe to study the progress that others were making in electric work. I had thus become well acquainted with the system which Nicola Tesla, a young Montenegron, was experimenting on at Pittsburg, U. S. A., called a "two-phase" system. I also had seen many things in various parts of Europe not generally known in England. Owing to these varied experiences, I HAD AN OPPORTUNITY ABOVE ALL OTHERS AT THAT DATE of foreseeing that the alternating current would soon be very generally applied not only to light, but also to motive power.

Here we must digress long enough to introduce a little correspondence between Prof. Forbes and the Westinghouse Company, in **1891**, which needs no comment.*

Acting upon this knowledge, I worked out complete plans, using only machinery which could then be got in the open market, and was able to furnish complete working plans, drawings, specifications and estimates of cost. This laborious work when concluded left no doubt in my mind that the alternating current must be adopted.

The Commission sat upon these plans, and, as I expected,

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* (*Prof. Forbes to Mr. George Westinghouse, Jr.*)

34 Great George Street, London, S. W.,
September 19, 1891.

Dear Mr. Westinghouse: I am going to read a paper on alternate current motors. I want to emphasize the importance of your work on the Tesla motors. May I ask you kindly to allow me to have as full information as possible by instructing one of your staff to forward some details? I daresay you cannot give me all the facts I want, but if I indicate them generally perhaps you will give me some of the points. First, and most essential, I want a drawing to show the winding of the armatures, especially the unsymmetrical winding, which I saw last year. I should also like to have drawings of the complete machines, generator and motor, the dimensions, weight, speed of revolution, output and efficiency of any particular machine that you have made. What are the largest and smallest machines you have had giving good results? What is the period of alternations and e.m.f. you have used? What examples may I quote of their successful use in practice? I know that the development of the motor has been retarded by other than engineering difficulties. I am glad to learn that the financial difficulties of the company have been surmounted.

With kind regards I am, yours most truly,

GEORGE FORBES.

P. S.—I also want facts about the power when starting the motor.

(*Mr. George Westinghouse, Jr., to Prof. Forbes.*)

Pittsburgh, Pa., October 30, 1891.

Prof. George Forbes, 34 Great George Street,
London, S. W., England.

My Dear Sir: I desire to apologize for not having written earlier in answer to yours of September 19th. I have given the matter very full and careful attention, denounced the alternating current, for none of them had had the experience which I possessed of the latest developments. . . .

I heard no more from the promoters of this enterprise for over a year. It took them all this time to realize that the Commission had made a mistake. Lord Kelvin was the most violent opponent of the alternating current; and for long afterwards (although he is my most esteemed and oldest scientific friend), even when I was appointed as the consulting engineer, he continued to write and cable to the company, though his opinion on this point was not asked for, telling them that they were making a "fatal mistake" if they followed my advice. . . . But in this and other points where my plans were at variance with the opinions of others, I was most loyally supported by the directors, and through this support alone they and I have been enabled to put the works into their present satisfactory condition. . . .

Early in the year 1892 it became evident to the acting committee that the views of engineers had been undergoing a change, and that the use of alternating currents for Niagara was a necessity, thus indorsing the prophecy I had made long before. They then asked me to act as their electrical consulting engineer, and during that year and the next and the next I was constantly in the States. The only real rest I ever got was in my voyages across the Atlantic. I soon came to feel at home on all the large liners. . . . The misfortune is that at most seasons the only class to travel much are the American bagmen or drummers, and they are not a favorable class to judge Americans by.

Sometimes I lived in New York where the offices were; sometimes at Niagara to be near the works. I did not care to go much into society, but I made some very firm friends, specially the Hewitts, and our amiable Consul-General Sir William Booker and his charming American wife. My greatest friend of former days had been S. L. M. Barlow, a well-known and remarkable man. Roscoe Conkling and I used to dine with him every Sunday. These two lawyers, both able men, on opposite sides in politics and also in the great Stewart will case, amused and instructed me much by the exposition of their views on men and things. Both were dead now and I had two friends the less to help me pass these three years. Part of the time I lived in Tuxedo, an hour from New York, where you could have fishing, shooting, boating, bathing and golf; and I shall never forget the cordial welcome I there received from the Potters Bruzes, Lorillards, Delafields, Fishes, Kents, Rushmores, Prestons, Van Courtlandts, Van Nests and from Allen Lathrop and many others. The lovely scenery and genial society of this place helped me greatly to retain health during a period of anxious and arduous work.

This is all of intense interest, and the Professor should not have cut it off so short. We crave for more.

In 1892 when I came to examine the plans put in by various manufacturers, I found that some of the crudest work conceivable had been submitted by the Americans. The Europeans sent some excellent designs, especially the Oerlikon Fabrik, near Zurich. But these makers were handicapped by the duty imposed on machinery imported into America. There was, however, one fatal defect in all the plans then or subsequently submitted by the manufacturers. . . . The American manufacturers were entreated to alter their dynamo designs to meet this difficulty. They tried, but they were unable to do so. . . . Meanwhile I had been constantly working at various new designs, and at this stage I saw that, for the credit of the company, it was imperative that I should, if possible, get out a design on new lines which should have the required fly-wheel effect without too great a weight. . . . It occurred to me that if I could make the external part revolve I should get a maximum of fly-wheel effect with a minimum of weight. . . . I proceeded to get out rough designs and found, with the utmost satisfaction, that I could meet all the requirements of the turbine-makers. I also found that this design gave far greater mechanical strength to the revolving part of the dynamo—an important matter, with this forty tons revolving more than four times a second. Furthermore, the magnetic attractions which in all the other designs increase the dangers from centrifugal force, in my design actually diminish them. It soon became evident that this happy idea of revolving the external parts completely extricated the company from the very awkward dilemma in which they had been placed. I then proceeded with a large staff of draughtsmen to get out the working drawings, and I secured an American patent as a protection to myself and my company. It was a matter of considerable satisfaction to all concerned that I had thus so simply got over the serious difficulty which at one time threatened us with starting afresh on all the machinery, turbines and all. . . .

The designing of a suitable dynamo was, however, only one of a number of difficulties that had to be overcome. Some of these were of an engineering character, but others savored of "politics" in the sense in which that word is used in the States. There *politics* means intriguing, underhand dealing and jobbery, and is always used in conversation to express that meaning. *Until I went to America the manufacturers of electrical machinery never had a consulting engineer to reckon with*, but dealt directly with the financiers who knew nothing about cost or efficiency of machinery. When they knew that I was to advise the Niagara Company, they tried by every means in their power to revert to the old plan. Every game of bluff, bounce and threats was used but without the least effect. One of our engineers in another department to mine, who knew nothing of electricity, was completely taken in by one of these firms. This and other intrigues hindered me a good deal in carrying out my plans. Then, again, I had at times great difficulty in keeping the president and vice-presidents in hand. One of the latter, after he had learnt a little about ohms and volts, believed himself capable of instructing me as to which tenders I ought to recommend for acceptance, and did his best to try to influence my judgment. Most of them began to think they knew something about the subject, and that they were quite capable of settling what tests the machines should be put to. All this was generally amusing enough, but became almost tragic at times when I found them endangering the whole work. On such occasions I would write to my millionaires and tell them that if they did not do what I told them they would be personally answerable to the directors and shareholders for any disaster that might occur. This always had the desired effect and my point was carried. I fear that at times they wished me at Jericho, but after any one of these tiffs was over I think they were glad that I had taken that line.

I have said that there were many new electrical problems to attack. One of these was a new departure on my part, which involved a very heavy piece of calculating and designing before I could be perfectly certain that my conclusions were correct. It occurred to me that with the large machinery we were using (the dynamos which I designed* were three or four times as powerful as any that had then been made) it would be best to make the alternating current reverse its direction as slowly as was consistent with making a good dynamo. This would not do so well for *lighting*, but for a *power* station like ours the advantages were powerful and numerous.

Then again, some of the manufacturers, threatened us with patent-litigation if we used certain types of machinery, so I had to get out designs of *another kind of motor* to drive the mills, so that in any eventuality we should be prepared and able to go on in spite of these threats. Then our first customers wanted continuous current, and I *had to select* a method of making the conversion. . . . In the afternoons I generally took a drive in a buggy on the Canadian side, where the roads were passable, and sometimes I rode. I had a *nigger* servant to look after the house, who differed from all his race. . . .

In this difference the nigger was similar to Prof. Forbes

An Englishman in America should always try to retain his Englishness—otherwise in a year or two he will be reduced to the level of an average American. Where all men think themselves equal, individuality is at a premium. An American once tried to find fault with me for pitching into my servant, because, forsooth, all men were equal. I never saw the man before, and would never see him again. So I told him that if he wished to be placed on a par with my valet I would willingly acquiesce, but he must not attempt to define my place on so short an acquaintance. . . .

It is unfortunate that Prof. Forbes never had any "Englishness" to retain. If Englishness means anything, it means refinement and good breeding. The process by which Forbes would reach the level of "the average American" is outlined in the Darwinian theory. It is not a process of reduction.

The dynamos were at last made and tested, after most annoying delays and disingenuousness on the part of the manufacturer. The makers of the transformers and machinery for getting a continuous current, on the other hand, were prompt and obliging, and the tests came out well. Then I got bids for the appliances for transmitting power to Buffalo. All the conclusions I had arrived at from my own designs were now confirmed. Their cost per horse power, even with my low frequency,* was a fifth part of those that had been used for lighting, and the efficiency guaranteed was as I had stated. I decided on all this transmission plant, and it is not now put in only because the Buffalo people want to get the power for next to nothing. There is too much "politics" in this business at Buffalo. Another triumph I have had is, that engineers all over the world have learned to appreciate *my low frequency of alternations*, while we ourselves have found new merits in it at every step. . . .

When this was all completed and the first plant in place, the period of construction and design gave way to a period of dividend-earning, and my continuing to take charge would have swallowed up too much of the annual income, so I concluded my engagement with the company.

Prof. Forbes's salary was $400 a month, including expenses, about one-half of what a good American bagman receives.

This letter from which I have made this extract attributes the splendid results which we attained mainly to engineering skill. I am inclined to believe that they were fully as much the result of an exercise of tact, judgment and forbearance, combined with firmness—qualities which I do not hesitate to say that both the officers of the company and myself recognized in each other, and without which we should have found it difficult to obtain satisfaction from the manufacturers. . . .

Of course he does not hesitate—not Forbes. Why should any man who has so plainly shown his tact, judgment and forbearance, combined with firmness, hesitate.

. . . Owing to the support I obtained from the acting directors, the whole work for which I was responsible has been put in place and set agoing without a single hitch. This is not usual in a novel work of so great magnitude. I

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and I have come to the conclusion that our company cannot afford at this time to make public the information it has acquired in its work on the Tesla motor. The Tesla patents and discoveries include many very important matters, and his patents particularly cover the multiphase forms of motors and generators now attracting so much attention.

You must have become aware that patent rights are no longer respected in this country; that whatever is brought out and fully explained is immediately availed of by unscrupulous competitors; and we now feel it is a matter of great importance to maintain for the present, and until we are well established, what are properly secrets of the trade. To no one would I sooner give the information asked for than to yourself, and I hope the day is not far distant when we will be able, with safety to ourselves, to meet your wishes in this respect.

Trusting that you will appreciate the reason given for not promptly complying with your request,

I am, very truly yours,
Geo. Westinghouse, Jr.

(Mr. George Westinghouse, Jr., to the London Times, Aug. 29, 1895.)

. . . Business relations were established between Prof. Forbes and this company in 1888 by the purchase of his patent for a meter operated by hot air currents, and he was afterwards employed by us as an expert in a patent case and in making tests on transformers. He thus had every opportunity to become acquainted with our practice and ideas in connection with the use of alternating currents for light and power purposes, and also had an opportunity to see considerable of the early work on the Tesla motors. That such opportunities were valuable to him is shown by the fact that the first plan submitted by him for the transmission of power from Niagara Falls was almost identically on the lines that we had laid out for such work and freely discussed with him.

In consequence of Prof. Forbes having written the foregoing letter without stating that he was a competitor for the honor that would accrue to the successful designer of a complete plan, our company, for that and other good business reasons, refused to permit Prof. Forbes under any circumstances to visit its works or to have anything to do with the designing, constructing, or testing of the generators, and we are not aware that he has ever seen the apparatus which is now in operation at Niagara and for which he seeks to claim the entire credit.

. . . In our [World's Fair] exhibit generators, motors, and rotary transformers were operated at 3,600 alternations per minute, being practically identical with the frequency actually adopted at the Falls, and very different from Prof. Forbes's recommendation of about 1,000 alternations per minute.

Prof. Forbes made a suggestion for a device for commutating currents, in place of a rotary transformer, which device was built, and upon test the fact was disclosed that it was not anything like as good as the rotary transformer which we had designed and which form was afterwards adopted by a rival company, as Mr. Forbes says, on his recommendation.

Westinghouse Electric & Manufacturing Co.,
(Geo. Westinghouse, Jr., President).

** (Mr. George Westinghouse, Jr., to the London Times, Aug. 29, 1895.)*

After a lapse of two years, and prior to the design of the dynamo referred to by Prof. Forbes, this company submitted to the Cataract Construction Company plans and specifications for a dynamo, with a system of distribution for the operation of arc lights, incandescent lights, street cars, and for electrolytic purposes, including rotary transformers. Full information and particulars were communicated to the engineers and officers of the Cataract Construction Company. Owing to the purloining of our plans by a rival company and for other reasons all tenders for generators were rejected by the Cataract Construction Company, who afterwards, in September, 1893, submitted to us plans for a 5,000 H. P. generator, saying that such plans had been prepared by their engineers, and asking us to make a tender for its construction and erection. A careful consideration of the plans submitted disclosed the fact that if constructed according to such plans the generator would be a failure, and this company thereupon refused to tender on the drawings and specifications presented. We, however, offered to accept the general form of generator, and to re-design it so that it would be a perfect machine mechanically and electrically, and to submit new plans and specifications upon which the company would tender. This was agreed to by the Cataract Construction Company, and the generators now in use at Niagara Falls were built by us according to plans and specifications prepared by our own engineers. There is about the same difference between the machine designed by Prof. Forbes and that designed by us as there is between the picture of a man and the man himself—the appearance externally being very similar, but internally there is no resemblance whatever.

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*See letter of George Westinghouse, Jr., to "London Times."

feel confidence in asserting that so long as the instructions I insisted upon are acted on, there will be no trouble with the electrical machinery.

I penned a letter to the *Times*, which was published at the end of the year 1894, and from which I may make an extract:

"I am perched on the top of a small Eiffel tower, lately erected. . . ."

Nonsense, Forbes. You are farther from the earth than the top of the Eiffel tower. You are flying *through* limitless space, and if you get too near the sun, as did Icarus of old, and melt your wings, you will still fall to earth unbruised—if you can light on your cheek.

. . . The directors have no present desire to send the current to great distances. It will pay better to create a smokeless manufacturing town in the neighborhood. If required, the power could be sent much more than a hundred miles, and still be more economical than steam, even though coal is cheap there. In countries where power is much wanted, but very costly, the electrical transmission will be successful at distances of many hundreds of miles. Such cases occur in many places where there are valuable mines but no fuel.

In conclusion, I may say that the work done at Niagara is the forerunner of much more, and already I have in hand the preparation of plans of schemes nearly as important.

I also wish to bear tribute to the kindly friendship which I almost universally experienced at the hands of American engineers. Hardly a single case occurred where any jealousy was shown at an Englishman (or rather Scotchman) being selected to carry out the work.

George Forbes.

American engineers jealous of Forbes! Perish the thought!

Electricity has a warm love for Englishmen and for England, and this feeling is the rule rather than the exception in America. But we rejoice that Forbes belongs to England and not to us.

HYSTERESIS COMPENSATOR.

The following specification forms part of letters patent No. 545,042, dated August 27, 1895, granted to Bruno Abdank-Abakanowicz, of St. Maur, France, by the United States Patent Office; application filed March 17, 1893:

To all whom it may concern:

Be it known that I, Bruno Abdank-Abakanowicz, electrical engineer, Parc St. Maur, near Paris, France, have invented certain new and useful Improvements in Methods of Compensating for Hysteresis (for which I have obtained letters patent of the Republic of France, No. 228,400, dated March 6, 1893, and of the Empire of Germany No. 78,937, dated March 22, 1893,) of which the following is a specification.

It is well known that in all electromagnetic apparatus in which iron is used as an electromagnet or solenoid acting on a core plate, or armature of iron, or even upon a coil or another electromagnet, it is impossible to realize or obtain effects that are proportional to the current or to any exact function of the current; or the above may be stated thus: first, the error of magnetization of iron is not a straight line, because the magnetization produced is never proportional to the current producing it; second, the function of magnetization is double—that is to say, the quantity of magnetism actually produced does not depend exactly on the quantity of current producing it, but also on the value of the current by which the magnetic system had been previously energized. This difficulty presents itself especially in that class of apparatus which depends upon certain fluxes of magnetism, as in electrical-measuring apparatus, and in indicating apparatus or that class of apparatus in which a mechanical action is brought into play, due to an electric current having attained a certain predetermined value. It is a well-known fact that when, in the last-mentioned class of apparatus, we employ masses of iron or electromagnets, it is impossible to make them work in a predetermined and satisfactory manner, and that the cause is due to residual magnetism, which is but a particular case of the general effect known as 'magnetic hysteresis."

My invention consists, therefore, in the combination with a magnetic circuit of one or more masses of iron, steel, or other magnetic matter, constituting what I call a "secondary differential magnetic circuit or circuits." This secondary circuit may be magnetized by the same current as that employed for the principal magnetic circuit, or it may be magnetized by a certain fraction of this current; but the actions of the lines of force of the secondary circuit are in an opposite sense to those of the principal circuit. By choosing suitably the dimensions of the secondary magnetic circuit with reference to its own physical properties, those of the principal circuit, the ratio of the air space to the rest of the circuit, and the magnetizing force employed, a differential value of the magnetic flux or differential value of the mechanical effects produced by the system on a core, coil, or armature, may be obtained for all currents within the working range of the apparatus, which shall be proportional to those currents. This may be briefly stated thus: The effect of the residual magnetism of the first circuit is neutralized by the residual magnetism of the second.

It is to be understood that the two magnetic circuits are not necessarily independent of each other, and that the conductor turns of one may be employed to energize the other. The practical realization of this combination does not present any difficulty from the fact that the magnetization curves of iron, steel, etc., are very similar in form, and that by a judicious choice of material, such as wrought or cast iron, steel, or other magnetic matter, combined with an air-space of suitable dimensions, it is always possible to obtain curves of the same form in such a way that the difference is represented very nearly by a straight line, which is a function of the ampere-turns. It is also possible, as is required in some particular cases, to have a curve of other shape than a straight line.

For the sake of greater clearness I will illustrate the application of my invention to several simple cases, it being, however, clearly understood that I do not limit myself to the particular cases cited, but aim to embrace the use of a differential magnetic system of the type described for the compensation of hysteresis.

In the accompanying drawings, which show mechanism embodying my invention, Fig. 1 is a sectional diagram of a wattmeter, showing its principles. Fig. 2 is a section of an ordinary solenoid or electromagnet. Fig. 3 is a section of a differential solenoid embracing my invention. Fig. 4 is a sectional side elevation of a similar arrangement in a different form, and Fig. 5 is a plan of the parts shown in Fig. 4.

Suppose, for example, that it is required to construct a wattmeter for the measurement of continuous currents of the type represented by the diagram, Fig. 1. The potential is measured by the movable coil and the current is made to traverse the coils H of the principal electromagnet, and the coils *h* of the secondary or compensating electromagnet. The core N^1, which produces the principal flux, should be made of metal having the smallest amount of hysteresis possible, of soft iron, for instance, while N^2, which produces the flux for compensation, should be made of cast iron or steel, or some metal having a high coefficient of hysteresis.

The double arrows in the diagram represent the directions of the magnetic fluxes and the single arrows of those of the current. By varying the sections of the two cores N^1 N^2, the ampere-turns applied to these cores and the air-spaces of the magnetic circuits, it is possible to make a combination such that the residual magnetism is either entirely or only in part compensated and that the resultant magnetic flux will be always proportional to the current, in which case the resultant torque of the armature will be proportional to the watts. I may apply practically the same method to the case of a solenoid acting on a core of soft iron, which core it is desired shall be drawn in by the action of the solenoid to a certain predetermined point when the current shall have attained a certain predetermined value.

In many forms of apparatus a solenoid A, Fig. 2, through the coils of which passes a current acts on an iron core N, suspended by a spring R or held in equilibrium by a counterpoise. For a certain value of current the core should arrive at a certain position —for instance, to just touch the stop *a*. This condition can never be quite realized by the employment of a form of apparatus similar to that shown in Fig. 2, for the reasons previously mentioned, due to hysteresis, and to avoid this difficulty, which prevents the construction of apparatus of great precision, I may employ my method as follows: I employ two cores N^1 N^2, Fig. 3 connected together mechanically. N^1 is the principal core, and is composed of material possessing small hysteresis. N^2 is of smaller section than N^1, but is made of a material having a high coefficient of hysteresis. To the first core I apply what I call the "principal solenoid" A^1, which tends to attract the core in a certain sense, and to the second core I apply a solenoid A^2, called the "compensating solenoid," which attracts its core in an opposite sense. The resultant attraction on the two cores will therefore be the difference of the two attractions, and from what has been said above it is easy to understand that the effects of hysteresis can be compensated for, especially with regard to the position of contact of the core with the stop when the two solenoids are traversed by the same current or by currents which bear always a certain proportion to each other.

The above-described combination, of which the mechanical disposition may be varied in an almost infinite number of ways, has for its object to render the resultant attraction independent of the effects of hysteresis in the core. The result aimed at is obtained by a suitable choice of the nature of the cores N^1 N^2, of the ratio of the turns on the solenoid A^1 A^2, (or of the ratio of the ampere turns if the two solenoids be in multiple,) and of the relative position of the solenoids with respect to the cores.

To demonstrate further the generality of the application of my method of compensation, I may give one more example. In a great many forms of apparatus there is an electromagnet which acts on a plate of soft iron, forming an armature, by the mechanical movement of which certain desired results are to be achieved—for instance, to establish an electric contact when the armature is attracted by the electromagnet. In this form of apparatus again precision is effected by eliminating hysteresis. The position of the armature or plate for a certain current is not always the same if the current has once surpassed a certain limiting value. The deviation is still greater if the apparatus be employed with alternating currents.

My method of compensation is particularly applicable to the case just mentioned, and constitutes an important improvement when applied to this class of apparatus. Fig. 4 represents the application to a particular case of this nature. The principal electromagnet E^1 acts on the soft iron armature N^1 in opposition to the spring R and against the action of the differential electromagnet E^2 and the armature N^2, which have a high coefficient of hysteresis. The two electromagnets are supposed to be excited by the same current, which presents the simplest case. By choosing suitably the elements of the magnetic circuits of the two electromagnets it is easy to arrive at such a combination as will insure that the contact between *c c′* will always just take place when the current has attained a certain predetermined value, whatever may have been the previous values of the current. The practical rule to follow in this case is as follows: The attraction due to the residual magnetism of the electromagnet E^2 and of the armature N^2 ought to be equal to the attraction produced by the residual magnetism of the electromagnet E^1 and of the armature N^1 for the position of contact.

FIG. 1.

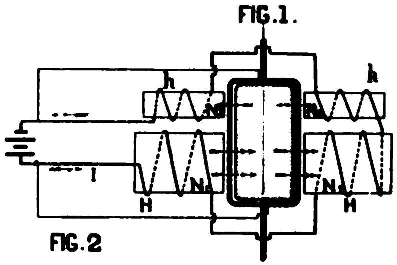


FIG. 2

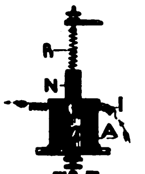


FIG. 4

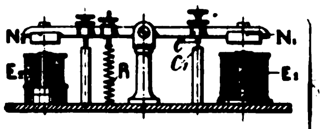


FIG. 3.

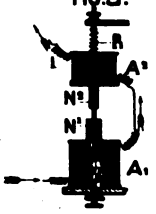
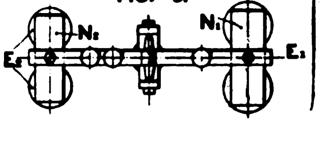


FIG. 5.



It is possible to show an almost infinite number of examples of the application of my method, but I consider that those already cited are sufficient to illustrate its operation.

Having thus described my invention, what I claim as new, and desire to secure by letters patent, is—

1. The method of correcting or neutralizing the effect of hysteresis in electro-magnetic apparatus, which consists in employing in such apparatus a main and an auxiliary magnetic circuit and neutralizing the effect of the residual magnetism of the first circuit by that of the second.

2. In combination, an electric circuit, and an electro-magnetic apparatus therein having a plurality of cores acting in opposition to each other, such cores having different magnetic material and so arranged that the resultant or differential effect of the cores actuates the apparatus and corrects or compensates for hysteresis, substantially as described.

3. In combination, an electric circuit, and an electro-magnetic apparatus therein having a plurality of cores acting in opposition to each other and of different magnetic retentiveness; the magnetic circuits of the apparatus being so disposed that the differential

action of the cores furnishes the effective actuating force of the electro-magnetic apparatus, and neutralizes hysteresis effects, substantially as described.

4. In combination, in an electro-magnetic apparatus, of a plurality of opposing cores having relatively different hysteresis coefficients and actuating the moving part or parts of the apparatus by the difference between their opposed effects and means for energizing the cores.

5. The combination, in an electro-magnetic apparatus, of electro-magnets having respectively cores of soft iron and of hard iron or steel, the cores being arranged to act upon a moving part in opposition to each other, and means for energizing the cores.

In testimony whereof I have hereunto affixed my signature, this 23d day of February, 1893, in presence of two witnesses.

BRUNO ABDANK-ABAKANOWICZ.

Witnesses: C. W. G. Little, A. M. Tanner.

THE PROPOSED MAGNETIC UNITS.*—III.

To the Editor of THE ELECTRICIAN.

SIR: It is after hesitation, and with some reluctance that I comply with your request to take part in the discussion of this question. The fact is I do not see that the proposed new names and new units are needed. When so clever a man as Prof. Lodge takes all these pains, I should like to believe that his proposals are meeting a felt want. But by whom is the want felt? I hold strongly that in this matter necessity should be the mother of invention. Dr. Lodge offers us sundry bantlings for adoption, but where is the maternal parent? New names and new units will be worse than useless unless they quickly become familiar. The B. A. Committee may make them legal tender among electricians, but will they come to be current coin? Will the success that attended the invention of ohms, volts and amperes be repeated, even in minor degree? Only if the new names allow us to conceive magnetic quantities more easily or to specify them more tersely than we can already do. We are accustomed to say that the permeability of air is 1. Will the advantage of calling it the "inductivity" instead, and of saying that it is one millihenry per kilometer, be immediately obvious to practical men?

In some cases it is proposed simply to give a name to the C. G. S. unit, and in other cases to use a multiple of the C. G. S. unit and give that a name. Thus Mr. Evershed would have us call the C. G. S. unit of magnetic induction a "thom," while Dr. Lodge would take 10^8 of the same unit and call it a "weber." Why do either? So long as we stick faithfully to C. G. S. a number is enough. To say that the total induction through an armature is 25 millions is at least as convenient and precise as to say that it is 25 million "thoms" or 0.25 "weber." Dr. Lodge has chosen the magnitude of the "weber" so that an E. M. F. of one volt shall be excited in a conducting circuit through which the total induction changes at the rate of one "weber" per second. But this endeavor to connect the new unit with the volt, the ampere and the ohm results in making it inconveniently large. Better, I think, use C. G. S. pure and simple in dealing with the magnetic quantities, and introduce the needful power of 10 when we want to reckon volts.

Again, we are asked to accept a new name for the line-integral of magnetic force, which most of us (following Mr. Bosanquet) call the magnetomotive force. This quantity is of first-rate importance in relation to the magnetic circuit as a whole. But I doubt if the occasion ever arises in practice to reckon magnetomotive force except for the whole circuit. And so long as we are dealing with the magnetic circuit as a whole it is not likely that any new name will be more serviceable than the familiar and eminently practical "ampere turns." When we want, for purposes of reckoning, to express the magnetomotive force in C. G. S. units, it is easy to multiply by $\frac{4\pi}{10}$; but ampere turns is too expressive and explicit a phrase to require addition or change.

As to the magnetic force at any point (H), no new name is wanted, and the C. G. S. unit is all that could be wished in respect of magnitude.

I understand that it is proposed to use one and the same unit for the permeance of a magnetic circuit and for the self-induction of a coil or the mutual induction of two coils. These are quantities of the same dimension, and as Prof. Lodge points out, the self-induction of a coil of n turns is $4\pi n^2$, the permeance of the magnetic circuit through its coil. Mr. Baily's objection that the self-induction of a coil would be liable to confusion with the permeance of its core has much force. As to permeance, which is total induction divided by magnetomotive force, no special unit name seems necessary. Whether a unit name for self-induction and mutual induction is practically important I have no opinion. The invention and partial use of "secohm" on this side of the Atlantic and "henry" on the other suggest that it is. But in any case it would be unfortunate and confusing to give the "henry" a value different from that which has already been assigned to it. Will American electricians consent to make their old name have a new meaning? Moreover, though this is of less consequence, the unit now proposed is, like the "weber," inconveniently big. These are large prices to pay for the kind of consistency that is aimed at in Prof. Lodge's proposals.

One or two points may be noticed that have come up incidentally in this correspondence. Prof. S. P. Thompson speaks of the quantity which we write B as "unfortunately sometimes miscalled the induction, as though induction were not the operation of inducing." I have rarely heard it called anything else, and am content to follow Maxwell, who probably believed that induction, like deduction, might properly name the result of a process as well as the process itself.

To define μ as $\frac{dB}{dH}$ would, in regard to iron, make μ useless. It should be remembered that, owing to the complications of hysteresis, the term permeability as applied to iron has a special meaning. It is used to name the ratio of B to H, which H is either (*a*) applied without previous magnetization, or (*b*) applied after previous magnetization by an equal and opposite magnetic force. These two definitions do not give strictly the same result; but the values are so nearly alike that the difference is, in practice, unimportant.

As to Mr. Heaviside's invitation to formulate a theory of the process of magnetic induction in iron, I fear that the relation of B to H is far too complex—as depending on previous values of B—to admit of mathematical statement. That at least is the conclusion to which a study of the model with small magnets seemed to point, where the process of magnetization was seen to occur through the breaking up and rearrangement of inter-molecular ties under the influence of the applied field. Yours, &c.,

J. A. EWING.

Festiniog, North Wales, Aug. 26, 1895.

To the Editor of THE ELECTRICIAN.

SIR: Referring to the correspondence on the subject of magnetic units now going on in your columns, I am sorry to say that Prof. Thompson could not have named in this connection a less sympathetic individual than myself, as the alleged necessity for new units does not in the least appeal to me.

It is unnecessary to seek a new name for "one line of force" or for "1,000 lines of force," or for "a million lines of force." As well might we coin a new term for "one revolution," follow that up with another for "100 revolutions," and still a third for "1,000 revolutions"—a *kilorevolution* to wit. It is as easy to say that the total flux is "5,000 lines" as to say that it is 5 *kilolines;* and the "thom" of my friends at Woodfield Works I have never been able to understand. Substituting *thom* for *line*—I put it shortly, without writing *of force* after it—I have always regarded as the most awful example of unit mania extant.

As regards *the number of lines per square centimeter* or *induction*, denoted by B the world over, I do not see that we require special names for particular values of it. "Lines per square centimeter" = so many, or "the induction" = such a figure, or B = so much, seems to meet all cases. There are some I know who would like to have a name invented for 1,000 lines per square centimeter, but I am not amongst them. *Engineers* have gone on very well without such variety of terms. *They* do not require a distinct name for a speed of 30 miles an hour and another for 60, or a special term for 100 lb. pressure per square inch and another for 120 lb. Proposals of this kind made by anyone would very properly be regarded as ridiculous, and having been brought up in a practical school, I am consequently inclined to look down upon the senseless multiplicity of terms some electricians would have us adopt.

There remains *magnetizing force* to be dealt with, and here I am still at a loss as to what is requiring new definition. Magnetizing force is expressed in two different ways, either as the *line integral* or *ampere-turns* accordingly as the constructive engineer regards one or other as the more convenient. What he has to determine is the magnetizing force required for a given circuit, and this he finds from his iron data in the usual manner; but how it will help him to give a name to some particular value of magnetizing force, whether expressed as the "line-integral" or "ampere-turns," and call it *unit magnetizing force*, I fail to see. Altering the unit of current is not to be thought of seriously for a moment. Magnetic quantities are only dealt with professionally, if I might so put it, while amperes, volts, watts and horse-power are dealt with commercially by everyone having the slightest connection with electrical matters. These quantities have become stereotyped as part and parcel of an industrial system, and even if a change were desirable, which it is not, they could not be altered with any greater facility than could the horse-power.

The advantage of having a universally received meaning for the terms in Prof. Thompson's paragraphs 5 and 6 seems to be more apparent than real. Whenever the relation between magnetic force and flux is given by any writer he is careful to state which way the magnetizing force is computed, so I do not think any confusion has arisen or is likely to arise under this head.

Of course I am writing solely from the constructive engineer's point of view, and it may be here observed that practicians who write on questions of construction are likely to adopt the language they have found most useful, whatever new names may be invented by the physicists. Probably Mr. Evershed would not give up his "thoms," nor Mr. Kapp his "English lines," nor the writer his "ampere-turns" without a pang. Again, it is unlikely that anything the practician urges will be considered by the high-and-dry theorist, for the latter seldom understands the mode of thought of the former, and when he does comprehend, he fails to appreciate it.

Probably all engineers do not share my views, but the engineers—I bar *electricians*—who are represented as thirsting for fresh units I have never met. We have done wonderfully well for some time with the existing terminology, and the "swallowing of camels," to use Mr. Heaviside's expression, has not impaired our faculties. By all means let the "scienticulists" invent units and names for units, as many as they please, but they should not delude themselves into the idea that the practician is benefited thereby; it makes not the slightest difference to him.

I understand Mr. Heaviside is the ringleader of the unit movement, and for that gentleman's work I have the greatest respect. But as the heavens are higher than the earth, so are Mr. Heaviside's thoughts loftier than those of a mere practician, and his conclusions correspondingly obscure to the average intelligence. Nevertheless in his own domain he has done work which will endure. And conscious that the practician can never degrade it by application to dynamo design or other things useful, he ought to be both proud and happy. Yours, etc.,

W. B. ESSON.

London, August 27, 1895.

To the Editor of THE ELECTRICIAN.

SIR: I am ashamed to say that for many years I designed dynamos without using the orthodox H and B, until the sarcasm of a third-year student, who wasted hours in drawing the most beautiful German capitals, at last induced me to multiply my square inches by 6.45 and my minutes by 60. It looks better, but it is more trouble.

As to the new units, they should certainly have the same relation to each other as the volt, ampere, and ohm; this will remove a great difficulty from the path of many students who have to teach themselves, and who always seem to find it so hard to get beyond Ohm's law. I do not see that any other units are wanted.

With regard to the 4π question I do not think that it is generally known that 2 H = the ampere-turns per inch long within 2 per cent. This is immensely useful, as all lengths can be taken in inches, so that I should be very sorry to see 4π disappear.

I hope that "thom" will not be adopted among the new names; it is nearly as offensive as "practicians." Yours, etc.,

HENRY W. RAVENSHAW.

110 Cannon street, E.C., August 26, 1895.

To the Editor of THE ELECTRICIAN.

SIR: So long as the unit of length of the mechanical engineer is not a centimeter, it is unreasonable for us to reckon lengths and areas in machine design by that unit. Conversions of the dimensions in a design from centimeters into inches are a serious nuisance which an engineer cannot afford to submit to merely in order to support a theoretical system of measurements. Hence I consider the units for magnetic quantities per centimeter (H), or per square centimeter (B), and consequently the names for such units, as of little interest (What about a name for the unit of current density in amperes per square centimeter?) until the mechanical engineer takes to the centimeter, or let me say, until he decides whether he will have that unit of lengths or not. For, suppose the electrical and mechanical engineers, whilst waiting for the millennium of metrical measurements, were to agree upon, say, a decimal foot (10 English inches) and 1 lb. avoirdupois as fundamental units, then they might any day, *without changing tools and gauges*, have the immense advantages accruing from the use of a rational system—advantages which otherwise seem to be still in the blue. It must be remembered that the C.G.S., besides having unsuitable fundamental units, is not a rational system.

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* From the *Electrician* (London).

I have a number of years ago constructed my B-H curves and tables with 1 kilo C.G.S. per square inch as unit B", and 1 ampere-turn per inch as unit H". With these units wrought iron and dynamo steel goes in the habitual ranges from 30 to 120 B" under 3 to 570 H", and the net magnetic pole in a dynamo, when it is running light, is (1 kilo C.G.S. being unit magnetic pole) $m = \frac{6 \times 10^8 E}{N b}$ (m = magnet pole, E = volts, N = revolutions per minute, b = number of bars effective), which are convenient values.

My H" unit, 1 ampere-turn per inch, being $\frac{0.4\pi}{2.54}$, and my B" unit $\frac{1,000}{2.54^2}$ times greater than the respective C.G.S. units, my ratio $\frac{B''}{H''}$, multiplied by $\frac{1,000}{0.4\pi 2.54}$, or 313.3, brings μ based upon unity for air; my quantities are those given in practice. If we use the C.G.S. system, the practical data are ampere-turns per centimeter and pole (or lines) per square centimeter and μ is obtained by multiplying their ratio by $\frac{1}{0.4\pi}$, or 0.7958, a figure which is no more convenient than my 313.3. Yours, etc., F. V. Andersen.

14 Westdown-road, Catford Bridge, London, S.E.,
August 27, 1895.

IS A FREIGHT OR MAIL SERVICE PROFITABLE OR UNPROFITABLE ON STREET RAILWAYS.*

BY BENJ. F. NORTON.

Discussion.

Mr. Meiklehan—I would ask the gentleman how he arranges to collect his freight, without interfering with his passenger traffic?

Mr. Norton—If you were running cars on four minute headway probably there would be some trouble, but where we run once an hour, between Newburg and Walden, we have ample time, particularly as the line runs through the main street, and the stores are all located on that street. It never interferes with the passenger service. We have a general freight house in Walden, with a siding, where freight is delivered during the day. We have our freight trains arranged on a regular schedule and some of it is collected along the line of the road. Of course, a great deal of it is delivered at the freight house.

Mr. Meiklehan—You say, if it does pay, it pays. Do you not think that the line is drawn at the point of the ability of the road to deliver and receive. In 1888 a road in Norristown undertook to do that work and made a great deal of money out of the freight service, but the trouble came in at the point of delivery. We were expected to take a package to anybody along the line, and its delivery might require skids to get it to the door, and the delay was found to be very annoying. If we could have certain points at which to take up and deliver freight, we could put in sidings, and the matter would be simplified.

Mr. Norton—Most of our freight is sent through from one point to the other. We have comparatively little intermediate freight in the twelve miles between the two points. Most of the firms who send their freight are within easy reach of the freight houses, so that we have not had any inconvenience in receiving or delivering freight.

Mr. Meiklehan—That is the question—whether you can get such freight in sufficient quantities.

Mr. Cole—Have you made any arrangements for carrying letter-carriers at a cheap rate?

Mr. Norton—We have not taken the matter up argely with the post office. There happens to be one instance that I think of where we do transport the mail carrier, on a route which is perhaps a little onger than the average—out to West Newburg. We et him ride both ways free, two round trips each lay, to collect and deliver mail.

Mr. Cole—Some years ago I was connected with he Utica Belt Line Road, and we made arrangements not only to carry the mail but received a stipulated um for transporting the mail carriers; it cost about hree cents a man.

Mr. Norton—We had that arrangement in Brookyn; it is in vogue now. The fare was three cents. understand it is four cents now.

Mr. Cole—At Utica we carried a sign on all the ars, "U. S. Mail," whether we had mail on the car r not.

Mr. Norton—You were authorized to carry the mail on your system?

Mr. Cole—Yes.

Mr. Norton—There is no question about the right to carry the signs. We had in Brooklyn two cars arranged like the regular railway mail post office, on the long line to Coney Island. We had a side track into the General Post Office in Brooklyn. The mail was put into the cars, and the mail clerks went along and distributed it, and they picked it up and sorted it in the car and delivered it at various stations. The West End division of the Atlantic Avenue system was formerly a steam road, and they had a regular Government contract to carry the mail. When we changed it over to electricity we carried on the contract. I do not think there is any other road, unless it is in St. Louis, where the service is performed in that way, as a regular railway mail post office. Many of the cars in most cities are allowed to carry signs simply to pick up mail bags and move them from point to point, but in Brooklyn the mail is regularly sorted in cars on the road.

Mr. Cole—I think it is so in Boston.

Mr. Ostrom—Also in Philadelphia.

Mr. McNamara—We have been operating for over a year a freight line between Albany and Troy—an interurban freight line. We have a freight house in Albany and one in Troy; we do not aim to take up packages on the way; it is a through freight line. We have been operating it for a year and are going to continue.

Mr. Norton—Have you any special provision in your franchise which authorizes you to carry freight?

Mr. McNamara—We are operating this freight line on a leased line which was chartered to do it, otherwise we could not do it.

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* Paper read before the New York State Railway Association, Albany, September 17, 1895.

PERSONAL.

Mr. Frank B. Rae, who has lately opened offices in the Dearborn Building, Chicago, has been a New York visitor this week.

Mr. Dan C. Spruance, of Philadelphia, called on a few of his New York friends last week.

Mr. H. J. Medberry, of Mechanicsville, was among our out-of-town callers last week. Mr. Medberry is considering the question of entering the field as a manufacturer of dynamos.

Mr. W. H. Knight retired from the General Electric staff October 1 and will devote himself to consulting work in connection with rapid transit development.

Mr. W. D. McQueston returned last week from a two months' European trip.

Mr. Samuel Insull, of the Chicago Edison Company, was in the city last week.

Mr. H. M. Byllesby, who has just made an unsuccessful attempt to reorganize the Missoula, Mont., Lighting Company, has returned to the East.

Mr. Elmer Morris, late of Indianapolis, has returned to the employ of the General Electric Company and is engaged in the railway department.

Mr. John Dick, of the Phœnix Iron Works, Meadville, Pa., was looking over the New York territory last week.

GENERAL NEWS.

What is Going on in the Electrical World.

Milwaukee, Wis.—The street railway extension to Cudahy will be ready for operation about the 15th inst.

Alexandria, N. J.—A scheme for an electric road from this village to Redwood is again being agitated by business men here.

Parkersburg, W. Va.—The council has given the American Construction Company another franchise for a street railway.

Lyndonville, Vt.—At a special village meeting, recently held, it was voted to put in and operate an electric light plant at once.

Walsenburg, Col.—The electric light plant here was damaged by fire on the 21st ult.; the estimated loss was $6,000; no insurance.

Troy, N. Y.—The motive power of the Green Island branch of the Troy City Railway has been changed from animal to electric.

Scranton, Pa.—The proposition of the board of trade of West Scranton, to establish an electric light plant, is meeting with encouragement.

Tiffin, O.—The horse car line at Tiffin has been purchased by Hatcher & Yeager, who will immediately put in an electrical equipment.

Shrewsbury, Mass.—A construction company has looked over the proposed route for an electric railway to Worcester, and will give estimates in a few days.

Suffolk, Va.—It is proposed to build an electric road between Suffolk and Smithfield. A Smithfield business man has offered to donate a site for a power house.

Erie, Pa.—The business men of Parade street are organizing a company with the intention of operating an electric railway on Parade street and out to Four-Mile Creek.

Akron, O.—A number of local capitalists are about ready to form a company for the purpose of building an electric line from this city to Massillon, by way of Turkey Foot Lake.

Newark, O.—The county commissioners have granted a franchise to the Zanesville and Columbus Electric Railway Company to lay track through Licking County and operate an electric road.

Newburyport, Mass.—It is understood that a company for the manufacture of street cars has been organized at Newburyport in which W. B. Ferguson of the Milford & Framingham Street Railway Company, Milford, Mass., is interested.

Elkhart, Ind.—President Burns, of the Indiana Electric Railway, has awarded the contract for laying the track from here to Milford, Ind., a distance of 30 miles. The line will be extended to Fort Wayne, Ind., by way of Wolf Lake.

Winchester, Mass.—The proposed Mystic Valley street railway has been taken hold of by the owners of the Wakefield & Stoneham road, and the new line from Stoneham to Winchester will be built and operated under that control.

West Orange, N. J.—The township committee has received a petition for a franchise from the South Orange and Maplewood Railroad Company; a public hearing will be given to applicants on the 7th inst.

Elberton, Ga.—This city is now enjoying electric lights, the plant having been started up simultaneously with the opening of the Atlanta Exposition. The generating plant is located on Beaverdam Creek, three and one-half miles from town where there is a fine water power.

New Brunswick, N. J.—By means of mutual concessions the Raritan River Railroad Company and the Brunswick Traction Company have finally arrived at an amicable understanding which will permit the immediate extension of the trolley system from this city to South River.

Pittsburg, Pa.—The contract for building the Knoxville, Fair Haven and Mt. Lebanon Railway has been given to J. J. Houghton of Allegheny. The new line will parallel the Pittsburg & Castle Shannon Railroad and will be operated as a rival line by the Pittsburg & Birmingham Traction Company.

Brooklyn, N. Y.—A Brooklyn trolley-car company, it is stated, has given a firm of car builders an order for a number of cars to be used for winter "trolley parties." The cars are to be sumptuously furnished and arranged as to heating, light, seats, etc., so as to afford all the comfort possible.

Florence, Neb.—At the special election held here to vote on the proposition to issue $13,000 in bonds to aid in the construction of the Omaha and Florence Street Railway there was 150 votes in favor and only 31 against. The Omaha and Florence Street Railway Company will now proceed to construct the road.

West Chester, Pa.—Application has been made to Lansdowne borough council for the right of way through several streets for a trolley line to be known as the Suburban Railway Company. The road is to be built from Philadelphia to West Chester, through Cardington, along the Marshall road, then along Darby Creek through Tuscarora and Heyville and on to West Chester.

Athens, Ga.—The city council refuses to accept the offer of the Electric Light Company to sell their plant for $20,000, and have called an election to vote on bonds to erect an electric plant. The election is to take place October 26. The plant will be an arc system and the amount of bonds voted for $10,000.

Lima, O.—The right of way has all been secured for the Lima and Piqua Electric Railroad. The line will run through Wapakoneta, St. Mary's, New Bremen, Minster and a number of smaller towns. The company will build a belt line around this city if a franchise can be secured. The line will carry both freight and passengers.

Albany, N. Y.—A survey of the route of the proposed Albany, Hilderberg and Schoharie Railway has been made under the supervision of Engineer George Yost of Johnstown. As soon as maps are completed the company will apply for a charter. The cars will be run either by electricity or compressed air, and will carry both passengers and freight.

Edinboro, Pa.—The right of way for the proposed electric railway from Edinboro, Erie County, to Cambridgeboro has been secured from all but a few property holders along the line. Surveyors are also said to be at work looking up the best route from Cambridgeboro to Meadville. Much is said to depend on the obtaining of a franchise for a line in Meadville.

Cleveland, O.—A. L. Bagnall and T. Kogi, electricians, from Yokohoma, Japan, were among the names registered at the Hollenden a few days ago. Mr. Bagnall says that electric lights are in general use in the cities of Japan, and nearly all the stores are lighted by them. In portions of some of the streets the lights are paid for by individuals, for municipal lighting has not been taken up yet.

Milford, Mass.—The stockholders of the Hopedale and Milford Street Railway and Electric Storage Battery Company have sold all the stock and franchise of the

Hopedale and Milford Street Railway Company, excepting the power house, cars and shops, to the Milford, Holliston and South Framingham Company. The new owners expect to continue the road as far as Mendon this year.

St. Louis.—A consolidation of the American and St. Louis car companies is reported to be under consideration. If the companies take this step, it is proposed to establish a branch in the East and bid for the trade of that section. Beside street cars the new company will manufacture all styles of railroad coaches, especially those requiring electric power.

Baltimore—A. Morton Bell, of the Great Eastern Railway, England, has been inspecting the electrical equipment of the Belt Railroad and the operation of the electric locomotive employed in drawing freight cars through the tunnel, and expressed surprise at the success attained. Mr. Bell says there is much discomfort in the London tunnels from the smoke of the locomotives, and he thought that electricity had many opportunities in England for service similar to that of the Belt Line.

Keene, N. H.—The Keene electric railroad project has come to a temporary standstill, owing to the necessity of proceeding under the general law which was passed at the last session of the Legislature. Under this law the incorporators must go before the Supreme Court for authority to construct their road, just the same as if they were intending to build a steam railroad.

Fort Wayne, Ind.—It is the intention of the directors of the Fort Wayne & Hicksville Electric Railroad to apply at once for a franchise for an electric road from Fort Wayne to Bryan, O., a distance of forty-three miles. The company's officers are: President, James B. Colgrove, Washington, D. C.; vice-president, P. A. Randall, Fort Wayne; treasurer, Charles McCulloch, Fort Wayne; secretary, John B. Winn, Defiance, O.; superintendent, James B. Hart, Hicksville, O.

Utica, N. Y.—A Mr. Fremyear has been here promoting a scheme to combine the Belt Line street railways, the Bleecker street road, the Electric Light Company and the Gas Company in one company which would establish a great electric generating plant at Trenton Falls to furnish all the power needed in Utica for railway, lighting and manufacturing purposes, besides supplying other towns in that section with transmitted electricity.

St. Paul, Minn.—There appears to be a growing interest here in the subject of municipal lighting, and it is being discussed among members of the city council, business men and others. Councilman Arosin proposes to introduce a resolution providing for an inquiry as to the cost of the establishment and operation of an electric lighting plant by the city of sufficient capacity to light the down town district. The plan also looks to the ultimate lighting by electricity of all that portion of the city now lighted by gas.

Chicago.—The General Electric Railway Company has had agents at work quietly securing the consent of property owners along certain streets on the south side through which it proposes to run cars, and is said to have met with such success that the council will be asked in a few days to grant it a franchise for a new street railroad. The company will introduce the Brandenburg under-car electric system.—It is stated that the Chicago and Northern Pacific will let the contracts for changing the line into an electric road within the next thirty days. General Manager Ainslie is now busily engaged figuring on estimates.

Philadelphia.—The Pennsylvania Railroad Company is negotiating for the introduction of new electric storage batteries on its Chicago Limited train and will give the system a fair trial. If it is found better than the one now in use it will be put on all the limited trains. The introduction of electricity on all through trains of the Pennsylvania Railroad Company has been considered for some time, and the item of expense has been the only drawback. If the new storage batteries can be had at a price which will produce light at a cost not too much greater than that of gas it is more than likely that the cars will be lighted in the future by electricity.

Buffalo, N. Y.—The Buffalo & Niagara Falls Electric Railway has been formally opened and cars are now running daily on a 15-minute schedule. The maximum speed attainable is 40 miles an hour. The motor cars carry four motors and have seating capacity for 44 passengers; they are of improved pattern and were built by the Brill Company of Philadelphia. The trailers will seat 50 passengers.—The test of electricity as a motive power on the canals, which was advertised to take place on the 25th of September, did not come off. The only explanation offered is that the company has not had time to fit up the experimental line.

Ann Arbor, Mich.—Two electric railway schemes of considerable magnitude are being agitated here. The first one concerns the purchase of the Ann Arbor & Ypsilanti motor line, at present run by steam power, by J. R. McDonald, of Detroit, who now has an option on the road and who is operating for Eastern capitalists. The second scheme is the project of an electric road to Detroit, via Ypsilanti, Shelden, Denton, Wayne and Dearborn, to Detroit. Thos. D. Kearney, of Ann Arbor, is attorney for the Eastern men who are pushing the enterprise. He confidently asserts that the proposed road will be built, equipped and in operation by October 1, 1896. The right of way has been secured for a large share of the distance between here and Detroit.

Los Angeles, Cal.—The completion of the Alpine section of the Mount Lowe electric road brings the terminus of the line to the snows which prevail on the mountain in winter. In recognition of the pleasures made accessible by this fact, the Alpine Club of Los Angeles has erected at the terminus a commodious clubhouse and proposes to open this winter a series of winter pastimes, made possible by the presence of abundant snow. These will include sleighing and toboggan slides. Thus the remarkable fact is presented of winter pleasures in the heart of a semi-tropical region. It will require but an hour to traverse the distance separating the orange groves and rose gardens of the valley from the deep snows of winter.—The council has given public notice of sale of a franchise for an electric railway in certain streets of this city, to be held on the 14th of October.—The cable roads of the Consolidated Company are to be changed at once into electric lines. Forty cars have been ordered to replace the cable cars now in use.

Washington, D. C.—At a meeting last week of the stockholders of the Washington and Georgetown Railroad, the agreement entered into between Presidenr George T. Dunlop of that company and President Francis G. Newlands, of the Rock Creek Railway, bettet known as the Chevy Chase electric line, was ratified. Under the agreement the Rock Creek Company absorbs the Washington and Georgetown Railroad Company, and the combination has taken the name of Capital Traction Company. The old officers of the Georgetown and Washington Railroad Company have been elected officers of the new company. They are: G. T. Dunlop, president; Charles C. Glover, vice-president; C. M. Koons, secretary and treasurer; C. C. Sailer, general superintendent, and D. S. Carll, chief engineer. The directors are: George T. Dunlop, Charles C. Glover, Henry Hurt, John G. Park, John R. McLean, Robert Beall and F. G. Newlands.—The Eckington Railway Company has awarded a contract to E. Saxton to equip its lines in this city with an underground electric system, the work to be done some time next summer.

COMMERCIAL PARAGRAPHS.

Mr. W. H. Mackay, the New York agent of the Columbia Lamp Company, is doing a good business for his company. Among the many orders booked last week was one for 10,000 lamps.

The Crouse-Tremaine Carbon Co. of Fostoria, Ohio, have been doing a constantly increasing business in Cored Carbons since putting them on the market. That central station men consider them in every way satisfactory is evidenced by the fact that orders for over 600,000 were booked in September. One order was also taken by this firm in September for 1,000,000 carbons.

The Partridge Carbon Company, Sandusky, O., is being kept busy these days to supply the rapidly increasing demand for the Partridge Motor Brushes.

The J. H. McEwen Manufacturing Company, manufacturers of the McEwen Automatic Engine and the Thompson-Ryan Dynamo, have removed their general sales office from Ridgway, Pa., to the Havemeyer Building, New York City.

INCORPORATIONS.

The D. E. Boswell Company, Chicago—to manufacture electric apparatus. Capital stock, $2,000. Incorporators: D. E. Boswell, A. A. Brown and T. B. Lambert.

The Asbury Park, Bradley Beach, Belmar and Spring Lake Street Railway Company, Bradley Beach, N. J.—to construct, maintain and operate a street railway for the transportation of passengers, construct and operate motors, cables, etc. Capital stock, $75,000. Promoters: Henry C. King, New York City; Alex. Bogey, Brooklyn, N.Y.; N. E. Buchanon, John Hubbard, Asbury Park, N. J.; Chas. H. Seaman, Bradley Beach.

The Warwick Electric Manufacturing Company, Cleveland, Ohio—to manufacture and deal in storage batteries, dynamos, motors, arc lamps, electrical appliances, and erect and maintain isolated electric lighting plants. Capital stock, $20,000. Promoters: P. B. Warwick, Dan. H. Ridgway, Geo. F. Ridgway, Michael Phalen, C. N. Cunningham.

The Fort Wayne and Hicksville Electric Railway, Fort Wayne, Ind.—to construct, own and maintain a street railway in Fort Wayne. Capital stock, $50,000. Promoters: John S. Hart, Hicksville, Ohio; Jas. B. Colgrove, Washington, D. C.; John W. Winn, Defiance, Ohio; Aaron M. Richelderfer, Harlan, Ind.

The Globe Electric Company, Cleveland, Ohio—to manufacture and sell electric telephones and other electrical and magnetic apparatus, and to do a general electrical business. Capital stock, $25,000. Incorporators: C. E. Collins, L. W. Bradley, Donald McKenzie, T. W. Larwood, Jr., and J. D, Barron.

The James D. Gray Steam Engine and Motor Company (incorporated in W. Virginia), Baltimore, Md.—to manufacture, purchase and sell steam engines, electric motors, batteries, dynamos, etc. Capital stock, $1,000,000. Promoters: P. V. Benson, M.D., R. Brent Walling, Ernest Sharp, Wm. S. Taylor, Baltimore.

The Citizens' Electric Company, Williamsport, Pa.—to supply light, heat and power by means of electricity to the public in Williamsport, Pa. Capital stock, $2,000. Promoters: Grant Sweet, C. H. Hill, Williamsport; Ray R. Sweet, Canton, Pa.

The Newton Electric Company, Newton, Ia.—to manufacture, generate, furnish and supply electricity for light, heat and power. Capital stock, $25,000. Promoters: B. E. Sunny, James S. Cumming, Chicago, Ill.; H. M. Vaughan, Newton.

The Ohio and Indiana Natural Gas Company, Indianapolis Ind.—to manufacture, mine and bore for gas and oil: transport natural, artificial and illuminating gas or oil and electricity for light, heat and power. Capital stock, $110,000. Promoters: Edw. Hawkins, Indianapolis; Richard G. Kerlin, Toledo, Ohio; Henry B. Smith, Hartford City, Ind.

The Huntington, Columbia City and Ligonier Electric Railway Company, Columbia City, Ind.—to construct, maintain and operate electric street railroads in the cities of Huntington, Columbia City, Albion and Ligonier. Capital stock, $50,000. Promoters: Vallorous Brown, Geo. W. Ruch, Joe. H. Ruch, Thos. R. Marshall, Wm. F. McNagny.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.

OCTOBER, 1895.

Date.	Light.	Date.	Extinq.
1	1.40 A. M.	1	5.10 A. M.
2	2.40 "	2	5.10 "
3	No light.	3	No light.
4	"	4	"
5	"	5	"
6	6.00 P. M.	6	7.30 P. M.
7	6.00 "	7	8.10 "
8	6.00 "	8	8.50 "
9	6.00 "	9	9.50 "
10	6.00 "	10	10.50 "
11	6.00 "	11	12.00 M.
12	6.00 "	13	1.00 A. M.
13	6.00 "	14	1.10 "
14	5.50 "	15	2.30 "
15	5.50 "	16	3.50 "
16	5.50 "	17	5.30 "
17	5.50 "	18	5.30 "
18	5.50 "	19	5.30 "
19	5.50 "	20	5.30 "
20	5.50 "	21	5.30 "
21	5.50 "	22	5.30 "
22	7.00 "	23	5.30 "
23	8.00 "	24	5.30 "
24	9.20 "	25	5.30 "
25	10.20 "	26	5.30 "
26	11.00 "	27	5.30 "
27	11.30 "	28	5.30 "
28	...... "	..	....
29	12.30 A. M.	29	5.30 "
30	1.30 "	30	5.30 "
31	2.30 "	31	5.30 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED SEPTEMBER 24, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

546,666. Means for Varying Light for Incandescent Electric Lamps. Charles A. Hussey, New York, N. Y., assignor, by mesne assignments, to the Electric Company, same place. Filed Sept. 29, 1893.

546,689. Electric-Arc Lamp. Conrad Weber, Friedrich Goelner and Albert Schweitzer, Allegheny, Pa. Filed Nov. 19, 1894.

546,790. Electric-Light Display System. Jonathan E. Woodbridge, Duluth, Minn., assignor to the Electrical Advertising and Sign Company of Maine. Filed Jan. 8, 1895.

546,826. Electric-Arc Lamp. Rupert Scheflbauer, Paterson, N. J., assignor to the Auerbach-Woolverton Electric Company, New York, N. Y. Filed Nov. 16, 1894.

546,827. Electric-Arc Lamp. Rupert Scheflbauer, Paterson, N. J., assignor to the Auerbach-Woolverton Electric Company, New York, N. Y. Filed March 5, 1895.

546,828. Electric-Arc Lamp. Rupert Scheflbauer, Paterson, N. J., assignor to the Auerbach-Woolverton Electric Company, New York, N. Y. Filed March 5, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

546,691. Continuous-Current. Rectilinear Motor. Charles E. Woods, Chicago, Ill., assignor, by direct and mesne assignments, to the C. E. Woods Company, same place. Filed April 6, 1895.

546,724. Electric System. Merle J. Wightman, Johnstown, Pa. Filed April 3, 1895.

546,756. Production of Displaced Phases and Rotary Fields. Charles S. Bradley, Avon, N. Y. Filed Dec. 24, 1894.

546,874. Electrical Indicating System for Annunciators. Walter F. Banks, Milford, Conn. Filed Oct. 2, 1888.

546,901. Attachment for Electric Generators. George W. Pickett, Denver, Col., assignor of nine-sixteenths to Samuel Lesem, same place. Filed Jan. 12, 1895.

546,966. Electrical System of Motor Regulation. Merle J. Wightman, Johnstown, Pa. Filed March 27, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

546,725. Self-Acting Commutator for Telephones. Saleman Berditschewsky dit Apostoloff and Moise Freudenberg, Paris, France. Filed March 27, 1895.

546,731. Telephone System. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed May 18, 1895.

546,892. Telegraphic Vibrator. Paul La Cour, Askov-Jus, Denmark, assignor to Karsten Viborg Tuxen, Brooklyn, and Peter Hoykendorf, New York, N. Y. Filed May 7, 1895.

546,904. Combined District Telegraph and Telephone System. Edgar E. Salisbury and Albert E. Dean, Tacoma, Wash. Filed Aug. 21, 1894.

546,965. Telephone. George A. Tower, Maurice Hunter and Joseph P. Eastwood, Richmond, Va., assignors of one-fourth to Maurice W. Thomas, same place. Filed Dec. 20, 1894.

546,972. Telephonic Attachment. Louis J. Gerson, Philadelphia, Pa., assignor of one-half to Charles Heritage, same place. Filed Jan. 14, 1895.

MISCELLANEOUS.

546,674. Electric Time-Switch. James F. McLaughlin, Philadelphia, Pa., assignor to James W. Difenderfer, same place, and Theodore H. Gehly, York, Pa. Filed April 11, 1893.

546,682. Apparatus for Exterminating Vegetation. Albert Scheible, Chicago, Ill. Filed Jan. 22, 1895.

546,700. Means for Analytically Recording Gait of Horses. Thomas J. Kean, Philadelphia, Pa. Filed Dec. 5, 1894.

546,739. Method of Making Porous Plates or Electrodes. John Johnson and James H. Robertson, Brooklyn, N. Y. Filed April 2, 1895.

546,802. Screening Electrical or Other Instruments and Apparatus. William E. Ayrton and Thomas Mather, London, England. Filed July 3, 1893.

546,820. Electric Switch. George E. Linton, Worcester, Mass. Filed Jan. 4, 1895.

546,821. Electric Switch. George E. Linton, Worcester, Mass. Filed Jan. 4, 1895.

546,884. Electromagnet for Pipe-Organs. Edwin S. Votey, Detroit, Minn., assignor to the Farrand & Votey Organ Company, same place. Filed Jan. 21, 1895.

ELECTRICITY.

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EDITORIAL NOTES.

The Telephone Situation. A correspondent, interested in the construction and operation of independent telephone exchanges, writes to ELECTRICITY making some pertinent inquiries on the telephone situation. He desires to know—(1) What is the present attitude of the Berliner case? (2) Have you any comments to make as to the probable outcome of the case and its effect on the new companies? (3) What action would you suggest on our part as to the situation? (4) Can any estimate be safely made as to the time when a decision may be reached in the pending suit?

The points involved in answers to the above questions being of as great general as individual interest, we take this method of replying.

1. There are in fact two Berliner cases now occupying the attention of the telephone world. The first has reached the third and final stage and had its origin in the bill in equity filed by the Attorney-General of the United States against the Bell Company, February 9, 1893, in which it was alleged that the Berliner transmitter patent of November 17, 1891, was an illegal grant and it ought of right to be annulled. The decision of Judge Carpenter of the Circuit Court of the Massachusetts District and the subsequent reversal by the Circuit Court of Appeals are of too recent occurrence to require further mention. A few weeks ago the decision of the Court of Appeals was appealed to the Supreme Court of the United States. The case has been docketed at Washington to be heard in the regular course.

To rightly understand the situation, it must be borne in mind that the decisions already rendered in the Government suit on the Berliner patent have not determined the validity of the patent. The reversal of Judge Carpenter simply rehabilitates the patent, leaving it on an equal footing, before the law, with any other patent owned or controlled by the Bell Company, or by anyone else.

The second and more important of the Berliner cases is the suit of the Bell Company for an order to restrain the National Telephone Manufacturing Company, the Bay State Telephone Company and the Century Telephone Company of Boston from alleged infringement of the Berliner 1891 patent. The bill of complaint was filed August 6. At the hearing assigned for September 3, thirty days were given in which to file an answer to the bill of complaint. At the expiration of this time, on the 3rd inst., an order was issued extending the time for filing answer until October 15.

2. The granting of an injunction in the Boston cases will, of course, affect directly and immediately only those companies against whom action is brought, but it is to be presumed—in fact is so declared by the Bell Company—that similar action will be taken against not only other alleged infringers in the Massachusetts judicial district, but wherever found.

The manufacturers of telephone apparatus now on the market all claim that they do not infringe any patents not controlled by them. Such is presumed to be their own or their attorneys' opinion, and while it is reasonable to suppose that the genius of one or two men, allied to or employed by the Bell Company, has not been so transcendent as to render it impossible for others to accomplish the same or better results by improved if not better means, the fact remains that none of the new forms of apparatus has been judicially declared to be non-infringing except the magneto instrument which requires the use of no switch and hence evades the Watson patent.

The Berliner patent alone, if valid, practically controls commercial telephony so far as it is dependent upon microphones operating upon the constant contact principle. We have always maintained, however, and still maintain, that commercial telephony is *not* dependent upon anything contained in the Berliner claims. The Bell Company have educated the public to believe that this patent is necessarily the sole key to the situation, but in our opinion this is a sheer fallacy.

A new telephone exchange company, to be safe, however, should procure their apparatus of those manufacturers who are not only able but willing to guarantee their customers absolute immunity from damages for infringement of patents. The purchasers should see to it that the guarantees given have no loopholes in them.

3. As has been repeatedly pointed out in these columns, the chief hope for the independent telephone manufacturing companies lies in the defeat of the Berliner patent, because if that patent is out of the way the open field is much broader. Its validity can be successfully attacked in a properly prepared and conducted case. It is eminently desirable to the public that the Berliner patent should be defeated, but the sole recourse of the independent companies does not lie in its defeat. The old magneto instrument, the patent for which expired with the original Bell telephone patents, makes a far better transmitter than most people are aware. Good and distinct articulation has been given with this instrument over *grounded* circuits between New York and Cleveland and between New York and Chicago. If specially wound for long distance transmission, its service over these distances could doubtless be far improved, and on metallic circuits be made even better than with transmitters of the variable pressure type, as it already is for short distances. The public have been too willing to believe the dictum of the Bell Company that the variable pressure microphone gives them the monopoly of the business or even gives them the best instrument. Even if the Berliner patent is sustained,

the independents should not lie down, but should set their ingenuity to work to improve transmitters on the magneto principle until they attain an instrument that is in every way better than any now made on the principles covered by the patent in suit.

4. Judged by the length of time other cases have been awaiting disposition by the Supreme Court, it may be two years before a decision is rendered.

* * *

The Gas Engine Business in America.

There is no journal in this country that appreciated earlier than this the possibilities of the gas engine in the electrical industry. There is no one that has investigated the subject more fully than we, and there is no one that has been so utterly disgusted with the way in which the gas engine business has been conducted.

Having early seen the advantages that would accrue both to the gas engine and electrical interests by bringing them into closer acquaintance, we endeavored at least two, perhaps three, years ago to induce the gas engine interests to cultivate the electrical trade and pointed out clearly how this could advantageously be done.

The gas engine manufacturer, however, as a business man has been unique. When approached for information as to his wares he became suspicious, wanted to know the pedigree of the inquirer, who his grandfather was, and who his aunt, and if the answers were not entirely satisfactory, shut himself up in his shell and nothing would he say. With perhaps one or two exceptions, no price lists were published, and even list prices would not be quoted unless the exact purpose for which the information was desired was stated.

When suggested to the gas engine man that there was a wide field for it in isolated electric lighting, instead of cultivating that field and encouraging others to take hold of it and use his engines, he said, as the New York agent of the Otto Gas Engine Company actually did say to an electrical engineer who applied to him for information, that no one in this country could go into the electric lighting business with gas engines "but us," and the home office when written to in regard to it practically endorsed the attitude of the agent.

Not only has this business policy been pursued in regard to the electrical industry, but also to others, until all classes of inquirers have become discouraged with American treatment, and where the magnitude of the undertaking has warranted, have gone abroad, where their inquiries have met with respectful reply. In many cases purchases have been made abroad of engines that have proved themselves to be no better than those made in this country, but the feeling has become general that the English, Germans and French make better gas engines than we. This we are loth to admit, but the fact is that the foreigners adopt rational business methods which American manufacturers of gas engines seem to have carefully avoided.

In the electrical line with which we are most familiar, the leading manufacturers who have attempted to corral the business to themselves have, through a lack of knowledge of the requirements and an unwillingness to ask assistance from those who possessed it, made the adaptation of the gas engine but a record of failures. With a few notable exceptions every gas engine lighting plant in this country has proved more or less unsatisfactory, and it has been the manufacturer rather than the engine that has been at fault.

Once in a while, when the manufacturers have seen a *very* desirable business opportunity slipping from their fingers, they have gotten down on their knees and endeavored, when too late, to retrieve the lost contract.

As illustrative of the foregoing, the De La Vergne Refrigerator Company, desiring a small motor for their refrigerating machines, inquired not long ago into the merits of the American gas engines. Being disgusted with the information obtainable they went abroad. Not being satisfied that the foreign engines were any better than ours, they considered very seriously the feasibility of building their own gas engines. Then the gas engine men fell all over themselves—to use a slang phrase and to quote Mr. Richmond's remarks at the April 10 meeting of the Mechanical Engineers—"I got as much as 40 per cent. discount quoted at the first slap. I don't know how much I could get by negotiation." He further said that the manufacturers then proposed that the De La Vergne Company, if they did manufacture, should add 200 or 300 per cent. profit, and then divide half and half.

In commenting upon the situation at the time (issue of May 29) we said:

"If, as implied by Mr. Richmond, the present prices include 200 or 300 per cent. profit, this new competitor will be satisfied with 25 or 50 per cent. Whether or not the present manufacturers continue to require your pedigree and certificate of character before they will impart any information, the new competitor will require no other credentials than other business men require and facts will be freely and fully given. Whether or not the present manufacturers will continue to try to monopolize the use of their own engines for electric lighting (a business which they have generally shown themselves totally incompetent to handle), and give guarantees that are not worth the paper they are printed on, the new competitor will be glad to sell to everyone who can pay a fair price for his engine, and he will sell to them low, and give a guarantee that can be relied upon in every particular. The American public and ELECTRICITY will welcome this competitor with open arms. We all hope he will be an American, but we will welcome him anyway if he changes, as he must, the present order of things."

And in referring to the American manufacturers we said:

"Do the latter think they can compete under their present policy with competitors, even from abroad, who not only know what they have but are willing and anxious that the world should also know it?"

Since then a very live English firm has established an agency in New York, and one of the largest American manufacturers of gas engines has been compelled to turn his business over into the hands of a receiver.

It is now announced that the new factory of the Weston Instrument Company, which is to be many times larger than the present one, and Arbuckle Bros.' coffee establishment, the largest in the world, are to be equipped throughout with gas engines purchased abroad. These results are but the legitimate outcome of the policy which we have condemned, but the end is not yet. There is a brighter lining to the cloud, which consists in the announcement that the Westinghouse Electric and Manufacturing Company is going into the manufacture of gas engines. We hail this announcement with genuine delight, for it means a revolution in the gas engine business of this country. If the Westinghouse Company turn out a good engine and put it on the market with their accustomed business ability, those now engaged in the business will have to reverse their business methods or go out of business.

Taking coal as our starting point, the maximum theoretical efficiency of the steam engine is 30 per cent. Its obtained efficiency is perhaps about 13 per cent. The maximum theoretical efficiency of the gas engine is 80 per cent. and its obtained efficiency is 20 to perhaps 25 per cent. There therefore appears to be a very easy possibility that the obtained efficiency of the gas engine may some time reach more than double the theoretical efficiency of the steam engine, and when this time arrives there will still be leeway for as much improvement as there now is in steam engine economy.

We are glad that the Westinghouse Company have taken hold of the gas engine business, and while it is not to be expected that the theoretical possibilities will be approached with giant strides or better than a halting gate, yet we feel assured that the entering of this field by business men has rescued the American gas engine business from destruction. All industries will be benefited by a good gas engine put on the market in a business-like way, but none more so than the electrical industry.

Under the Searchlight.

Views and Opinions on Timely Topics.

WE are pleased to chronicle the following, which was given out over the signature of Mr. W. B. Rankine:

> "Allow me, in behalf of the Construction Company and the Niagara Falls Power Company, to correct this statement [that these companies were concerned in the electrical tests for canal haulage]. Neither of these companies has anything to do with the preparations for or the carrying out of the proposed tests."

A few days later we received a notification from Mr. Frank W. Hawley, vice-president, and Charlton T. Lewis, secretary, of the Cataract General Electric Company, that there would soon be another "canal experiment" at Tonawanda. We wish Mr. Rankine would go a step farther now and tell us just what relation the Cataract General Electric Company bears to the two companies mentioned by him, and who is supplying Mr. Frank W. Hawley with the money which keeps up this serio-comic show. We know Mr. Hawley too well to suppose that he is laboring exclusively for the good of the canals or of the State.

* * *

Straight Tips for Advertisers.

Expert D. E. Goe, of the Central Electric Company, Gives to the World the Benefit of His Vast Experience.

(From the Trade Press, Chicago.)

One of the best posted advertising men in the city is Mr. Goe of the Central Electric Company, whose portrait appears in another column. He dispenses the advertising patronage of one of the largest electric companies in the West.

Mr. Goe is not a difficult man to approach on the subject of advertising, for, like all men who know considerable about the advertising business, he is always on the alert to catch new ideas, and he will listen, of course, if your story is interesting and not too long. It might be well to add also that he generally insists on knowing very nearly what he is doing when he signs an advertising contract. As a result of this caution, he says there is only one out of the seven electrical journals he is using that would not give him satisfactory evidence of its circulation. Whether or not the other fellows were able to hoodwink him of course is a question.

The journals he has found to pay in Chicago are *Electrical Industries*, *Western Electrician* and *Electrical Engineering*. In the first named he uses a full page, and also uses the same space in *Electrical Engineering*. In the *Western Electrician* he alternates a page and a half page. He makes use of four of the large New York journals, and places their importance in the order named below. The *Electrical World*, alternate page and half-page; *Electrical Review*, alternate one-half and one-quarter page; *Electrical Engineer*, alternate one-half and one-quarter page, and ELECTRICITY, one-fifth page.

It would be unpardonable presumption to dispute the correctness of the views of Mr. Goe. Like Prof. Forbes, he is supreme in his line, and his record shows it. Since he came into the electrical field over $50,000 of other people's money was spent on his education in the science of advertising while he was conducting *The Electric Spark*. We know of few people who have had such favorable opportunities to become experts. The only wonder is that a man who knows so much should have been associated with so many failures, and holds even at the present time such an obscure position. He must be a victim of persistent hard luck, but we assure him of our most distinguished consideration.

* * *

A FEW months ago suit was brought by E. R. Gilman to recover from Mr. George C. Duffie five $1,000 bonds of the Faribault Consolidated Gas and Electric Company, the plaintiff claiming that Mr. Duffie did not own the bonds; that he (Gilman) had paid Mr. Duffie for them. It was shown in rebuttal that the only consideration ever received by Mr. Duffie was a $1,200 check drawn by Gilman which went to protest. Mr. Duffie won.

General Electric.

(From the Boston News Bureau.)

General Electric people have obtained good legal advice to the effect that the General Electric preferred stock cannot be scaled.

It is believed in well informed quarters that when the General Electric is ready to resume dividends the common stock will be scaled by making its par $50, or issuing one share of the par of $100 for each two shares now outstanding and that the back dividends will previously be paid on the preferred stock; $14 per share had accumulated up to last July.

The General Electric is doing a business of over $15,000,000 gross per annum, and is earning at the rate of $3,000,000 net per annum, but making allowances for some "writing off" at the end of the year, it cannot be said that the stock is yet earning much more than $8 per share. Not until the company is earning a fair dividend will the stock be scaled.

A General Electric man says: "What we really need in the electric field is an agreement with Westinghouse and higher prices for apparatus, but Westinghouse is a very difficult man to treat with. He is way up in the air and won't come down."

This comes from Mr. Coffin's home organ, and may be taken as his view of the field.

The statements of supposed fact may be accepted as being just as true as the first, second or third annual report of the General Electric Company.

* * *

The *American Engineer*, one of the best monthlies on our exchange list, announces that after November 1 the journal will be published bi-weekly, and will appear every alternate Thursday. Each number will contain one-half as much reading matter as is now given in the monthly issue. The price, per number, will be reduced to 10 cents, and the annual subscription to subscribers in this country, Canada and Mexico to $2.50. It is wisely thought that the more frequent publication will enable our contemporary to keep more closely in touch with current events and the advancement of engineering art and science, and that the change will materially increase the interest of the paper to its constituents.

* * *

The London correspondent of the New York *Sun* writes that the experiment of installing the telephone by trotting cavalry has been successfully undertaken by the Prussian Uhlans between Berlin and Potsdam. Two sets of officers proceeded respectively from Berlin and Potsdam. Each set was equipped with complete telephone apparatus, which, together with the requisite quantity of small wire, was carried by one of the men in a leather case. The end of the wire was, by means of a fork fixed at the end of a lance, thrown over the tops of trees along the road. As each kilometer of wire was thus suspended a halt was made to ascertain whether there was connection with the station. The two sets met at Teltow, where the wires were connected and telephonic connection between Berlin and Potsdam was established. The distance is twenty miles, and the task was completed in about four hours.

The Thomson Regulator Patent.

WESTERN ELECTRIC WINS ON APPEAL.

(Special Dispatch to Electricity.)

Chicago, Oct. 8.—In the United States Circuit Court of Appeals decision has again been given for defendant in the case of the Thomson-Houston Company vs. the Western Electric Company for alleged infringement of the Thomson Regulator Patent.

Judge Grosscup had decided on January 14 last that there was no invention involved. This decision is now sustained.

It will be remembered that Judge Colt's unjust decision sustaining this patent had the result of driving the old American Company (Goff's) out of business.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER XII.

The Faribault Plant.—II.

(*Concluded from page 142, September 25.*)

In concluding the first chapter of our analysis of this Faribault plant, we showed from the official statement of the company that there was a deficiency for the year ending April 30, 1893, of $9,682.02 in operation.

In the first trial balance, made up under the Byllesby regime, the item of plant account was $1,243.99, and notes payable $12,360.87. The following trial balance was made up one month later:

[copy.]

FARIBAULT CONSOLIDATED GAS AND ELECTRIC COMPANY.

TRIAL BALANCE FOR ONE MONTH ENDING MAY 31, 1893.

Plant account	$175,000.00	
Electric plant	1,243 99	
Street lines and wire	3,995.60	
Wiring	153.15	
Tools and fixtures	25.87	
Faribault Boot and Shoe Company	162.15	
Meters	1,249.59	
Transformers	1,030.74	
Accounts receivable	1,173.50	
Cash	851.41	
Salary of superintendent	125.00	
Wages of engineer and fireman	105.00	
Lamps	124.12	
Traveling expenses	6.00	
Repairs to electric plant	2.50	
Carbons	10.00	
Profit and loss	2,817.99	
		$188,076.61
Credits.		
Capital stock	$100,000.00	
Bonds	75,000.00	
Notes payable	6,546.87	
Northwest General Electric Company	5,674.72	
Earnings	855.02	
		$188,076.61
Interest.		
Interest on bonds	$4,500.00	
" " notes	237.82	
		$4,737.82

It may be presumed that the above was made up by Mr. Byllesby's agents, under instructions, when another effort was being made to dispose of the stocks and bonds of the Faribault Consolidated Gas and Electric Company. The "plant account" is put down at $175,000, the electric plant at $1,243.99, while the floating debt remains about the same, $12,221.59.

It cannot escape those interested in the methods of Byllesby and Coffin and their remarkable system of bookkeeping that this plant account is just equal, in their official valuation, to the amount of securities issued, $175,000.

As before stated, Mr. Gilman had originally invested in this property $20,000 for the gas plant, and $1,600 for the electric outfit in 1889. Subsequently much new electrical apparatus and equipment was added, for which over $12,000 in notes were given to the Northwest General Electric Company. In 1893 the source of supplies was cut off, as the Northwest Company was no longer able to get credit from the General Electric Company in New York. From that time on the Faribault plant has had to stand on its own bottom.

One thing which will at once strike the central station man as peculiar is the large amount of apparatus, supplies, etc., which this plant had bought. The pole line construction was enough for a city of 20,000 people, and there were enough supplies on hand for a station three times the size of this one. Those familiar with the affairs of the Northwest Company know why this was so. Those in authority received commissions on everything sold to the various stations, and they were consequently very liberal buyers.

But even with all the stuff bought, they had been unable to get more than $40,660.21 invested in the entire plant, on which nearly $75,000 was raised from the sale of bonds. What became of the remainder of the money we leave to Mr. Coffin, Mr. Gilman and Mr. Byllesby to explain. Some of it perhaps was devoted to the purchase of yellow dogs, some to paid-up life insurance policies, and some perhaps found its way to Boston.

In the early part of 1893 the plant may be said to have been at high-water mark. Following Gilman, Messrs. Coffin and Byllesby stood sponsor for it; its affairs and its securities were manipulated by them. There was in the market $100,000 of stock and $75,000 of bonds.

Now we propose to show what basis there was for this capitalization. We present below the complete schedule of property. The valuations are made by us, and are in error, if at all, on the side of liberality:

SCHEDULE OF PROPERTY OF THE FARIBAULT CONSOLIDATED GAS AND ELECTRIC COMPANY.

March 1, 1893.

REAL ESTATE.

Lots—¾ of lots 1, 2, 3 and 4 and all of lots 5 and 6, block 18.
Paquin's 2d addition.
Buildings—Brick electric light station, 40 ft. x 20 ft.
Frame boiler house, 35 ft. x 17 ft.
Frame coal shed, 20 ft.x40 ft.
Frame coke shed, 30 ft.x20 ft.
Stone gas house, 60 ft.x45 ft.
Frame residence, 200 ft. from station.
Frame gas holder house.
Sheet iron naphtha tank, capacity 10,000 gals.

STEAM PLANT.

One Russell engine, 11x22; 2 pulleys at 66 in.x 12 in. One steel boiler, 60 in.x16 ft. Robinson & Carey. One vertical boiler, 5 H.P. One Hazelton boiler, 75 H.P. One Blake pump, size 2½. One Barr Pumping Engine Co.'s, duplex pump, size 5. One wooden water tank, 16x5½ x 3 ft. 6 in. outside measure. One water tube feed water heater, Goubert Mfg. Co., N. Y. One brick boiler setting containing 20,000 brick.	$5,500

ELECTRIC PLANT.

One A—6 alternator, estimated	$300.00
One K—4,089 arc dynamo	850.00
One A—18 alternator	550.00
One D—3 exciter	132.50
One pair arc lightning arresters	14.00
Two arc regulators, 6.8 amp	100.00
Two ground detectors, inc	40.00
Two potential indicators	60.00
Two ampere indicators	41.00
Five bank boards, I., 63 amp	50.00
Seven type F. lightning arresters	49.00
Two D. P. D. throw S. B. switches, 300 amp	60.00
Three buckle switches	30.00
Two station transformers	120.00
12 ft. 3" lt. sgl. belt	20.40
One Schieren perforated belt, 10", 24' C. to C.	96.30
One Munson double, 8 in., 14' C. to C.	31.35
One type 143 rheostat	70.00
One Munson double 6 in. 19' C. to C.	41.50
One type 37 rheostats	40.00
One type 65 rheostat	20.00
Two No. 8,170 feeder block	12.00
60 ft. No. 4 Okonite	12.00
One 50 amp. D. P. switch	10.00
4 D. P. 75 amp. S. B. switch	10.00
Two potential switches	9.00

SUPPLIES.

½ bale cotton waste	$12.50
1 bbl. cylinder oil	22.50
½ bbl. dynamo oil	6.25
1 bbl. machine oil	15.00
⅓ bbl. boiler compound	8.00
11 arc lamps, 1200 C. P. single carbon	220.00
20 16 C. P. lamps	8.00
20 32 C. P. lamps	10.00
50 25 C. P. lamps	22.50
4 arc lamp hoods	11.00
2700 gals. naphtha in tank	270.00
1 extra armature for K. 4089	425.00
1 extra armature for A. 18	275.00
Tar, 400 gals	40.00
1 commutator for A. 18	50.00
Total	$9,664.80

Total brought forward	$9,664.80

POLE LINES (ERECTED).

10 1,200 C.P. sing. carbon arc lamps	$7,642.41
100 street hoods	
10 arc lamp hoods	
100 alternating street series sockets, No. 9,015	
5 junction boxes, No. 7,645	
110 removable pin break arms	
500 2 pin cross arms	
500 ½x7″ lag screws	
2,500 D. P. D. G. glass insulators	
1,000 feet flexible wire cable	
1,000 oak brackets, 1½ in	
1,964 lbs. No. 1 feeder wire	
2,381 lbs. No. 10 W. P. wire, street circuit	
8,078 lbs. No. 8 W.P. wire, street circuit	
50 gal. iron cross arm braces	
500 No. 4 porcelain insulators	
455 30-foot cedar poles	
52 35-foot cedar poles	
78 25-foot cedar poles	
12,480 feet No. 6 Under. wire	
10,640 feet No. 8 Under. wire	
17,160 feet No. 6 Under. wire	
14 transformer lightning arresters	
26 sleet-proof pulleys (Cutter's)	

TOOLS AND FIXTURES.

1 pair Stubbs' pliers, 8 in	$1.80
1 pair Stubbs' pliers, 6 in	.80
1 pair Stubbs' pliers, 5 in	.70
1 pair copper snips	1.75
1 augur, 1 in	.75
Bits, one ¾, one ⅝, one ½, one ¼	.84
Corner brace, (one)	3.00
I brace (straight)	1.25
1 back saw	1.00
5 wrenches for engine	7.00
2 pipe cutters	8.00
5 files	2.00
1 screwdriver	.40
1 vise and strap	3.60
1 clock	5.00
1 clawhammer	.60
1 level	2.00
2 wooden chairs	3.00
1 bench vise	8.00
1 ratchet	2.75
1 stove	6.00
Pipe Cutting Dies—Two ½ in., two 1 in. left; two ½ in., one ¾ right; two ½ in., one ¾ left; two ½ in., two ⅜ right; two ½ in., one ½ right; two ½ in., one ⅛ right; 4 in., three 2 in. right; 4 in., one 2 in. left; 4 in., one 1 in. right; 4 in., one 1½ in. right; 4 in., one 1 ¼ in. right; 2 die stocks, from ¼ in. to 1 in	37.50
5 brass brackets	5.00
1 grindstone	4.00
Taps—One 2 in. right; one ¼ in. right; one 1 in. right; one 1 in. left; one ¾ in. right; one ½ in. right; one 1 ½ in. right; one 1 in. right drilling tap	7.50
Bushings—1 from 1′ - ¾′; 1 from 1′ - ½′; 1 from 1′ - ¼′; 1 from 2′ - 1 ½′; 1 from 2′ - 1 ¼′; 1 from 2′ - 1′	2.00

TOOLS.

1 pair pipe tongs	$2.00
1 sledge hammer	1.00
1 pair scales, 800 lb	10 00
2 coal shovels	1.50
3 spoon "	3.75
2 picks	1.50
2 canthooks	2.50
2 14 ft. ladders	5.00
1 oak desk	25 00
1 pair pulley blocks, No. 5729	4.50
150 4-pin cross arms	45.00
1 brick hammer	.75
1 ladle	.40
2 digging bars	3.00
2 shovels, long handles	2.00
1 axe	1.25
1 hand axe	.75
1 coil flue cleaner	6.00
2 oil tanks	8.00
1 oil filter	15.00
1 set chain blocks	40.00
1 flue cleaning rod	3.00
1 Cardew voltmeter	60.00

TRANSFORMERS.

Three 150 Light, 110 volts.; One 90 Light, 50 volts.; No. 1025, Class 2 E, 52 V.; 11450, Class 1 E, 52 V.; 1702, Class 25, 52 V.; 1001, Class 40, 52 V.; 1375, Class 15, 52 V.; 1755, Class 15, 52 V.; 14255, Class 2 A, 52 V.; 2762, Class 15, 52 V.; 1323, Class 15, 52 V.; 17514, Class 1 E, 52 V.; 9874, Class 2 E, 52 V.; 15411 Class 8 E, 52 V.; 1355, Class 5 E, 52 V.; 1736, Class 25, 52 V.; 10,631, Class 2 E, 52 V.; 11135, Class 1 E, 52 V.; 1165, Class 25, 52 V.; 1283 Class 15, 52 V.; 1321, Class 15, 52 V.; 2141, Class 15, 52 V.; 7445, Class 1 E, 52 V.; 1083, Class 40, 52 V.; 487 Class 40, 52 V.; 1360, Class 1 E, 52 V.; 715 Class 40, 52 V.; 9542, Class 25, 52 V.; 1253, Class 15, 52 V.; 497, Class 15, 52 V.; 48141, Type F, 600 W.; 48829, Type F, 600 W.; 47980, Type F, 600 W.; 52694, Type F, 300 W.; 53367, Type F, 300 W.; 53375, Type F, 300 W.; 54134, Type F, 300 W.; 51890, Type F, 300 W.; 8 Type F, fuse cut-outs	$1,500.00

SUPPLIES.

Electroliers—Two No. 7244, 2 L.; one No. 7244, 3 L.; two No. 7265, 2 L.; one No. 7265, 3 L.; one No. 3614, 3 L.; one No. 3613, 2 L.; one No. 3607, 2 L.; one No. 7602, 2 L.; two No. 7357, 1 L.; one No. 7410, 1 L.; two No. 186, hall; one No. 113, hall	75.00
1 Bernstein series socket	1.25
Three 3 in. bells	2.25
1 hanger board and switch	6.00
1 dozen assorted tint shades	8.00
2 cells open circuit battery	2.00
2 cells gravity battery	4.00
1 cell Grenet battery	2.50
2 learner's sets telegraph instruments	11.50
1 Lee annunciator	8.00
2 push buttons	.40
1 Rumkof spark coil	7.50
4 Geisler tubes	9.00
1 motor for same	12.00
1 alternating fan motor	30.00
2 toy motors	20.00
Total	$19,364.75

Total brought forward	$19,364.75
48 cedar poles in yard	120.00
Gas Plant—1 Goodwin station meter, 1,000,000 cubic feet; two 5-light meters; one 20-light meter; three 14-light meters; sixteen 3-light meters; 1 test meter; 1 gas pressure gauge; 1 gas pressure governor; 1 photometer (Jones); 1 pocket pressure gauge; 3 retorts; 4 condensers.	
Gas Meters—Sixty-one 3 L.; three 5 L.; ten 10 L.; four 20 L.; one 40 L.	

WATTMETERS:

47, 10 Amp	$470.00
6, 25 "	99.00
3, 30 "	55.00
8, 15 "	104.00

ADDENDA—TOOLS.

1 alcohol blowpot	2.50
1 bellows	1.00

ADDENDA—SUPPLIES.

4 gals. wood alcohol	6.00
43 porcelain tubes	6.45
One 30 amp. porcelain switch	4.00
5 porcelain wall sockets	3.00
14 Edison key sockets	4.20
86 T. H. key sockets	27.50
17 5 amp. switches	10.20
33 ft. black cord	2.20
12 porcelain rosettes	1.20
10 wire guards	2.50
3 boxes screws, 2½ No. 12	1.00
75 lag screws	3.35
Three 100 amp. porcelain cut-outs	4.50
Seven 10 amp. porcelain cut-outs	3.50
Three 10 amp. porcelain branch blocks	2.40
8 rolls black tape	6.40
9 rolls white tape	7.20
1076 wood cleats	3.75
109 wood rosettes	7.00
Twenty-three 16 C.P. lamps	9.20
120 yards No. 16 cord	24.00
900 ½x12 carbons	9.80
Three 32 C. P. lamps	1.50
405 No. 4 porcelain insulators	6.00
160 ft. No. 12 Okonite wire	8.00
708 ft. No. 16 Okonite wire	21.24
436 ft. No 14 Okonite wire	15.26
992 ft. No. 8 Okonite wire	79 36
1000 ft. No. 10 Okonite wire	65.00
25 ft. No. 4 Okonite wire	.75
74 lbs. No. 16 Undrs. wire	11.84
105 lbs. No. 14 Undrs. wire	16.80
114 lbs. No. 12 Undrs. wire	18.24
170½ lbs. No. 8 Undrs. wire	27.20
38 lbs. No. 7 Undrs. wire	6.08
21 lbs. No. 6 Undrs. wire	3.36
25 lbs. No. 6 K. K. wire	4.25
9 lbs. No. 8 K. K. wire	1.53
5 lbs. No. 4 K. K. wire	.85
15 lbs. No. 1 K. K. wire	2.55
60 ft. No. 00 Undrs. wire	4.80
Total	$20,660.21

The property not valued was included in the gas plant, to which slight additions had been made, and for which Mr. Gilman had paid $20,000. It is therefore easy to arrive at the basis on which the $175,000 of securities rested:

Cost of gas plant	$20,000.00
Cost of electric plant as per schedule	20,660.21
	$40,660.21

It is not fair, however, to assume that the above was the *value* of the property. Just what the value was, or is, it is not easy to determine. Here was a company bonded for $75,000, with a floating debt of over $12,000, losing nearly $10,000 a year, in a town of 6,520 people, with no prospect of rapid growth (and which, as time has shown, has not grown materially); its property representing a possible investment of $40,000—we must leave the *actual valuation* to the promoters. There is, however, some evidence extant as to just what the present owner, Mr. Coffin, considers the property worth. In August last it was offered for sale at $10,000, and up to our last report had not been sold.

Further comment is unnecessary. The affairs of the Faribault Consolidated Gas and Electric Company have been made clear, and the story is on record as another link in the chain which binds Mr. Coffin to the gigantic swindling operations carried on under the name of the Northwest General Electric Company.

Next week we shall treat the Owatonna electric light plant.

ELECTRICITY.

At a recent meeting of the Western Railway Club, at Chicago, Mr. L. B. Stillwell delivered an address on "Electricity as a Motive Power for Surface Roads" which contains passages of a far higher style of thought and expression than is usually found in addresses of this kind. We subjoin an extract:

> Electricity never stretches, never breaks, weighs nothing, can be subdivided indefinitely with great ease, can turn corners without loss. It can transmit large amounts of energy at pressures easily controlled along wires of moderate size, and it never freezes. Its loss by friction is comparatively insignificant, and its other losses in comparison with every other known agent are almost negligible.
>
> It is interesting to note that in employing electricity we are using not a solid, not a liquid, not a gas, but ether—that mysterious something which as modern science teaches penetrates all matter and fills all space. We cannot accurately define electricity, but this much at least is known. Electricity has to do with the same medium that transmits light; it is as swift as light and as strong as steel; it weighs nothing, and yet if compressible at all it is certainly less compressible than any known material; let us say a push applied to one end of a circuit in Chicago is instantly felt at the other end in New York. We have within a few years come to recognize electricity as the nerve system of civilization. We are just beginning to realize that it is also muscle. We may hope that at no distant day great systems of electric conductors, noiseless, motionless, giving no sign of the work they are doing, radiating from central stations suitably located, will propel every car and train and every wheel of industry in our cities.
>
> Power can be far more economically developed in large quantities than in small, even where coal is the source from which it is derived and making all allowances for losses in transmission through conductors and conversions in motors. It is cheaper to-day, so far as the cost of power is concerned, to propel suburban trains by electric motors than by steam locomotives; and where a transmission system is adopted it becomes possible to utilize any cheap power which may be found within reasonable distances—say twenty-five, or even fifty, miles. It is entirely within the limits of the possibilities of electric traction as now developed to operate trains within the city limits of Chicago by power transmitted from the drainage canal near Joliet.
>
> In view of the facts to which I have briefly referred, we are, I think, justified in concluding that a broad view of the situation indicates that electric traction is destined to generally supersede all other systems of traction in our large cities and their suburbs. To what extent electric traction will, in time, compete with steam in cross-country service it is yet too early to say, but if I may be allowed to express my personal opinion, I should say that where distances are great and traffic comparatively light it will be a long time before steam locomotives are superseded. For the cities, however, the change cannot well come too soon. It is true that the best means of transmitting power from the central station to the moving car has not been conclusively fixed upon. The overhead trolley, the conduit, and the systems in which contact points under the moving car are charged as the car passes and discharged when the car has passed—these, and perhaps others, are to-day in practical operation, and in no small degree successful, but they have not been in use for a sufficient length of time to make it clear that any one is superior to its competitor—in fact, it is altogether probable that here, as well as elsewhere, we shall find that no one system is best for all cases; that various methods must be employed to meet different conditions.

THE MONTREAL MEETING.

There are two desirable routes for Eastern delegates to choose from in going to the Montreal meeting of the American Street Railway Association. The sessions open on Tuesday, October 15 next, and the first train, made up chiefly of the Pennsylvania contingent, leaves New York on Monday morning the 14th, going over the New York Central to Albany, thence over the Delaware and Hudson along the western shore of Lake Champlain for its entire length, and reaching Montreal at 9:30 P. M.

The second train leaves the Grand Central Depot Monday evening, and passengers will arrive at Montreal early Tuesday morning.

Accommodations on the first train can be secured through Mr. William Hulings, care of the J. G. Brill Company, Philadelphia, and on the second train through M. C. Roach, 413 Broadway, New York.

OUTING for October is a readable and finely illustrated number. The contents are as follows: "A Bit of Blue Ribbon," by Sara Beaumont Kennedy; "Rugged Labrador," by R. G. Taber; "Boar Hunting in the Ardennes;" "Banana Land Awheel," by E. M. Aaron: ,,Hero," by Therese G. Randall; "'Neath Cloudless Skies," by Fred. C. Green; "A Sporting Vacation in Montana," by G. M. Dillard; "Moose Hunting in New Brunswick," by the late E. P. Rogers; "Lenz's World Tour Awheel;" "Finnish Fish and Fishermen," by Fred. Whishaw; "Guns and Shooting," by Ed. W. Sandys; "The Great Dismal Swamp," by Alex. Hunter: "The New Hampshire National Guard," by Geo. H. Moses; "Football," by Walter Camp, and the usual editorials, poems, records, etc. The merry sports of Autumn live again in OUTING's pleasant pages. The frontispiece shows the sportsman upon our broad prairies. This cut illustrates G. M. Dillard's account of a Sporting Vacation in Montana. A very striking full-page portrays a bull moose in the act of calling.

STORAGE BATTERIES.*

BY H. A. EARLE.

When I undertook to read a paper before this Association, I hoped that I might have been able to treat the subject in a more exhaustive manner; the time at my disposal has, however, been limited, and the subject is one of such magnitude, and the results under different conditions of tests so numerous, that *I have* found it impossible to do more than give a general outline from a practical point of view.

It is interesting to trace the history of storage battery manufacture, and, by so doing, each step in the advance up to the present time can best be considered.

The discovery of secondary current dates back to 1801, when Gautherot found that silver or platinum wires, which had been used to decompose a saline solution, were capable of giving a reverse current of short duration. Ritter, in 1803, was, however, the first to make a secondary battery, in which he employed plates of gold separated by cloth or paper, the same being moistened with a saline solution; he experimented with various metals, including lead, but the secondary currents obtained were of short duration, and the batteries only of scientific interest. It appears, at first sight, strange that Ritter, when using lead, obtained no increased effects, this being the metal exclusively employed at this time; he, however, used salt water, and this formed chloride of lead scarcely soluble, and a very bad conductor; on this account the current was very weak in comparison with that which would have been obtained if water acidulated with sulphuric acid had been used.

Since that time many scientists have investigated the subject, and De la Rive, in 1826, obtained secondary currents from platinum plates in a voltameter filled with water and sulphuric acid, and he closely approached the elements of our present storage battery, when, among his many experiments he used in a primary battery a platinum plate covered with a film of peroxide of lead, and a zinc plate, immersed in an acid solution.

The first powerful storage battery was introduced in 1860, when Planté constructed cells composed of lead plates immersed in an acid solution of 1.068 specific gravity (10 per cent. acid); these were a success, with the exception that the method employed for their formation, namely, frequent charges, discharges, reversals of charge, and periods of rest, was too long and expensive for practical purposes, several months being necessary to obtain a useful capacity.

The subsequent rapid development and improvements in electrical machinery and lamps created a real demand for a good storage battery, and turned the thoughts of many to the subject, and the next, and one of the most important of subsequent improvements, was that introduced by Faure, in 1881, namely, of pasting a coating of lead oxide on the surface of the plates, which rendered them, after a comparatively short formation, ready for use. The Faure cell was never, however, as originally designed, a practical success, for though the active material was encased in a covering of flannel or felt, the pasted coatings being on upright surfaces, and having insufficient adherence, came away within a period not sufficiently long to give economical results. Swan realized that the active material required a better mechanical support, and introduced a plate of grid form, the interstices serving to retain the material; this frame, combined with the Faure pasting, was the origin of the plate that has been largely used in this country and elsewhere.

Up to the date of the expiration of the Swan and Faure patents, the manufacture of pasted plates in this country was in the hands of one company and its licensees, and competition was thereby to a great extent absent; this is, however, more likely to have been an advantage than otherwise, for much has meanwhile been done to perfect and cheapen the production of the solid lead plates, and these are making such strides forward that it seems probable they will eventually outstrip and replace their pasted rivals. Solid plates have been made of various types, and some have been pasted to avoid the expense of formation, the paste in this case serving to give the required capacity till the action of charging and discharging gradually attacked the solid surface; improved methods, have, however, been discovered for effecting rapid formation at a reasonable cost, and although pasting is now open to all, in all probability there will be little extension of its use, unless means are devised for the better retention of the material.

Another type which differs greatly from the solid lead plate, but which is not pasted, is the chloride plate; in this case the material, to become active, is a mixture of chloride of lead and chloride of zinc, which is cast into small tablets, these being framed by casting antimonious lead around them under high pressure, the subsequent elimination of the chlorine and zinc leaves a porous structure of pure lead, of a crystalline nature, good conductivity, and with a large surface exposed to the electrolyte, the result being a large capacity for a given weight and for the space occupied.

The mere manufacture of an accumulator, with lead and sulphuric acid, is a simple matter; but when combined with the necessary requirements of low first cost for a given capacity, and long life, it presents more difficulties than is generally supposed. Omitting the question of cost, the chief points to be considered are the *chemical action*, the *mechanical construction*, and the proper *treatment* of the cells when made. In lead batteries the minimum weight is limited by the chemical requirements, the theoretical value of lead peroxide is 4.44 grammes per ampere hour, or roughly, 1 lb. is the equivalent of 100 ampere hours; presuming that the positive and negative plates were identical, the value would be approximately 50 ampere-hours for 1 lb. of peroxide and spongy lead. As a matter of fact, the highest capacity plates yield only about 7 ampere-hours per pound of positive and negative plates, or 16 ampere-hours per pound of peroxide and spongy lead, due to the facts that a conducting frame of considerable weight has to be employed, and to the impossibility in practical working of reducing the whole of the peroxide. To obtain the best results for a given weight, the frame must be reduced to a minimum consistent with the necessary strength and conductivity, and the distribution of the peroxide must be such as to admit of the perfect circulation of the electrolyte and its penetration throughout the mass.

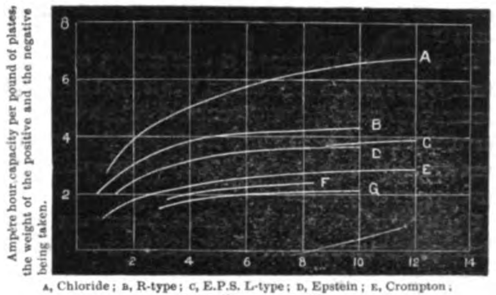
When the active material is retained in holes or interstices, due provision must be made for its expansion on oxidation; for the power exerted is so great that it will bend or burst a frame which holds it too tightly; various methods have been adopted to prevent buckling, but it is still a source of trouble with perforated pasted plates; solid grooved or ribbed plates, however, the grooves on which are filled with paste, are not subject to the same extent to this fault; solid plates on which the active material is formed out of the substance of the plate itself are practically free from it.

In the chloride plate ample provision is made for this increase in volume by the elimination of the chlorine and zinc, which renders the structure porous and cellular.

Nothing is more interesting than the behavior of cells under various conditions, and from the innumerable curves that can be plotted we can readily study the effects due to different rates of charge and discharge, to the penetration and strength of the electrolyte, and to the ratio of the positive and negative plates; from these and many other similar tests, much useful information can be obtained for guidance both in manufacture and treatment. There is a given rate of charge for every type of cell which is most suitable, not only for its efficiency, but also for its durability; with some types a high rate is quite inadmissible, and a period of ten hours is required; other types, however, are of such a construction that they may be fully charged in four hours without detriment; this variation is mainly due to the disposition of the active material, to its thickness, and to the method of its production, namely, whether it has been mechanically applied or electrolytically produced. Most of the effects of varying rates of charge can be ascertained from the resultant discharge, but discharge curves have, nevertheless, characteristics of their own which are, to a great extent, unconnected with the conditions of charge, and they depend upon the type of plate, strength of acid, the rate of discharge, and other influences.

A series of curves is exhibited (Fig. 1), and these give at a glance results obtained with plates of various manufacture. In every instance the weight of one positive and one negative has been taken; knowledge of the ratio of weight of active material to frame is naturally necessary for the complete investigation of these curves, but in this case the weight of the plates themselves has only been taken into consideration, as it is merely intended to show results obtained from various types of plates at present manufactured.

Curve A is taken from plates, the active material on which is of a very porous and cellular nature, of $\frac{5}{16}$ths of an inch thick. It will be noticed that the capacity per pound of plate continues to rise up to the 12-hour rate, and that at that point it is still slightly on the increase. This increase is no doubt partly due to the gradual penetration of the acid, and partly to the rapid sulphation of the surface at the higher rates.



A, Chloride; B, R-type; C, E.P.S. L-type; D, Epstein; E, Crompton; F, E.P.S. K-type; G, Tudor.
Duration of discharge in hours.

FIG. 1.

Curve B is that given by a positive plate, the active material on which is distributed in a thin layer over a very large surface, the negatives being the same as employed for curve A. This plate gives less ampere-hours per pound of plate, owing to its possessing a heavy frame, but per pound of peroxide of lead its yield is greater: the active material in this plate is not formed out of the substance of the frame, but is entirely independent of it. A plate of this description, in which the whole face of the active material is directly exposed to the electrolyte, is capable of giving its maximum capacity at a comparatively high rate of discharge. A thin layer of peroxide spread over a large surface reduces the clogging of the surfaces to a minimum, and a free circulation of the electrolyte admits of fresh acid of the proper specific gravity being continually available.

Curve C is obtained from a pasted plate suitable for slow rates of discharge, and from its rise in capacity at reduced rates we notice somewhat similar characteristics to that in curve A.

There is, however, a remarkable point of difference between curves A and C, for the plates in each instance contain approximately 30 per cent. by weight of active material; curve A, therefore, gives us about double the ampere-hour yield per pound of active material over curve C, and this is obtained by the cellular and porous structure of the material in the A curve plate.

Curve D is taken from plates cast with ribs on their surfaces, the active material being formed out of the substance of the plates themselves. The curve is very similar to B, but falls lower on the scale, this being caused by the weight of the positive plate, its thickness being considerable in order to give a reserve of metal, which in its turn is acted upon as the plate gradually disintegrates.

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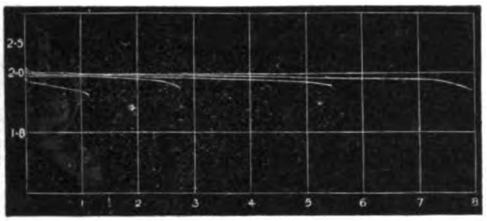
* Paper read before the British Association at the meeting September 11-17, 1895.

Curve E is given by plates, the surfaces and interior being full of blowholes, which gives a large exposed area; their weight for a given output is, however, large.

Curve F is a pasted plate with a solid frame, which gives a poor return for its weight; in this curve we notice the rise in capacity at reduced rates due to pasted plates.

Curve G gives the capabilities of very heavy plates which are pasted on their surfaces, the paste being intended merely to give the required capacity till its disintegration, by which time the frame itself has been sufficiently formed to do the work; the rapid flattening of this curve indicates that the layer of paste is thin.



Duration of discharge in hours.

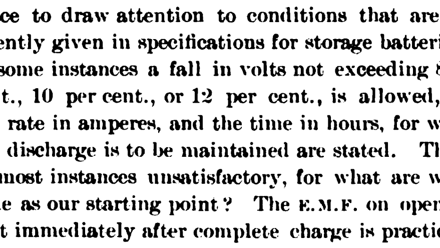
FIG. 2.

The curve of voltage of a discharging cell varies greatly, and is dependent upon the rate of discharge, the strength of acid, the distance of plates apart, its curve of internal resistance, and the treatment it has been subjected to beforehand, besides many other interesting conditions.

Fig. 2 demonstrates the effect of varying rates. These curves have all been obtained from cells of the same type, the acid having been approximately 1.210 specific gravity when the cell was fully charged.

Discharges of varying rates are given, namely, 1 hour, 2½, 3½, 5½, and 7½ hours, and though slightly different results would be obtained with other types of cells, they may be taken as a fair approximation for general reference.

When considering the question of fall in volts on discharges at different rates, it will not be out of place to draw attention to conditions that are frequently given in specifications for storage batteries—in some instances a fall in volts not exceeding 8 per cent., 10 per cent., or 12 per cent., is allowed, and the rate in amperes, and the time in hours, for which the discharge is to be maintained are stated. This is in most instances unsatisfactory, for what are we to take as our starting point? The E.M.F. on open circuit immediately after complete charge is practically a fixed value, with a given type of cell and a known strength of acid. But the fall in the first few minutes varies greatly according to the rates of discharge, and at high rates it may fall as much as 10 per cent. in a few minutes or even seconds, before a comparatively straight line has been reached, and the cell is working at its normal voltage for the specified rate of discharge; this is quite clear by reference to Fig. 2. Another point to which our attention is drawn is the fall of voltage on open circuit after the completion of charge. A series of curves (Fig. 3) are exhibited, showing the fall in voltage for a period of 21 hours, each curve being for a different strength of acid; it is therefore evident that if a given percentage of fall is allowed, it will be most advantageous for the manufacturer, but not for the purchaser, to allow the battery to stand for a few hours in order that this useless high voltage be reduced. The best way to meet this point is, however, to take the first reading of voltage five or ten minutes after the discharge has commenced. In other specifications the voltage is fixed to a hundredth of a volt, and the cell must give the specified capacity above this limit in many instances, and especially when high discharge rates are specified. The voltage given is much too high on the curve, and in some instances I have found it actually fall on a straight portion of the same, so that the time at which this point is passed raises an unpleasant difference of opinion between the buyer and the seller. This class of specification generally necessitates a very much larger battery than was intended, with corresponding increased cost, and should the manufacturer not have been exceedingly careful in preparing his estimate, he may find that the buyer is not satisfied with a good excess of ampere-hours, but will have his volts as well, even if this means 50 per cent. in ampere hours in excess of what he thought he was ordering.



Interval in hours after completion of discharge.

FIG. 3.

(*To be continued.*)

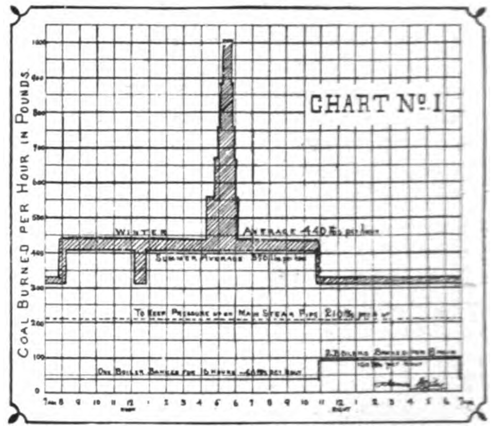
FROM THE COAL PILE TO THE METER.*

BY JAMES MILNE.

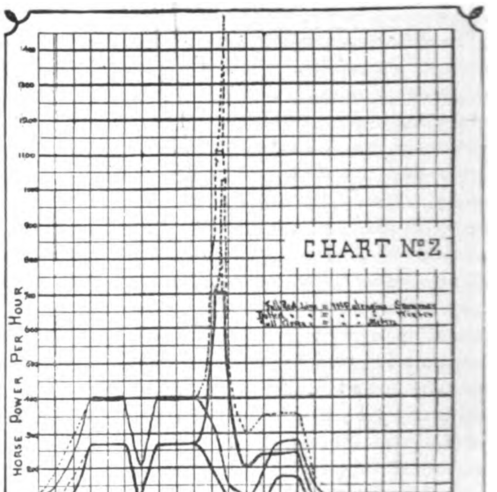
We see so many curves these days showing the high efficiency of this and the very high efficiency of that, and so on, that we are apt to think there is little room for improvement. My intention is therefore to trace from the coal pile to the meter on the consumer's premises, and endeavor to show by means of diagrams, calculated from different sources, the condition of affairs in light and power plants and to see if there is not something that could be improved on.

Chart 1 illustrates at a glance the following: First, the amount of coal required to keep up the pressure at the boilers without delivering any to the main steam pipe. It will be seen that for 16 hours 40 lbs. are consumed and for 8 hours it takes 100 lbs per hour. Second, the amount of coal required to keep the pressure up when steam is turned on the main pipe, which is equal to 210 lbs. hourly. Third, the amount of coal required to keep the steam pressure up for running the average friction load in summer. In this load I have included the power required to run the generators and charge the fields, but not supplying any current to the external circuit. Beginning at 11 P. M. we find the average friction load takes 310 lbs. per hour up to 8:15 A. M.; after that it rises to 420 lbs. and continues at this until noon. It then decreases until 12:30, and again rises, and at 1:15 it is 420 lbs. and remains at this until 11 P. M. Fourth, the amount of coal used for the average friction load in the winter time. It will be observed that for the same load there is a slight increase in the coal consumption owing to increased radiation, condensation, etc.

We are now ready to supply current to the external circuit, and Chart 2 illustrates the power indicated as the engine for 24 hours' run, summer and winter. The full red line shows the I H. P. at the engine in the summer, the dotted red line the I H.P. in the winter, and the full and dotted green lines the I H. P. available at the service or when the wires enter the consumer's premises. You will observe as the H. P. increases the distance between the red and green lines also increases. This is accounted for by the decrease in the efficiency of the external circuit and also the increase of the friction load, and you will readily understand that when the load is at its lowest the distance between these lines will be a minimum and the only time they would coincide would be when the plant is shut down. The peak in the winter time is always an interesting figure to those in the business and no doubt deserves a word or two, for it is generally about this time that a few words are said in the power house, but whether they be good or bad I will leave that for yourselves to conjecture. I thought of plotting this peak 50 % higher, but the data I have was not very reliable, so I concluded it was better to leave off at the point where it might be misleading. According to our diagram it is plotted for 1,200 H. P. at the engines, and we find by looking at the green line 700 H. P. is being registered at the meters, which means that by deducting the correct amount for friction, losses in generators, etc., we find a loss of 25 % in the line, or in other words we get at this time an efficiency of 75 % between switchboard and meters. It may seem to you, or some of you at least, that this is an enormous loss and steps should be taken to reduce it. When everything is taken into account I think we will find it cheaper to put up with this loss than try to overcome it. It (the loss) is only for 60 days a year, etc., for one hour per day, making a total of 60 hours per annum. Now if copper were put in to reduce it we know that interest, depreciation, etc., runs on continually, and would in some cases more than offset the amount spent for the extra coal consumed during this loss. It would be an easy matter to calculate the amount spent on coal to make up this loss and see how much copper it would be equivalent to, even taking the whole amount as interest on the investment.



On diagram 1 we showed the coal consumption per hour necessary to keep up the steam pressure to run the engines and generate current up to the switchboard. We now come to Chart 3, which shows the amount consumed when running as indicated on Chart 2. The part in section shows the increase for the winter load, and in this we have again an interesting diagram which, when calculated out, shows very clearly the effects of forcing boilers. By comparing the run made between 10 A. M. and 12 noon and that made between 5 and 6 P. M., in the winter time, we find there is an increase of 75 % in the amount of coal burned per horse-power per hour, which certainly shows that forcing boilers is far from being economical. Diagram 4 shows the amount of coal consumed per square foot of grate surface. Be-



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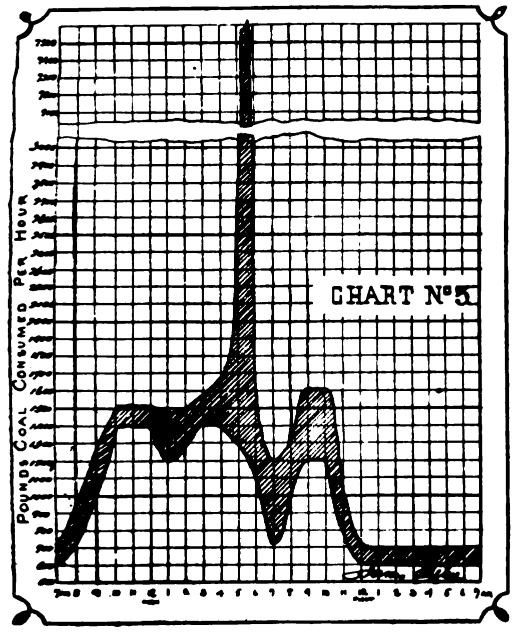
* Paper read before the Canadian Electrical Association.

ginning at 11 P. M. we have 22 lbs. This continues up to 7 A. M. when a change over is made which re*duces* the amount to 9 lbs. for a short time. It then gradually increases until 10 A. M. when we get a fraction over 17 lbs. At 12 noon it diminishes to 15, and we again find at 3 P. M. it is the same as from 10 to 12, viz., 17 lbs. From 3 to 5 it averages 16 lbs., *and at 6* it has reached 9 lbs. From 7 to 9 it increases from 9 to 15 lbs., and continues at 15 lbs. for 1½ hours. The part in sections, as in the other diagrams, shows the difference between the summer and the winter loads. The two peaks show the amount burned per foot of grate service on two different sets of boilers. On one it will be seen that 43 lbs. per foot are consumed and 32 lbs. on the other, and to my mind shows that they are going for all they are worth.



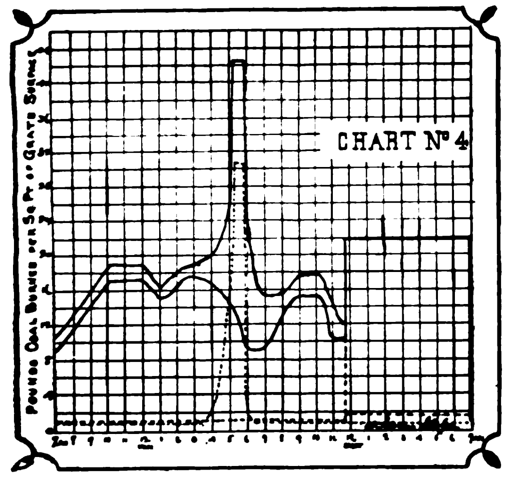
In calculating the amount of coal consumed per foot of heating surface I find at the most economical load .322 lb. is burned, and the most uneconomical load, between 5 and 6 P. M. in the winter, it is as high as .9 lb. per square foot.

Let us now see what economy we are getting from the boilers.

Summer:

Total water evaporated for 24 hours = 201,600 lbs.

$\frac{201.600}{25,000} = 8.07$ lbs. water evaporated from temperature of feed or 210, which is equivalent to 8.32 lbs. from and at 212° per lb coal. Allowing 10 % ash, which is not excessive and compares favorably with the average of the data I have received from different plants, we get 8.97 from temperature of feed or 9.24 lbs. from and at 212° per lb combustible.



Winter:

Total water evaporated per 24 hours = 276,343 lbs.

$\frac{276,343}{36,000} = 7.5$ lbs. from temperature of feed or 200°, which is equivalent to 7.9 from and at 212°, and allowing the same percentage of ash we get 8.34 lbs. from 200° and 8.78 lbs. from and at 212° per lb. combustible.

In the summer time we have stated that an evaporation of 8.32 lbs. per lb. of coal is obtained, and taking the coal at 12875 B. T. U. we get a theoretical evaporation of 13.32 lbs. water per lb. of coal from and at 212°. This agrees fairly well with any of the tables giving the thermal units of heat of the grade of coal burned.

Theoretical evaporation = 13.32 lbs.; actual evaporation = 8.32.

Efficiency therefore is = 62.47 %, or say 62.50.

We are all more or less acquainted with the first law in thermodynamics, which may be stated thus: Heat and mechanical energy are mutually convertible, a unit of heat corresponding to a certain fixed amount of work called the mechanical equivalent of heat. We can calculate the mechanical equivalent of the coal pile thus:

$$\frac{12,875 \times 772 \times 25,000}{24 \times 60 \times 3300} = 5229 \text{ H. P.}$$

$\therefore$ 5229 × .6247 = 3266.5 H. P. available at the stop valves of the boilers, which, if all were utilized, would give us 3.1 H. P. per lb. of coal per hour, or a little over .31 lb. coal per H. P. per hour, a result which with the greatest refinement in engineering has not yet been attained in practice, and I think I am safe in saying never will.

We will now calculate the efficiency of the steam

Average steam pressure, 125 lbs. absolute.
Average exhaust pressure, 20 lbs. "
Water per H. P. per hour, 28 lbs.
Temperature of feed, 210° Fah. (summer).
Temperature of water before entering heater, 40°.
125 lbs. abs. = 1187 units. Feed water raised from 40° to 210° = 170° by heater.
$\therefore$ 1187 — 170 = 1017 thermal units of heat expected per pound of steam.

Thermal units per 1 H.P. per min. $= \frac{1017 \times 28}{60} = 474.$

$\therefore \frac{42.75}{474} = .09$ or 9 % efficiency.

Taking the temperature of the feed at 210 and that of the steam at 344°, we get

$\frac{344 - 210}{805} = .168$, or an efficiency of 16.8 %,

if same were a perfect engine working between the limits of the temperatures 344° and 210°. Therefore the relative efficiency between the perfect engine and the above is

$$\frac{.09}{.168} = 53 \%.$$

By the above reasoning we get an efficiency or 9 %: of the total power available at stop valves of boilers:

$$3266.5 \times .09 = 293.98 \text{ H. P.}$$

Our actual H. P is 230 or 78.23 % of 293.98.

$\therefore$ .9 × .7823 = .070407, or a fraction over 7 %, representing the efficiency of engine to boiler, and calculating to coal pile we get an efficiency of .625 × .09 × .7823 = .625 × .070407 = .044, or a net efficiency of 4.4 %.

We also find from actual results that a mechanical efficiency of 82.3 % is obtained from the engines; that is to say, it takes 17.7 % to overcome friction and run generators up to speed.

Therefore the power available for running the generators is 230 × .823 = 189.29 H. P.

Efficiency of generators not less than 92 %.

$\therefore$ 189.29 × .92 = 174.14 H. P., available for sending out to the line, and from boiler to switchboard we have

$$.09 \times .7823 \times .823 \times .92 = .0533,$$

or briefly, $\frac{174.14}{3266} = .0533$, or 5⅓ % efficiency,

and going back to coal pile we get .0533 × .1247 = .0333 or 3⅓ % efficiency.

We have got one more item to take into consideration to complete our calculations, and that is the efficiency of the external circuit, which is in the summer time 85 %. Therefore the total H. P. available at the meter on the premises of the consumer is 174.14 × .85 = 147 H. P. fully, or more accurately

$$3266 \times .09 \times .7823 \times .823 \times .92 \times .85 = 148 \text{ H. P.}$$

The net efficiency from boiler to meter is

$$\frac{148}{3266} = .0453 \text{ or } 4.53 \%,$$

and from coal pile to meter we get .0453 × .6248 = .0283 or 2.83 %.

From the above we get the following results:

Power for running generators	100
Power available at switchboard	92
Power available at meter	78.20

Efficiency of the electrical apparatus, including outside circuit = 78 1-5 %.

Engine	100
Available for generating current	83.3
Available at switchboard	75.72
Available at meter	64.35

The commercial efficiency from engine to meter is 64.35 %.

Boiler equivalent	100
Indicated H. P. at engines	7.04
Available for generating current	5.79
Available at switchboard	5.33
Available at meters	4.53

The efficiency therefore from the boilers to the meter is 4.53 %.

Coal pile equivalent	100
Available at stop valves of boiler	62.47
Indicated H. P. at engine	4.4
Available for generating current	3.62
Available at switchboard	3.33
Available at meter	2.83

The above extended results apply, as has already been stated, to the summer load, but as the results from the winter load are practically the same, I need not take up your time going over them.

We see, therefore, that the electrical end shows up exceedingly well. For every 100 H. P. at the engine, 82.3 is utilized for generating current, and 75.77 of this is sent out to the line, which, although it could be improved on, leaves very little to be gained by any new invention or alteration that may hereafter be made.

Regarding the steam end, there can be no doubt that considerable attention has been paid to it, and it is still receiving more. Yet it does not alter the fact that it is here where we get the worst showing. When some of the great scientists arrive at the method of abstracting electricity direct from the coal pit or even the boiler without the intervention of the steam engine, better results may be obtained.

I see in some of the engineering papers that evaporation condensers are coming into use and are being applied to plants that have heretofore been running non-condensing. This is a step in the right direction, and as no more water is used than that required for steam purposes, parties at present having to pay for their water might find this a profitable investment, inasmuch as a vacuum of from 22″ to 26″ is readily obtained—in fact, guaranteed by the builders.

Married.

Mr. William Eugene Keily, who was the last of the editorial staff of the *Western Electrician* to succumb, capitulated on Thursday, September 26, to Miss Catharine Meagher.

First it was Mr. Kreidler himself, next it was Mr. O'Hara, only a few weeks ago it was Mr. Perry, and now Mr. Keily. The infection seems to have been strong in that office and only died out when there ceased to be material for it to feed upon. But the *Western Electrician* is a better paper and its editors better men for the inoculation, and as we have heartily congratulated each successive renunciator of celibacy and wished him and his fair bride a happy future, so do we now, no less sincerely, congratulate Mr. and Mrs. Keily and wish them God speed.

The marriage was announced on September 18 of Mr. W. G. Whilden and Miss Marie L. Ryder at 200 St. Mark's Place, Brooklyn. Miss Ryder had been for nearly six years private secretary to Mr. J. P. Ord, vice-president of the General Electric Company, and had made many friends. Among the wedding presents was an oxidized silver tea strainer, sent by Mr. Ord.

HOW THE ELECTROPOISE WAS FIRST MADE.

To the Editor of ELECTRICITY.

DEAR SIR: The predictions of Mr. Brush in your issue of the 18th inst. will certainly come true if you continue in the good work, and, as he says, you deserve it.

Your article on the Bell Company and the opposition in the last edition is timely and to the point—just such articles as all fair-minded, honorable people like to read. Follow it up with others of like nature and the general public will commend you and patronize your paper.

I am glad to note that you are ventilating that great fraud the Electropoise. I know something about that instrument. The company was first organized at Birmingham, Ala., and about the first city they attempted to do business in was Memphis. I was called upon to put up the first machine, which, by the way, was quite different from those now being used. The mysterious little cylinder was placed underground about 18 inches at some convenient place, from which a wire was run to a box placed in the patient's room. This box resembled somewhat a telephone. From the box flexible cords extended to the patient. On the box there was a dial with a hand and about twelve contact points. On these contact points were engraved names of diseases the instrument was supposed to cure.

While putting up the instrument I had an opportunity to look into the box and found, to my surprise, that one of the wires from the patient ran to all the contact points, and was so arranged that in moving the hand from one contact to another you added about 2 inches of No. 18 copper wire to the circuit, if there was a circuit, at each move..

I was also called to refill some of the cylinders, and having a quantity of the contents of old Laclanche battery porous cups, showed it to the agent and he pronounced it just the material required, and the cylinders were filled with it and seemed to cure (?) just the same as the others did. Yours truly,

JAS. D. RANDALL.

Memphis, Tenn., Sept. 23.

To Remove the Assignee of the La Roche Company.

Counsel for Harry S. Smith, the Ball Engine Company, J. W. Parker & Co., J. G. Gray, assignee for Queen & Co.; John McCullough. Merchant & Co., McCalvey Elevator Works and others have begun equity proceedings against J. Franklin Stevens, assignee of the La Roche Electric Works, asking the Court to discharge the respondent as assignee; that other appraisers be appointed who shall not be officers of the assigned estate, and that an accounting be made of all the property belonging to the assigned estate.

The bill sets forth among other serious charges that on July 15, 1895, the Ideal Electrical Company was incorporated by James Collins Jones, who is attorney for the La Roche Electric Works and also for F. A. La Roche & Co.; J. Franklin Stevens, assignee for the La Roche Electric Company, and George F. Louty, who is at present and who has been since the assignment in charge of La Roche & Co., doing business in the building of the assigned estate; George A. Colgate, of the firm of George A. Colgate Co., of New York City, which represents the Keystone Electrical Instrument Company, and James D. McIntosh and William G. Toylis, and that this last named company is at present occupying the building of the assigned estate without charges for rent or uses of machinery, and the creditors' rights and privileges are displaced; also that it is the full intention of the assignee to sell all the property and assets of the assigned estate at the appraised value or less to the Ideal Electrical Company, in which he holds a great financial interest, thus involving an enormous loss to the creditors individually as well as to the assigned estate generally.

The complainants state that an inventoried value of the property of the assigned estate as filed and stated by the assignee is $147,836.85 and the value of the property as appraised by the assignee and by the appraiser appointed by the Court is $25,711.10.

The Welsbach Light Company.

Edward C. Lee, treasurer of the Welsbach Light Company of Philadelphia, tells the *Boston News Bureau* that the company is now paying dividends at the rate of 80 per cent. per annum, and is earning a very satisfactory surplus above that.

The output of the company at the present time is at the rate of 2,500,000 lights annually, but the manufacturing facilities of the company have been enlarged to an annual capacity of 5,000,000 lights.

The Welsbach Light Company was a consolidation of three companies, and the capitalization was scaled from $19,000,000 to $525,125, divided into 105,025 shares, par $5. Of this capital $515,806 has been issued. It is now proposed to increase the capitalization to $10,000,000, par $100.

The company's dividend record is as follows:

June, 1893 (first dividend)	2	per cent.	$10,316
June, 1894	4	"	20,632
September, 1894	4	"	20,632
December, 1894	8	"	41,264
March, 1895	10	"	51,580
July, 1895	20	"	103,161
September, 1895	20	"	103,161
Total			350,746

The stock of the company is now quoted at 92; it sold as low as 39 in March of this year.

An Electrical Headquarters.

A movement is on foot to arrange for an electrical headquarters at the New Manhattan Athletic Club in this city. At the formal fall opening of the club on Monday evening, Sept. 23, quite a number of electrical men were present and the idea met with general approval. The dues of the club are $36 per annum, or for non-resident members $18. The clubhouse, as is well known, is one of the finest in the country. The scheme would have many advantages over any attempt to run a distinctly electrical club. Among those who were present at the opening meeting referred to were the following:

Fred'k A. Scheffler, Jas. B. Olson, G. A. Prendergast, Edgar A. Dunham, F. W. Harrington, W. J. Morrison, David Chalmers, Elmer P. Morris, Frank B. Rae, Harry Alexander, S. Davis, R. A. Stacpoole, Geo. F. Porter, E. F. Peck, John F. Outwater, S. A. Douglas, A. Alexander, C. E. Nooney, Clarence Kelley, W. Sharland, J. H. Sharland, E. A. Record, A. C. Shaw, B. E. Greene, Joseph Crowell.

To Reorganize the Detroit Electrical Works.

A new reorganization committee has been appointed for the above company, and L. Warfield and W. A. Jackson, trustees, have issued a circular to certificate holders, presenting the following statement of assets and liabilities:

Assets.

Plant, including machinery, drawings, patterns, and fixtures	$95,232
Material in stock	17,584
Cash on hand	475
Current accounts and notes	10,049
Stocks and bonds, par value	70,800
Suspense account	2,009
Accounts and notes	207,498
Total	403,647

Liabilities.

Accounts and notes payable	$28,998
Four notes Atlanta City Street Railway Co *	17,499
Interest and fees to August 31*	1,424
Electric Supply Co.†	4,471
Buffalo Forge Co. (heater contract not filled)†	3,600

* Contingent liabilities to Hugh McMillan.

† Disputed liabilities in suit.

In addition to the above assets there are suits growing out of unfilled contracts in which is claimed $60,975, and suits against W. A. Boland and F. A. Barnaby for $750,000 damages, and $593 accounts garnisheed at time of mortgage.

Horn & Brannen Manufacturing Co. Burned Out.

The extensive gas and electrical fixture manufactory of the Horn & Brannen Company, Philadelphia, one of the largest in the country, was almost totally destroyed by fire on Wednesday night, Oct. 2, causing a loss estimated at between $130,000 and $140,000. The fire originated in the basement at the foot of an elevator shaft running through the building. Fourteen men and two women were working in the building when the fire broke out, but all escaped safely. Insurance almost covers the loss, the closest estimate being that it amounts to $110,000, distributed between thirty or forty companies. Two hundred hands will be temporarily thrown out of work, but only for a short time, it being the expressed intention of the firm to rebuild immediately.

Municipal Lighting.

The question of municipal control of electric lighting plants will, no doubt, receive considerable attention at the next meeting of the American Society of Municipal Improvements, to be held in Chicago next year. At the last annual meeting, held last month in Cincinnati, the number of standing committees of the Society was increased, among the additions being a Committee on Electric Lighting. J. A. Cabot, city electrician of Cincinnati, was made chairman of the committee. His associates are Harold P. Brown, Newark, N. J., and F. W. Cappellen, Minneapolis, Minn.

LEGAL NOTES.

A bill for a receiver and for the foreclosure of a mortgage against the Ottawa, Ill., Electric Railroad has been filed by the Mercantile Trust Company of New York. The mortgage was given to secure $75,000 worth of bonds issued July, 1889. The court is asked to decree that the local creditors who have attached rolling stock and buildings on claims be compelled to stand aside in favor of the mortgagor, as the mortgage was recorded long before the road became indebted to others.

The General Electric Company has filed a bill in the United States Circuit Court for the District of South Carolina against all of the stockholders of the Charleston Light and Power Company. This proceeding aims to enforce the 5 per cent. liability, which under the laws of the State can be collected from the stockholders of an insolvent corporation. (A receiver has been appointed for the company on an action brought by the Atlantic Trust Company of New York.)

In the United States Circuit Court at Hartford, Judge Shipman has passed a final decree in the case of the Edison Electric Light Company against the Bryant Electric Company in a suit on infringement of an electrical patent. The Judge grants an injunction and an accounting.

Judge Townsend, in the United States District Court at New Haven, on the 1st inst., in the suit of the Westinghouse Company and Nikola Tesla against the Thomson-Houston Electric Company, granted an extension of time of forty days to the defendants, whose counsel claimed that they did not have time enough to prepare their case. The parties in the suit have been engaged in taking evidence for about a year, and the time of the defendants for this work expired October 7.

PERSONAL.

Mr. W. B. Vanzwoll has taken an active interest in the Sunbeam Incandescent Lamp Company, Chicago, and has been elected secretary. Mr. F. S. Terry, who formerly held that office, has been made vice-president.

GENERAL NEWS.

What is Going on in the Electrical World.

Bronson, Mich.—At the recent special election the people voted three to one in favor of having electric lights.

Clay City, Ind.—A fire here has destroyed the power house of the Clay City Electric Light Company; the machinery was ruined.

Montclair, N. J.—The Montclair Electric Light and Power Company has applied for a franchise to supply electric lights in Montclair.

Santa Barbara, Cal.—The Santa Barbara Consolidated Electric Company has been awarded the electric street railway franchise lately advertised for sale.

Bordentown, N. J.—The Bordentown Electric Light and Motor Company has been granted a franchise for the erection of an electric light plant in this city.

Dublin, Ga.—The aldermen have employed B. M. Hall, C. E., to make a survey and furnish estimates of the cost of providing this town with electric lights and waterworks.

Catskill, N. Y.—An electric road will be built from Catskill to Windham by a company incorporated under the title of the Catskill, Cairo and Windham Street Railway Company.

Jacksonville, Fla.—There is talk here of building an electric road to Panama Park to accommodote visitors to the grounds which the Jacksonville wheelmen intend to lay out there.

Harrison, Mich.—The township board has granted a franchise to John P. Martz to run an electric road from the foot of the Lakeside boulevard to the North Erie line on the lake shore.

Omaha, Neb.—The city electrician has been directed to prepare plans and estimates for an electric plant to light the city hall, run its elevators and light the public library and an engine house.

Williamsport, Pa.—The trolley line between Sunbury and Selinsgrove has reached a point where it is likely to become a reality. The company is making an effort to secure the right of way.

Oil City, Pa.—A charter has been granted to the Oil City Station Railroad Company, John B. Smith as president, and it is contemplated to build an electric line between Oil City and Franklin.

Hoboken, N. J.—One of the flywheels in the Hudson Electric Light Company's building burst early on Saturday morning, killing the engineer in charge, Carl Anderson, and severely hurting two others.

Seneca Falls, N. Y.—H. D. Lynne, of Geneva, has been awarded the contract for the construction work on the new electric road from Seneca Falls to Geneva. Mr. *Lynne* is one of the projectors of the road.

Beatrice, Neb.—The clerk of the council has been instructed to advertise for bids for supplying the city with *the same* number of electric lights now in use, the old contract having expired some time ago.

Pasadena, Cal.—An ordinance is to be prepared for *the city* council granting a franchise to Prof. T. S. C. Lowe for an electric railway connecting the Southern Pacific road with the Mount Lowe electric railroad.

Frederick, Md.—The board of aldermen has granted the Frederick and Middletown Railway Company a franchise to lay its railroad tracks, erect trolley poles and hang wires through the various streets of this city.

Detroit, Mich.—Detroit's new municipal lighting plant is now in operation, and for the first time in its history the city is in full control of its lighting system. There are about 1,500 electric lamps in place throughout the city.

Woonsocket, R. I.—The Woonsocket Electric Machine and Power Company has given up its franchise for lighting the town of Blackstone, and the authorities of that town have advertised for bids for an electric lighting service.

Glenolden, Pa.—The police and light committee and the highway committee of Glenolden borough council, after considering the question of lighting the borough, decided to have 50 electric lights of 25 c. p. placed at selected points.

New Orleans.—The Orleans Street Railway is being converted into an electric system.—The Traction Company has contracted with the J. G. Brill Company of Philadelphia for forty-five 22-foot cars, some of which have arrived.

San Jose, Cal.—The committee appointed by the board of trade to look into the proposition made by J. F. Pfetch and L. M. Hale to build an electric road from this city to Saratoga has reported in favor of indorsing the project.

St. Joseph, Mo.—The St. Joseph Traction and Lighting Company has sold its property and the company will be reorganized with an increased capital stock. The electric railway will be improved and extended, for which $500,000 in bonds will be issued.

Erie, Pa.—The charter and right of way have been secured for the proposed electric railway between Northeast and this city. The capital stock of the company is $250,000, and the road will be sixteen miles long, with branches running to a number of summer resorts.

Hagerstown, Md.—E. R. Sponseller, of Harrisburg, Pa., and Capt. Seidell, a wealthy Pennsylvania iron manufacturer, are applicants for a franchise for an electric railway in this city. Mr. Sponseller says if a franchise is granted to them they will commence building the road this fall.

Saginaw, Mich.—The township board has granted a 30-year franchise to the Saginaw Street Railway Company.—Besides three projects to build electric railways between Saginaw and Bay City, there is another one in view looking to the construction of a line to Bridgeport, six miles out from Saginaw.

Oshkosh, Wis.—It is authoritatively stated that work on the Interurban Electric Railway will begin in a few days. The line will be built by the Central Wisconsin Electric Railway Company; it will run from Oshkosh to Kaukauna, through the cities of Neenah, Appleton and Menasha, a total distance of 26 miles.

Atlanta, Ga.—The Electricity Building is one of the most admired on the grounds of the Exposition, but the exhibits within do not come up to expectation, chiefly owing to delay in sending or locating them. The General Electric Company occupies the center of the building and its exhibit is complete and attractive.

Tonawanda, N. Y.—Ground has been broken here for the promised experiments in propelling canal boats by electricity, which for some reason unknown did not materialize on the 25th of September, the date set for the test. Frank W. Hawley announces that the experiments will certainly take place as soon as the arrangements are completed.

St. Louis.—Some St. Louis County capitalists are alking of constructing a freight and passenger electric ine from the intersection of Longborough avenue and Gravoir road to Morse's Mill, in Jefferson County, a distance of 35 miles. This would drain a rich farming country which annually transports 50,000 tons of produce, etc., to St. Louis by wagon.

New York.—The sale of the People's Traction Company's franchise, which was postponed from the date set at first, will take place to-day (9th). The North New York Traction Company, it is said, proposes to bid gainst the People's for the franchise, which covers a number of streets and avenues in the northern suburbs, ast of the Harlem river.

Seattle, Wash.—The board of works has published a all for bids for furnishing street lights for 1896, according to the plans under which the present contracts were made. Bids will be received up to 2 o'clock, October 1.—By mutual consent the consolidation of the Union Electric Company and the Seattle Gas and Electric Light Company has been dissolved.

Greensburg, Pa.—The Greensburg and Pittsburg Electric Street Railroad Company has finally decided to close the deal for the Greensburg and Hempfield electric ne. Judge Saddler, of Carlisle, the president of the Greensburg and Pittsburg Company, has agreed to take the road. The road between Greensburg and Jeannette will, it is said, be in operation within thirty days.

Rushville, Ind.—The city council has decided to accept the proposition of the Howe Pump and Engine Company of Indianapolis to construct waterworks and electric light plants in this city. The proposition is to put in a water and light plant for $85,000 on a twenty-year franchise. The Howe Company is to purchase the present electric light plant of the city and run it in connection with the one it is to build.

Knoxville, Tenn.—The old Electric Light Company has been granted a ten-years' franchise for lighting the city at $80 per light.—There is a lively fight in progress between the Knoxville Electric Street Railway Company and the Citizens' Railway Company about laying tracks to the approaches of the bridges and on Central avenue. The council granted the right of way to the latter company, but the other company claims to have a prior right.

Allegan, Mich.—A deal by which Allegan will be connected with Saugatuck and Holland by an electric railroad has been nearly consummated. The name of the proposed road is to be the Holland, Saugatuck & Southeastern, and F. A. Makin, of Benton Harbor, is the general manager. Besides running the cars, the company proposes to string wires and furnish the city with electricity for lighting purposes.

Plattsburgh, N. Y.—The interests of Messrs. Myers, Kellogg and the Inman estate in the Plattsburgh Light, Heat and Power Company, have been purchased by New York parties. Messrs. Myers, Kellogg and Inman are succeeded on the board of directors by H. G. Runkle, of New York, and H. E. Barnard and A. E. Reynolds of Plattsburgh. H. M. Pierson and George M. Cole are the other members of the board as now constituted.

Syracuse, N. Y.—Some Philadelphia capitalists have a scheme in view that arouses much local interest. It is proposed to form a stock company to purchase Pleasant Beach on Onondaga lake and make it an attractive pleasure resort. An electric railway from this city to the beach is included in the plan. Mr. Daly of the Electrical Amusement Company of Philadelphia has been looking over the ground, and has expressed a very favorable opinion of the project.

Montreal, Can.—The eleventh annual report of the Royal Electric Company shows that the net gain on the fifteen months' operations was $106,209.14, out of which five quarterly dividends of 2 per cent. each, amounting to $99,900.10, have been declared, the remainder going to swell the balance of $308,758.98. The lights on the direct current arc system have been increased from 1,617 to 1,666; the lights on the alternating current incandescent system from 40,013 to 53,977, and the motors from 347 to 688 H. P.

Troy, N. Y.—The new electric railway between this city and Averill Park has been successfully operated as far as West Sandlake. The track is nearly completed to Averill Park. The new power station of the road is admirably constructed, and the apparatus is of the most modern design. The plant comprises three upright boilers of 150 horse-power each and two Westinghouse compound condensing engines of 225 horse-power each, connected directly with the generators, which are of the Westinghouse pattern.

Osawatomie, Kan.—Sealed proposals will be received by the board of trustees of the State charitable institutions until 3 o'clock P. M. on Monday, October 14, 1895, at the insane asylum in Osawatomie, for the construction of an electric light plant for that institution. Separate proposals will be received for engines, for dynamos and for counter shaft, or proposals will be received for these three parts complete and in place. Separate proposals will also be received for wiring the buildings complete, and also for the construction of a power house.

Bingham, Utah.—O. B. Hardy and W. J. Moorhead have asked the county court for a franchise to build and operate an electric plant for furnishing light and heat and maintaining and operating electric railroads in the West Mountain district, with headquarters at Bingham. Another purpose is to erect an electrical plant for the precipitation of the copper that is known to exist in the waters of certain springs situated just above this town in the main canyon. The two men agree to light the jail at Bingham during the life of the franchise, free of cost to Salt Lake County. The application was referred to the county attorney.

Hopedale, Mass.—It is reported that the Hopedale Electric Company has been communicating with the big Philadelphia storage battery syndicate in reference to a union with the latter concern. The Hopedale Electric Company was incorporated in 1892 with a cap tal stock of $5,000,000, for the manufacture and equipment of cars on the Stevens storage battery patents. The company had cars in operation by this system on the Milford and Hopedale line when the Brush Company began a suit for infringement and enjoined the company from using the battery. The suit, begun nearly two years ago, has not been terminated.

Philadelphia.—The Union Traction Company has formally assumed control of every street railway line in the city with the exception of the Hestonville, thus completing the scheme of consolidation and putting an end to the many recent reports throwing doubt on the stability of the deal.—The directors of the Electric Storage Battery Company have elected five new directors—Clement A. Griscom, Rudolph Ellis, William D. Windsor and Joseph F. Sinnott, of this city, and Edward Tuck, of New York. Three more directors are still to be elected, all of whom will come from New York. The board will then consist of fourteen members instead of seven.

Boston.—The Railroad Commissioners have given the Lowell and Suburban Street Railway Company authority to issue $176,500 for payment of the floating debt and $63,500 for the purchase of a pleasure park, and specify that the new stock must be sold at not less than $115 per share, which will give the company $202,975 for the floating debt and $73,025 for a park, making a total of $276,000 received on a sale of but $240,000 worth of stock at par value. The company some time ago asked for authority to issue $400,000 new stock, of which $300,000 was to be used to pay the floating indebtedness caused by changing the motive power from horse to electric power, the remaining $100,000 to be for the purchase of a pleasure park.

Milwaukee, Wis.—The "Wisconsin" says: "An electric trolley line offering quick service and cheap transportation from Chicago to the lake region north is what is proposed by the Chicago and Wisconsin Inland Lakes Railroad Company, which has just been incorporated by Chicago capitalists under the laws of Wisconsin. The route of the projected line is not as yet specifically laid down, but it is proposed to run from a central point in Chicago to Madison, with branch lines to all the intermediate lake resorts. If found advisable a line will be run also to Milwaukee, and the entire system further extended. The incorporators and directors of the road are A. E. Case, Frank Boden, S. Marcus Rothschild, A. J. Toolen and G. D. Green. A. E. Case is also attorney for the road. The company is capitalized for $10,000,000."

Waukegan, Wis.—Construction work on the long-proposed electric railroad line between Chicago and Milwaukee has been begun at Waukegan, and nearly one-half of the road will be completed, it is said, by next summer.—The city council has granted an amended ordinance to the Bluff City Electric Street Railway Company, with the right to lay its tracks on five miles of streets. This company has also applied for franchises which will give it the right to extend the line to South Evanston. The plan of the company is to build a line from Waukegan to Evanston. The distance is twenty miles. The line passes through Lake Bluff, Lake Forest, Fort Sheridan, Highwood, Highland Park, Glencoe, Winnetka, Wilmette and North Evanston, and will terminate, if the council allows, at Davis street in Evanston. A franchise will have to be obtained in each one of these towns and villages, and besides one of the grants will have to come from a board of county commissioners. It is intended if the franchises are granted to change the name of the company to the Bluff City Interurban Electric Company and place its capital at $500,000.

Niagara Falls.—A party of directors of the United Tramways Company of Dublin, Ireland, have been recently visiting here. They have come to this country to inspect the various systems of electric railways in the United States and Canada, with a view to introducing the best one on their tramways, which cover the city of Dublin and its vicinity. In the party are William Carte, chairman of the board; John R. Wigham, president of the Dublin Chamber of Commerce; William Murphy, a prominent politician and director of the "Freeman's Journal," and William Anderson, secretary and manager of the company.—Capt. A. E. Hunt, president of the Pittsburg Reduction Company, says that his company will take from the Niagara Falls Hydraulic Company an additional 4,500 horse-power, to be delivered off the shafts of the turbines of the Canal Company. The turbines are to be below the cliff, and the power house, which will also be beneath the bank, at the water's edge, will have six dynamos of 750 horse-power each. The dynamos are being constructed by the Westinghouse Electric and Manufacturing Company of Pittsburg. Above the bank will be the building for the manufacture of aluminum.—The officials of the Cataract Construction Company held a meeting here on Monday of last week, and among other things took up for consideration the Buffalo franchise. Several clauses in the document did not meet the approval of the officials, who decided to accept the franchise if the alterations they submitted were made by the authorities of Buffalo.

COMMERCIAL PARAGRAPHS.

The contract for a 15-ton electric crane, which will traverse the entire length of the main building of the new plant of the Franklin Steel Casting Company, Franklin, Pa., is but one of the number recently closed by the Morgan Engineering Company, Alliance, O.

Those who receive from the Forest City Electric Works, Cleveland, O., the novel reminders they are sending to the trade, will be certain to "bear in mind" the many good points possessed by the Roll Drop Commutator Bars.

The Proctor-Raymond Company, of Buffalo, N. Y., has purchased the business, machinery and stock of the Proctor-Raymond Electric Company, formerly of Rochester, N. Y., and will continue the manufacture of the specialties put on the market by the latter concern.

Joseph Lee, general electric millwright and agent for standard motors and dynamos, has removed his office and factory from Brooklyn to 2, 4 and 6 Reade street, New York.

C. S. Van Nuis, of Ajax Switch fame, 136 Liberty street, New York, is soon to place a new low potential direct current arc lamp on the market.

The Emerson Electric Manufacturing Company, St. Louis, Mo., have issued a very complete catalogue of the many specialties they are now manufacturing.

The Standard Underground Cable Company has secured the contract for furnishing underground cables for the telegraph department of the city of Buffalo, N. Y.

After a competitive test, conducted under severe con tions by the United Electric Light and Power Company

New York, a contract was awarded this week to the Fleming-Spence Electric Company, 654 Hudson street, New York, for a large number of their new type alternating current arc lamps.

Imperial Incandescent Lamps.

In their forthcoming catalogue of incandescent lamps the Bryan-Marsh Company will publish the accompanying table, which is a tabulation by them showing the range of efficiencies in which the Imperial Incandescent Lamp is made. By reference to the table it will be seen that one-watt lamps are now made ranging from 3 to 10 C. P. and from 3 to 16 volts. These very high efficiency lamps are employed by the Electric Storage Battery Company to a considerable extent, as well as for bicycle lamps, train lighting, etc., being used for the latter purpose at an efficiency of two watts per candle.

According to this table sixteen candle power lamps are now furnished of an efficiency of 2.5 watts per candle at commercial voltages ranging from 50 to 125. The Bryan-Marsh Company state that many such lamps are now being used by several large central stations:

Normal Candle Power.	1 Watt.	2 Watt.	2½ Watt	3 Watt.	3½ Watt	4 Watt.
	Volts.	Volts.	Volts.	Volts.	Volts.	Volts.
½	....	....	....	3— 6	3— 8	3— 10
1	....	....	3— 6	3— 7	3— 9	3— 10
2	....	4— 8	4— 10	4— 12	5— 12	6— 15
3	3— 4	3— 4	3— 8	5— 10	6— 12	8— 15
5	5— 8	6— 10	6— 12	6— 16	10— 20	10—120
6	6—12	6— 14	8— 20	8— 30	8— 60	8—120
8	8—12	8— 16	8— 30	12— 40	15—125	20—125
10	10—16	10— 30	10— 35	20— 40	30—125	40—125
16	....	8— 60	8—125	20—125	30—125	40—250
20	..	15— 60	20— 75	30—125	40—250	50—250
25	....	25— 75	40—125	40—125	40—250	40—125
32	....	30— 75	30— 85	40—125	40—250	40—125
50	....	40—100	40—110	40—125	40—125	40—125
75	....	40—110	40—120	40—125	40—125	40—125
100	...	40—125	40—125	40—125	....	....
150	....	50—125	50—125	50—125	....	....
200	....	50—125	50—125	50—125	....	....
300	....	50—125	50—125	....	....	....

BUSINESS HINTS.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Billings, Mont.—It is proposed to erect a brick opera house on Montana ave.

Brooklyn, N. Y.—M. Mulvihill will erect 2 four story double apartment houses, northeast cor. of Lexington and Tompkins ave....S. F. Buckhout will build 3 four story double apartment houses on east side of Franklin ave., south of Java st. .. Postmaster Sullivan contemplates the erection of a handsome residence in the 29th ward.

Buffalo, N. Y.—The owners of the new Guarantee Building, which is under construction at Pearl and Church sts., contemplate putting up a new hotel and theater in the vicinity of Pearl and Franklin sts....The office building to be erected by the Ellicott Square Company will have 1 freight and 15 passenger elevators and the electric light plant will consist of four dynamos and 7,000 lights each of 16 C. P.

Cleveland, O.—Auld & Conger will erect a six story steel building on Prospect st. at once.

Dover, Del.—It is probable that an opera house will be erected in a short time by Harry A. Richardson.

Flatbush (Brooklyn), N. Y.—The buildings to be erected at the Flatbush Asylum are to be lighted by electricity.

Helena, Mont.—The site has been selected for the State building. The building will have complete heating, ventilating and lighting apparatus and an elevator connecting all the floors.

Hoboken, N. J.—L. Beyer, of Hoboken, has prepared plans for the Public Library building which have been accepted by the Library Commission; the structure will be three stories and basement; specifications include steam-heating plant, electric wiring and fixtures, etc.

Kingston, N. Y.—Adolph Richler, proprietor of Hotel Richler, will erect a hotel northeast cor. of Broadway and Dederick st., which will be lighted by gas and electricity.

Minneapolis, Minn.—Minneapolis Chamber of Commerce will be rebuilt and enlarged, to cost $130,000.

New Haven, Conn.—Police Commissioner Roosevelt, of New York City, will build a summer residence near Green Farms, to cost $200,000.

New York City.—Architect John R. Thomas, 160 Broadway, is preparing plans for an eighteen story fire-proof building to be erected on the old Clearing House site, northwest cor. of Nassau and Pine sts., on property recently purchased from the Clearing House Association by Donald Mackay .. Schenk & Schlichts will erect a six story factory, from plans prepared by John P. Voelker, at 22-23 Jones st., which will be heated by steam and lighted by electricity ..Blake & Massey, 30 West 132d st., will erect a five story flat on south side of 38th st., west of Amsterdam ave.; Architects Webster & Thompson, 215 West 125th st.; also 4 five story brick flats, on south side of 88th st., west of Amsterdam ave.; same architects . Frederick Haas, 307 West 38th st., will erect a seven story flat on northwest cor. of West End ave. and 91st st.; Architect W. O. Tait, 65 Fifth ave... Catherine Aste will erect a five story flat at 220 and 222 Sullivan st.; Architect Henry Gilvany, 1 Broadway ...Spencer Aldrich, 107 East 34th st., will build a four story and basement brick dwelling on northeast cor. of West End ave. and 72d st.; Architect G. A. Schlessinger, 128 Broadway... Ella A. Guthrie, 51 Park ave., will erect 5 brick dwellings at 22 Park ave.; Architects McKim, Mead & White, 160 5th ave.

Philadelphia, Pa.—Estimates are being received by Charles Anchter for the erection of the new hall for the Labor Lyceum, to be built at 2d and Cambria sts.. to contain a gymnasium and other improvements essential.... Plans are nearly completed for the Surgical Amphitheater to be erected by the Medico-Chirurgical College and Hospital; the structure will cost about $100,000.

Providence, R. I.—The excavation for the foundation of a hotel has been commenced on Thames st. by Contractor Eugene Leclair; the structure will be four stories, 200 x 40, and contain modern improvements.

INCORPORATIONS.

The Chamberlain Electric Lighting Company, Chamberlain, S. D.—to operate an electric light plant. Capital stock, $10,500. Promoters: C. D. Tidrick, W. L. Montgomery, G. W. Pitts, Chamberlain.

The Archbald Electric Street Railway Company, Archbald, Pa.—to build a street railway in Archbald. Capital stock, $30,000. Promoters: James Kane, Winton, Pa.; Edw. Munley, Michael J. Moran, Archbald.

The Des Moines Heating Company, Des Moines, Iowa—to purchase, build, maintain and operate steam and electrical plants. Capital stock, $100,000. Promoters: M. P. Turner, I. S. Polk, G. B. Hipper.

The Electric Arc Light Company, New York City—to deal in electrical appliances. Capital stock, $100,000. Promoters: Lionel Sutro, L. B. Marks, H. C. Skelly, New York City.

The Citizens' Light, Heat and Power Company, Columbus, Ohio—to establish and maintain an electric plant and furnish electricity to the public. Capital stock, $200,000. Promoters: Chas. S. Knight, Thos. Cooper, David C. Beggs, Ronald T. McDonald, Ralph R. Rickly.

The Vandergrift Water Company, Vandergrift, Pa.—to operate an electric light plant. Capital stock, $1,000. Promoters: S. H. Vandergrift, Geo. Mercer, Jr., Vergyl Preston, Pittsburg, Pa.

The Croton Valley Electric Railway Company—to construct a narrow gauge street surface railroad, about four miles long, from the New York Central Depot in Croton-on-Hudson to the new Cornell Dam. Capital stock, $10,000. Directors: Charles E. Grattan, Edward White, Robert B. Wright, and others of Croton-on-Hudson.

The Marine Electric Propeller Company, Minneapolis—to manufacture electric boat propellers. Capital stock, $27,500.

The Troy, Tippecanoe & Dayton Railway Company—to build and operate an electric railway between Troy, Ohio, and Dayton, by way of Tippecanoe, taking the most practical route. Incorporators: Theodore Sullivan, George S. Long, Geo. W. Scott, J. F. Knopp, Philip J. Gates, W. R. Thompson, F. M. Sterritt and W. H. Weekley. Messrs. Knopp, Gates, Thompson, Long, Sullivan and Scott are residents of Marion County, Ohio, while Weekley lives in Dayton. Mr. Sterritt is a brother of Dr. J. A. Sterritt, formerly Representative from Marion County.

The Wetheredville, Franklintown & Edmondson Avenue Electric Railway Company has filed articles of incorporation in the clerk's office at Towson, Md. The capital stock is $25,000. Incorporators: William Ferguson, Joseph Henry Judik, Charles W. Dorsey, Dr. Joseph C. Monmonier and Levi Z. Conden.

The Central New York Light and Power Company—to supply electricity in Oneida and Canajoharie and in places within five miles of these villages. Capital stock, $100,000. Directors: H. Walter Webb and Wm. H. Gelshennen, of New York City; Wm. J. Arkell, of Canajoharie, Judson M. Warner, of Oneida, and Alden M. Young, of Waterbury, Conn.

The Irondequoit & Lake Shore Electric Railroad Company—to construct a street surface road from Forest Lawn, in the town of Webster, Monroe County, N. Y., to a point near the intersection of the shore of Lake Ontario with the easterly bank of the Genesee River in the town of Irondequoit. Capital stock, $100,000. Directors: A. J. Johnson, Joseph C. Tone, Joseph A. Johnson, Frank W. Elwood and Edward S. Ellwanger, of Rochester; E. O. McNair and David W. McNair, of Warsaw, N. Y.

Articles of association have been signed for the formation of a new electric street railway company in Dedham, to be known as the Norfolk Central Street Railway. The line is to be ten miles long and of standard gauge. The board of directors is composed of Hon. R. Bullard, Thomas T. Robinson, Dr. John W. Chase, Henry C. Delano, Ferdinand F. Favor, all of Dedham, Mass.; Francis Doane, of Norwood, and A. R. Whittier, of Boston.

The Monroe Electric Railroad Company, of Monroe, Mich.—to build a street railway from the eastern to the western city limits of Monroe, with a view of extending it to Dundee. Capital stock, $50,000. Incorporators: F. C. Rauch, A. B. Bragdon, F. G. Strong, Fred. H. Humphrey and W. H. Cowles, of Monroe; George M. Jewett, of New York; George M. Stearns, of Chelsea, Mass., and L. E. Walkins, of Boston. The following officers were agreed upon: President and manager, W. H. Cowles; secretary, F. G. Strong; treasurer, L. E. Walkins.

The Chicago Electric Street Railway Company, Chicago, Ill.—to construct, equip and operate street railroads and subways in the City of Chicago. Capital stock, $5,000,000. Promoters: Sherman D. Parnia, John Parrott, O. W. Larson.

The Merced Falls Electric Power and Manufacturing Company, San Francisco—to furnish electric power for operating mines, railroads, electric light for cities, towns; deal generally in land and water rights, etc. Capital stock, $1,000,000. Directors: R. H. Duncan, Herman Juan, San Francisco; Augustus Laver, Alameda; Basil Owen, London, Eng.

The Equitable Electric Light Company, of Baltimore County, Baltimore, Md.—to supply electric light and power. Capital stock, $50,000. Incorporators: Henry A. Parr, John Cowan, George R. Webb, J. William Middendorf and Richard R. Culbreth.

The Shuttleworth Electric Company, Camden, N. J.—to manufacture, lease, buy and operate electrical apparatus, motors and other articles, etc., for the utilization of the electro-magnetic induction system of propulsion devised by the said Stephen C. Shuttleworth and known as the Shuttleworth system. Capital stock, $100,000. Promoters: Alphus C. Shuttleworth, Hugo M. Quinn, Philip R. Wells, Howard A. Engle, W. Howard Holden, Louis F. Brons, Frankford, Pa.; John L. Burk, Holly Beach, N. J.

The Dwyer Motor Company, Portland, Me.—to manufacture gasoline, petroleum, electric and other motors. Capital stock, $100,000. President, George H. Hewitt; treasurer, Theodore N. Lute, both of Springfield, Mass.

The Safety Electric Elevator Company, San Francisco, Cal.—to construct, build, sell and deal in elevators; manufacture and generate electric power, light and heat; deal in patent rights, etc. Capital stock, $100,000. Promoters: John W. Gentry, John Cushing. N. W. Spaulding, R. D. Hunter, Oakland; Jeffrey Jacob, Fruitvale, Cal.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

OCTOBER, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	1.40 A. M.	1	5.10 A. M.
2	2.40 "	2	5.10 "
3	No light.	3	No light.
4	"	4	"
5	"	5	"
6	6.00 P. M.	6	7.30 P. M.
7	6.00 "	7	8.10 "
8	6.00 "	8	8.50 "
9	6.00 "	9	9.50 "
10	6.00 "	10	10.50 "
11	6.00 "	11	12.00 M.
12	6.00 "	13	1.00 A. M.
13	6.00 "	14	1.10 "
14	5.50 "	15	2.30 "
15	5.50 "	16	3.50 "
16	5.50 "	17	5.30 "
17	5.50 "	18	5.30 "
18	5.50 "	19	5.30 "
19	5.50 "	20	5.30 "
20	5.50 "	21	5.30 "
21	5.50 "	22	5.30 "
22	7.00 "	23	5.30 "
23	8.00 "	24	5.30 "
24	9.20 "	25	5.30 "
25	10.20 "	26	5.30 "
26	11.00 "	27	5.30 "
27	11.30 "	28	5.30 "
28	...... "	..	....
29	12.30 A. M.	29	5.30 "
30	1.30 "	30	5.30 "
31	2.30 "	31	5.30 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCTOBER 1, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

547,068. Electric-Motor Truck. William G. Gaither and William R. Gaither, Chicago, Ill. Filed Nov. 10, 1894.

547,077. Electric-Railway Repair-Wagon. Anthony Iske and Albert Iske, Lancaster, Pa. Filed Dec. 18, 1894.

547,283. Trolley and Trolley-Pole. Wilbur L. Pepper, Philadelphia, Pa. Filed Dec. 29, 1894.

547,302. Electric Motor for Street-Cars. William Stine, Omaha, Neb. Filed Jan. 11, 1895.

547,304. Conduit Supply System for Electric Railways. George Tolmie, Carbon, Wyo. Filed July 10, 1894.

547,369. Device for Controlling Speed of Electric Cars. James Brady, Brooklyn, N. Y. Filed June 24, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

547,106. Hanger-Board for Electric Arc Lamps. Thomas E. Adams, Cleveland, O., assignor to the Adams-Bagnall Electric Company, same place. Filed July 17, 1895.

547,127. Electric-Arc Lamp. Johan W. T. Olan, New York, N. Y. Filed April 8, 1893.

547,246. Mast-Arm for Electric Lamps. John I. Drake, Providence, R. I. Filed Feb. 21, 1895.

547,249. Incandescent Lamp. Henry Green, Hartford, Conn., assignor to the Ætna Electric Company, same place. Filed Jan. 25, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

546,996. Armature for Electric Motors and Dynamo-Electric Machines. Henry Chitty, London, England. Filed July 26, 1892.

547,043. Rectifier for Electrical Currents. William J. Still, Toronto, Canada, assignor to William Burrowes Close, same place. Filed Dec. 24, 1894.

547,069. Rotary Field-Motor. Johannes H. F. Georges, Berlin, Germany, assignor, by mesne assignments, to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Oct. 10, 1893.

547,323. Electric Motor. Addison E. Boggs, Allegheny, and Fremont J. Cleaver, Beltzhoover, Pa. Filed Jan. 4, 1895.

547,383. Reciprocating Electric Engine. Frank B. Rae, Detroit, Mich. Filed May 31, 1892.

TELEPHONE AND TELEGRAPH APPARATUS.

547,265. Telephone. Harry T. Johnson, Elizabeth, N. J. Filed June 18, 1894.

547,388. Telephone-Exchange System. Ernest E. Yaxley and John H. Riley, Chicago, Ill., assignors of one-half to Le Roy Brown, same place. Filed Jan. 14, 1895.

547,405. Telephone-Toll Apparatus. George K. Thompson, Malden, Mass., assignor to the American Bell Telephone Company of Massachusetts. Filed May [illegible] 1895.

MISCELLANEOUS.

547,031. Contact for Electrically-Propelled Vehicles. Emil B. W. Reichel, Charlottenburg, Germany, assignor, by mesne assignments, to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed April 4, 1894.

547,034. Electric Vibrator Mechanism. Frank J. Russell, New York, N. Y., assignor of one-half to Horace See, same place. Filed April 15, 1895.

547,035. Electrical Indicating Mechanism. Frank J. Russell, New York, N. Y., assignor of one-half to Horace See, same place. Filed April 15, 1895.

547,072. Electric Device for Controlling Actions of Musical Instruments. Frederick W. Hedgeland, Chicago, Ill., assignor to the W. W. Kimball Company, same place. Filed Feb. 23, 1894.

547,078. Electrical Junction-Box. Warren S. Johnson, Milwaukee, Wis. Filed Jan. 21, 1895.

547,120. Insulating Compound. Salomon Heimann, New York, N. Y., assignor of eleven-twentieths to Leopold Katzenstein, same place. Filed Feb. 28, 1895.

547,149. Electric Switch. Norman Marshall, Boston, Mass., assignor to the Anchor Electric Company, same place. Filed June 8, 1895.

547,215. Portable Electric Drill. John W. Jamison, Vallejo and John M. Edmunds, Napa, Cal. Filed Dec. 5, 1894.

547,230. Automatic Electric Switch. George W. Russell, Jr., and Alexander V. Officer, Denver, Col. Filed March 18, 1895.

THE TELEPHONE WORLD.

THE BERLINER PATENTS.

To the Editor of ELECTRICITY.

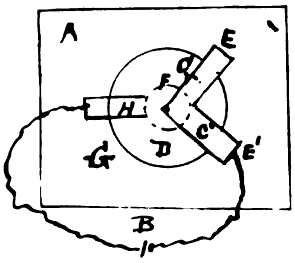
Sir: The queries of your correspondent, and more particularly your answers, in your issue of September 11, relative to the Berliner patent, interested me very much. There is hardly a paper devoted to the subject of electricity that does not contain an advertisement worded as follows: "The American Bell Telephone Company.—This company owns Letters Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined telegraph and telephone covering all forms of microphone transmitters or contact telephones." Allow me to take issue with you and with the assumption contained in the above copied advertisement.

There is no disputing that the Bell owns a patent on a certain kind of microphone, but I for one will not sit quietly by and let a corporation appropriate unto themselves that which I believe belongs to the public. Hence please allow me to give through the columns of your valuable paper the grounds upon which I base my denial.

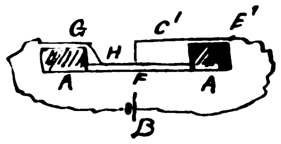
You say Berliner's disclaimer is an acknowledgment by him that a method of which his was relatively but a species had existed before his invention. How does Bell's genus, viz., the method of producing undulations in a continuous voltaic circuit by gradually increasing and diminishing the resistance of the circuit differ from Berliner's genus, viz., the method of producing in a circuit electrical undulations similar in form to sound waves by causing the sound waves to vary the pressure between the electrodes in constant contact? For my part I see no difference; both commence with the words "The method of producing." Here Berliner adds the words "in a circuit electrical," which are the same kind of undulations understood by Bell's undulations. Both use the word "undulations." Bell adds after the word undulations "in a continuous voltaic circuit," which can be done only when the electrodes are in constant contact. The idea is the same in both. Berliner modifies his undulations by "similar in form to sound waves." Bell's whole patent refers to nothing else but sound-wave undulations. Both are the same in this respect. Right here Berliner still adds "by causing the sound waves to vary the pressure between the electrodes in constant contact." He says in his disclaimer, "Neither do I claim that I am the first who caused electrical undulations similar in form to sound waves by varying the resistance of an electric circuit in which a current was passing," which throws out the fore part of Berliner's broad claim up to and including the words "sound waves." Now, it remains to be seen whether "by causing the sound waves to vary the pressure between electrodes" was first invented by Berliner. I turn to page 540 U. S. Rep., vol. 126, and read: "Reis discovered how to reproduce musical tones." (Reis died in 1874.) Musical tones are sound waves. On page 290 U. S. Rep. are shown two diagrams used by the Bell's attorney and described as follows:

"The transmitter A consists of a hollow box about four inches square and deep. The top or cover is pierced with a round hole over which is stretched a membrane about 1¼ inches in diameter. To this is cemented a strip of flexible platinum foil (H in the diagram). A piece of brass (C, C′ in the diagram), shaped like two sides of a right-angled triangle, is provided at the angle and at each extremity with a little leg made of a small pin of platinum, so that it can stand on the three like a tripod. Two of these legs (E, E′ in the diagram) rest on the frame of the instrument, while the third, placed at the angle, rests on the spatula-shaped end of the platinum foil, H, at the center of the diaphragm. The instrument is so connected with a battery, B, that when at rest the current flows to the foil at G, through the foil H, to the platinum leg resting on it at F, through one branch C, on the angle piece to its leg at E, which is connected with a wire leading back to the battery."

Now it is evident to any telephonist that by the third platinum leg resting on the foil H the force of gravity would make the electrodes to be in constant contact. Any vibrations up to vibrations of a certain amplitude would impart similar vibrations to the platinum leg without breaking the contact. This is what Reis succeeded in doing, for he says: "The consonants are for the most part reproduced pretty distinctly, but the vowels as yet not in an equal degree" (U. S. Rep. 126, page 42). That is, the vowels produced vibrations of too great amplitude for the platinum electrodes. And had he the delicate receiver of the present day, he could have reproduced a conversation carried on in a whisper. The pressure was caused by the voice—in other words, sound waves. All that was lacking to make this a good transmitter was the carbon in the place of the platinum. Without the carbon of Edison, Berliner's transmitter will not transmit any better than a Reis. It was not the Berliner that brought the microphone up to a commercial success, it was the Edison carbon. Blake's transmitter was modeled after Reis's and not after Berliner's.



The Supreme Court says: "It is not contended that Reis had ever succeeded in actually transmitting speech, but only his instrument was capable of it if he had known how." Again: ". . . it was not until after Bell's success that he found out how to use a Reis instrument so as to make it transmit speech. Bell taught him what to do to accomplish that purpose." (U. S. Rep. 126, pages 542–545.) What did Bell do to make a Reis instrument transmit speech? It was the invention of the magneto receiver, and the introduction of a carbon leg in the place of the platinum wire. Speaking against the Reis diaphragm in a loud tone would cause a make and break contact, so will the same loud sound against the Berliner diaphragm break the contact, and a very loud sound against a Blake transmitter will do the same, thereby making an unintelligible blurring noise. How many times we hear spoken over the 'phone, "You speak too loud; speak lower." This is because the loudness of the voice causes the electrodes to make and break contact. Berliner's is not a telephone for the same reason that Reis's is not. Now what is left of Berliner's so-called broad claim, not before invented? Only what is claimed in the words "as described," which shows a metal ball C terminating the screw-threaded rod B. This piece of mechanism is truly novel and patentable.



You say that Bell's fourth claim "distinctly describes a genus method to which Berliner's is a species, and is evidently exactly what Berliner referred to in his disclaimer." Berliner certainly knew that Reis had produced an instrument which he (Reis) named a telephone, which instrument was so constructed as to be operated by sound waves. These sound waves increased and decreased the resistance of the circuit at the point F, even if it did at times make and break the circuit. May we not suppose that Berliner's disclaimer not only disclaims what Bell and Gray had accomplished but also what all other inventors previous to Bell had solved and produced in the variable resistance field? Is it not this very disclaimer which will save Berliner's claims one and two from annulment by the Supreme Court?

If Berliner had used in place of the words "sound waves" the term articulate speech waves, we might then accord to him the generic patent on that kind of a microphone. But for him to claim credit for what had been done years before is plagiarism of which I do not accuse him. You say Bell intended to cover all methods of producing undulatory currents by varying the resistance of the circuit. Is Bell guilty of plagiarism? He is if your construction of his intentions are correct. The Supreme Court admits that others long prior to Bell transmitted tones through the agency of a battery telephone; and since experience has proven that in no other way can sound waves be transmitted by the agency of a battery 'phone other than that of varying the pressure between the electrodes, practically speaking it is an admission on the part of said Court that others long before Berliner's day caused sound waves to vary the pressure between the electrodes in constant contact. These earlier inventors, Reis and others, may not have arrived at the true theory of such transmission. They may have supposed that their instruments in reproducing sound waves did so by making and breaking the circuit at each wave. But this is not so, as Bell proves in his specification of his first patent. Tones cannot be produced by making and breaking the circuit. Reis produced tones. The Supreme Court admits this. A click can be heard when a make and break contact has been made, or a blurring noise, but no tones. The Supreme Court says: "Reis discovered how to reproduce musical tones; but he did no more. He could sing through his apparatus, but he could not talk" (U. S. Rep. 126, page 540). This can only be done by varying the pressure between the electrodes. "It is not contended that Reis had ever succeeded in actually transmitting speech, but only his instrument was capable of it if he had known how" (*Ibid*, page 542). Here is an admission by the Supreme Court that Reis's instrument was capable of transmitting speech if he had known how; that is, if he had used carbon instead of platinum, and the use of a magneto 'phone receiver. A Berliner microphone is no better than the Reis, and in proof of this, it has never been in commercial use. Neither has the Berliner, through any improvement or improvements, paved the way to make a battery 'phone a success. All improvements in the microphone have been in the line of the Reis and not Berliner. In witness of this, see Reis's microphone of 1861, modeled after the human ear.

In view of the facts as herein presented, how a person can say that the Berliner is a generic patent is beyond my comprehension. If Berliner had been the first in this field I would be the last to rob him of that which is rightfully his, but on the other hand I cannot too highly condemn the inventor who seeks fame from the product of some other inventive brain.

Chicago, Ill. HELLO.

[Bell's method of producing electrical undulations was the broad one of causing the sound waves to vary the resistance in a similar manner. This covers broadly all possible methods by which sound waves may vary the resistance of an electrical circuit for telephonic purposes. It is unqualifiedly a generic claim. Bell specified several methods, one of which was by varying the depth of immersion of one of the electrodes in a liquid connected with the other. The specific methods named by Bell in his patent are now public property because that patent has expired. He did not mention the method of varying the pressure between electrodes in constant contact, and there is no indication that he knew that such a method would produce the results desired. Berliner claims to have discovered that this method was effective and patented it. The qualifying clauses which our correspondent quotes are essentially the same in both patents except the one in Berliner's "by causing the sound waves to *vary the pressure* between electrodes always in contact." This clause differentiates Bell's device and Reis's from Berliner's.

From the sketches and our elaborate explanation it will be perfectly clear that Reis did not anticipate Berliner, because Reis's idea was not to vary the pressure between electrodes *always in contact* but to *break* the contact. By Reis's method there was no possibility of producing electrical waves exactly similar to the waves of the human voice. By Reis's method the waves were all of exactly the same height, the only possible variation being the frequency with which they might follow each other, which constitutes the *pitch* of a musical note. That is but a minor factor in articulate speech but an essential in music. Just what were the essentials to speech, there is no evidence that Reis knew. If it could be proved that he did not endeavor to have his transmitter interrupt the circuit it might be inferred that he did know, but the very construction of his instrument is evidence almost indisputable that he did not understand the proper principle. Had he understood it, it would have been a very simple expedient either to have made his triangular electrode heavier or to have maintained its contact with the diaphragm by means of a spring.

We do not think that Bell is guilty of plagiarism. His great discovery was not how to make sound waves vary the resistance of a circuit, but that if sound waves were caused to vary the resistance of the circuit so as to produce electrical waves in that circuit which were *similar* to sound waves, then he could transmit articulate speech. Reis had already caused sound waves to vary the resistance of the circuit—had caused them to interrupt the circuit, but the current flowing under these conditions bore no resemblance in its variations to the sound waves which cause the variations.

Our correspondent is away off when he says "since experience has proven that in no other way can sound waves be transmitted by the agency of a battery 'phone other than that of varying the pressure between the electrodes," for experience has proved just the contrary. His conclusions therefore have no basis in fact.

He is again wrong in his statement that "tones cannot be produced by making and breaking the circuit." Tones *can* be so produced and were so produced by Reis and others. All the conclusions based on this premise are also, therefore, fallacious.

On what does "Hello" base his statement that "all improvements in the microphone have been in the line of the Reis and not the Berliner (method)?"

He seems to be very positive in all of his statements, but at the same time shows such a lamentable ignorance of the subject of acoustics and the art of telephony that we would suggest more moderation in future in his controversial essays.—Ed.]

Why the Bell Company is a Trust.

To the Editor of Electricity.

Sir: The movement to prevent the illegal combination between the American Bell Telephone Company, the Western Union Telegraph Company, the Western Electric Company, the American Telephone and Telegraph Company and the licensees of the Bell Company has not taken the form of an action by the Telephone Protective Association, or by the Western Telephone Construction Company particularly. The writer has assumed the responsibility.

In the writer's opinion the Western Union and American Bell contract is clearly in violation of Federal and State laws. This contract provides that the Western Union will withdraw from competition; that the Bell Company will monopolize the various telephone interests of the country, including the purchase or control of telephone patents desired for this purpose.

The contract further provides for a minimum rate at which telephones shall be put out. Prices were raised; competition was specifically agreed against. A stipulating clause provides that $15.00 be the net price, or royalty, demanded by the Bell Company upon the telephone exchange subscriber's station from the licensee. The contract further provided, specifically, that reduction in these prices be made when, for the interest of this combination, it became necessary to throttle competition. In conformity with this agreement the monopoly has directed its licensees to cut the rates.

These cut rates, and this policy of oppression, where competition is started, are so clearly in pursuance of this illegal combination that there is no question in the writer's mind but that telephone exchanges throughout the United States, which are met with this sort of oppression, will ask for restraining injunctions, and get them.

This is the most gigantic and monstrous effort for the annihilation of competition that the writer has ever heard of. A specific written agreement, which plans the stifling of competition; the raising of rates; the monopolization and exclusive control of the greatest industrial art of the day, even to the extent of buying up and side-tracking other inventions, is so disastrous to public policy that the writer cannot rest while it stands.

It seems that some one had to take hold of it in order to have it done, and, while overburdened with duties of another nature, I hope to find time to prosecute my efforts in this direction to a successful conclusion, believing thoroughly and firmly that I am right and that it is necessary for some one to bear the burden and responsibility.

Already this movement has been charged as an effort to affect Bell stock. You know that the writer has no interest whatever in Bell stock, except as it might be affected in the just, open right of people to do a telephone business at this time. I expect to be charged with all sorts of motives, but this will have no effect. The combination seems absolutely and clearly unlawful and the sooner it is broken the better.

The Bell Company has spent a tremendous amount of money invoking the law to aid them in maintaining a monopoly. They have flaunted their patents in the faces of almost every court in this country. They have hidden this unlawful compact from the public. It is to be hoped that the law will now sustain itself against their illegal conspiracy as fully, or one-hundredth part as fully even, as it has been sustained to maintain that monopoly.

Data is being prepared to properly present in the form of a petition; and as the Bell Company seems to love law so well, possibly it may have misinterpreted its meaning as affecting them.

Very truly,
J. E. Keelyn.

Chicago, Ill., September 24, 1895.

To Sell Telephone Privileges.

An ordinance has been introduced in the select council of Philadelphia, authorizing the Mayor to have plans and specifications prepared for the construction of a public telephone system, and to advertise for proposals for the sale of the privilege to construct, maintain and operate the system. The ordinance requires companies bidding for the privileges to specify what percentage of gross receipts they will agree to pay for, and the shortest time in which they will obligate themselves to construct a complete telephone service.

Bidders must submit satisfactory evidence of their financial ability to carry out any contract to be made with the city, and of the efficiency of the apparatus proposed to be employed, and of their right to use the same. The successful company is to be awarded all necessary street and underground privileges and is empowered to lease any underground system owned by other companies. It shall furnish for the free use of the city one duct in its conduits, and shall maintain telephones in all of the State, county and municipal offices, including police stations, public schools and hospitals.

The company shall fix in its bid the maximum cost of its annual service and shall afford any companies applying for the same entrance to its exchanges and facilities for telephonic communication with its subscribers. The company securing the contract shall pay a license to the city and give a bond in the sum of $100,000. It is forbidden to sell or lease to any telegraph or telephone company or corporation or individual the rights and franchises conferred by this ordinance, under the penalty of making all the grants obtained under its provisions null and void.

"Doing a Valuable Work."

To the Editor of Electricity.

Dear Sir: Having read with much interest several articles in your valuable publication, touching upon the telephone situation, and believing that you are doing a valuable work, as an interested party I herewith enclose a voucher for the subscription price of your journal for one year.

It may be of interest to you to know that we have an exchange here in full operation, using 300 phones. The Bell Company has put forth every effort to defeat us, but the people are standing right by us. I have secured a franchise and am at work on the construction of a plant at Charleston, W. Va., having 250 subscribers signed for five years.

I fear that the manufacturers are not as active as they should be in defending the various suits brought by the Bell people.

Very truly yours,
The Lynchburg Telephone Company,
W. P. Roberts, President.

Lynchburg, Va., September 30, 1895.

Will Pay to Be Sued.

That there are some telephone manufacturers who have not become frightened by the threats of suits by the Bell Company is made evident by a recent declaration from the Manhattan Electrical Supply Company, New York. This company has issued a card to the trade in which they make the following statements:

"We will pay $100 for the privilege of defending a suit brought by the Bell Telephone Company on the Berliner patent against dealers or users of our telephones; the action to be brought in any State in the Union. To the first person who can induce the Bell Telephone Company to bring suit against them in the State of New York for infringing the Berliner patent by using or selling our telephones, we will pay $300 cash, provided we are furnished with evidence of such action and authority to defend the suit."

A New Cable to the West Indies.

The United States and Haiti Cable Company has chartered the cable steamer Mackay-Bennett, owned by the Commercial Cable Company, for the purpose of laying the first section of a submarine cable to connect New York direct with Haiti, West Indies. The United States and Haiti Company will handle business for the West Indies, Venezuela, the Guianas, and Brazil. The Board of Directors of the company, which is an American corporation, are John W. Mackay, George G. Ward, J. W. Mackay, Jr., A. B. Chandler, and Albert Beck.

Ask for a Receiver.

Suit has been brought at Indianapolis, Ind., by W. C. McCurdy and David B. Smith for the appointment of a receiver for the Phœnix National Telephone Company. It is alleged that the defendant company made a contract with the plaintiffs to construct telephone exchanges at Huntington, Shelbyville and several other towns in Indiana, and that they have refused to pay the 5 per cent. due under the agreement.

Telegraph and Telephone to be Combined.

The Swedish state telephone authorities are about to combine the telephone with the state telegraph system. In future every subscriber will be allowed to make use of his telephone address as his telegraph address, which will entitle him to the free transmission of telegrams between the telegraph office and the subscriber's telephone.

Bell Telephone Output.

The American Bell Telephone Company's output for the month ending September 30 was: Gross, 18,318, increase, 9,084; returned, 5,659, decrease, 1,007; net, 12,659, increase, 10,091. For the fiscal year ending September 30: Gross output, 128,223, increase, 65,845; returned, 61,510, increase, 7,864; net output, 66,713, increase, 57,981.

Another Company Feels the Pressure.

The Philadelphia Telephone Company, which has been doing business from "P. O. Box 707," Philadelphia, has sent out the following: "Owing to patent litigation we are compelled to suspend business in the telephone line."

Another Atlantic Cable.

A contract has been signed for laying a cable from Brest to New York, to connect the French telegraph system with the Antilles.

The capital stock of the Electric Messenger Company, the vigorous anti-Bell Telephone Company of Pittsburg, Pa., has been increased from $250,000 to $1,000,000 and it has been decided to push the work of construction as rapidly as possible. Already a line has been constructed from Wilkinsburg to a point several miles beyond Greensburg. The line will be continued east, and it is expected that Altoona will be reached before the close of winter. No attempt will be made to lay the underground system in Pittsburg before spring, as an ordinance forbids the tearing up of paved streets after October 1. The main line of the company will parallel the Pennsylvania Railroad to Philadelphia, with branches into populous districts. The general charter also includes lines through the Ohio, the Allegheny, the Monongahela and Youghiogheny valleys, and along the principal railroads to the great lakes.

Negotiations are under way whereby the Western Electric Telephone Company of West Union, Ia., will become an ally of and connected with the La Crosse Telephone Company of La Crosse, Wis., in the construction of a line which will connect the principal cities of Southern Minnesota and Northern Iowa.

The Farmington Telephone Company, Uniontown, Pa. has let the contract for the extension of its line to Gibbons Glade via Elliottsville. C. W. Leib and John Umbel are the contractors. They expect to have the line completed by October 15. The line will be extended into West Virginia.

The Richmond Standard Telephone Company, composed of Richmond and Manchester men; the Home Telephone Company, which is backed by Baltimore men, and two New York telephone contractors are bidding for a telephone franchise at Richmond, Va.

The opening of the exchange of the Phœnix Telephone Company at Altoona, Pa., has brought the Bell Company rates down to $1.75 and $1.25 per month. The Phœnix Company's rates are $2 and $1.50 per month.

The Cazenovia Telephone Exchange, Cazenovia, N. Y., has upwards of one hundred subscribers. This exchange is operating apparatus designed by D. H. Fitch, manager of the Beehive Electric Works, Cazenovia.

Plans are being prepared for placing the fire and police signal wires underground in Providence, R. I. An appropriation of $30,000 has been made to complete the work.

A. H. King, Jacksonville, Fla., is receiving bids for the complete installation of a telephone exchange plant of five or six hundred instruments.

An ordinance has been recommended to the city council of New Orleans, La., which requires the laying of all telegraph, telephone and electric light wires underground.

The Central Union Telephone Company has made a further reduction in rates to $20 and $15, to meet the competition of the new exchange at Champaign, Ill.

The Central Pennsylvania Telephone and Supply Company, Williamsport, Pa., has issued $120,000 thirty year six per cent. bonds to fund the floating debt of the company.

At request of the city authorities, the wires of the Western Union Telegraph Company will be placed underground at Bay City, Mich.

F. M. Zempe, J. W. Corbett and T. E. Goodale are interested in the formation of the Camden Telephone Company at Camden, S. C.

The Southwestern Telegraph and Telephone Company will shortly begin work on an underground system at Houston, Tex.

G. E. Huguley, mayor, will be manager of the new telephone exchange to be built at Barnesville, Ga.

B. W. Sharborough & Company are constructing a telephone system at Paulding, Miss.

A local exchange company is being organized at Henderson, N. C.

An automatic exchange plant is to be installed at Coudersport, N. Y.

A telephone company has been organized at Waverly Ohio.

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THE AMERICAN NEWS COMPANY,

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EDITORIAL NOTES.

The Lenox Ave. Conduit Railway Every now and then the world is startled with the announcement that some existing want has been almost miraculously supplied. The world accepts these claims with undoubting faith, because the world at large does not reason closely, and because, as Barnum realized, it likes to be fooled. The engineer, however, is not of this class. He is cold and calculating, a cynic and an iconoclast, if you choose, and when these statements are made he sets himself down and *figures*. He may be willing to admit at once that the thing *can* be done in the specified way, but there is no sentiment about him—he wants to know if it will *pay*. If it will not, then to him it has no attractions and it might just as well not be invented.

There has, it is true, been a popular demand for a conduit electric railway system, and an example of such construction has for some time been in operation on Lenox avenue, New York City. This, from the start, has been heralded abroad as a successful solution of the problem, and Mr. John D. Crimmins is quoted as having proclaimed, after a few weeks' trial of the system under fair-weather conditions, that experience with it showed "that the saving in operating expenses is four cents per car mile as compared with cable traction and eight cents per car mile as compared with horses."

Let us as engineers consider this statement a little.

In the first place the conduit and roadbed are in this case exactly the same as they would be were cable instead of electricity the motive power, so that there can be no economy in these items. If any change were required it would be in the way of heavier and therefore more expensive construction for the electrical use, on account of the greater weight of the motor cars. For electricity an efficient drainage of the conduit far beyond that required for cable is a first requisite, so that we may say that if there is any difference in the cost of these items it will be in the direction of greater cost for electric traction; but for the purposes of our argument let us assume that this part of the investment is the same for cable and electricity.

The Lenox Avenue road consists of $2\frac{3}{8}$ miles of double track, upon which are operated at present 12 cars supplied with current from a station located at one end of the line and delivering current at a nominal voltage of 300. As a matter of fact, the voltage at the terminals of the generator is 350 volts, and at the further end, when all 12 cars are running, is 250 volts, or in other words the drop at the end of the line with 12 cars in operation is 35 per cent. These are actual figures, and the road as it stands is not a commercial project or an engineering feat worthy of the name. According to accepted engineering practice in overhead construction the drop in line should not exceed 10 per cent. The Lenox Avenue road is, therefore, throwing away 25 per cent., not of its coal alone, but of its manufactured power (which is a far more serious matter) over and above what is allowable in the overhead system; it means also that 25 per cent. more of boilers, engines and dynamos must be installed, and further than this, it is difficult to see how satisfactory or even tolerable service can be gotten out of motors subjected to a variation of 35 per cent. in voltage.

At present no feed wires have been installed, and it is manifestly unfair to criticise a road whose installation is confessedly incomplete.

Let us take it, therefore, as it is intended to be. It has been announced that eventually there will be 50 cars in operation and that the drop will be equalized by the proper use of feeders. What does this mean in the way of investment in copper with an initial voltage of 350?

Evidently the most favorable distribution of load would be that obtaining when the cars are uniformly distributed throughout the length of the road. The average distance then from the station of all the cars would be half the length of the road, or $1\frac{3}{16}$ miles. The length of feeders—outgoing and return—for each track would be $2\frac{3}{8}$ miles, and allowing 15 K. W. for each car would give for 25 cars a requirement of 375 K. W., which at 350 volts means a current of 1,071 amperes.

If a drop of 10 per cent. in the feeders is allowable, this means the placing of sufficient copper so that in the outgoing and return feeders $E = R\,C = 35 = 1071 \times R$, or $R = \frac{35}{1071} = .03268$ ohms; $2\frac{3}{8}$ miles $=$ 12,540 feet.

The resistance of 1 ft. No. 0 B. & S. wire is .0001096. The resistance of 12,540 feet will therefore be 1.374384 ohms. But the resistance of the line to give 10 per cent. drop must be .03268 ohms. The feeders must therefore be equivalent to $\frac{1.374384}{.03268}$ No. 0 wires. This figures out 42. In other words, the feeders must be equivalent to 42 No. 0 wires. A No. 0 wire weighs .3195 lbs. per foot; 42 No. 0 wires would weigh 13.419 lbs. per foot, and the $2\frac{3}{8}$ miles of feeders would weigh 13.419 $\times$ 12,540 $=$ 168,274.26 lbs. This is the weight of copper that would have to be put into one track. There are two tracks, however, and this amount would have to be doubled, making the total of copper required under the conditions amount to the enormous sum of 336,548.52 lbs.

If, however, instead of feeding into the center of the line alone, we have four feeders, the arrangement would be somewhat more economical of copper.

Under these conditions the total length of feeders for each track would be

			Lbs.
No. 1,	5,016 feet	weight	6,771.6
No. 2,	10,032 "	"	27,086.4
No. 3,	15,048 "	"	60,944.4
No. 4,	20,064 "	"	108,345.6
			203,148.0
For both tracks			406,296

Lead covered cable costs for 500,000 circular mils at the rate of 60 cents per foot.

Feeder No. 1 would therefore cost	$2,708.64
" No. 2 " " "	10,834.56
" No. 3 " " "	24,377.76
" No. 4 " " "	43,338.24
Total	$81,259.20
For both tracks	$162,518.40

No allowance is made above for placing the feeders underground or for the connections between feeders and mains.

The following estimate is given as the cost per mile of conduit such as that on Lenox avenue. The actual cost may have been more—it certainly was not less :

Wheel rails, slot rails, and joints	$6,468.00
Conductor rails	1,267.20
Bolts, nuts, washers, liners, tie-rods, etc	792.00
Yokes, man-hole frames, covers, and all cast iron	5,068.80
Insulators	264.00
Malleable iron clips	264.00
Bonds, finished (single bonding)	227.40
Excavation	2,376.00
1st class concrete for tube	5,068.80
2d " " " paving base	3,062.40
Track laying, hauling and temporary track	2,455.20
Taking up and relaying pavement	2.518.20
Total	$29,832.00

The above estimate is for straight single track, but includes nothing for drains or special work. At this rate the Lenox conduit

Cost 4.75×29,832	$141,702.00
Add for copper	162,518.40
Total investment in track	$304,220.40

This is an investment exclusive of motive power and rolling stock of $64,046.40 per mile of track, the interest on which at 6 per cent. would amount to $3,842.78.

It would seem, therefore, that this analysis conclusively settles in the negative the practicability of that kind of conduit road. Its chief difficulty lies in the necessary low voltage of distribution. Secondary to this is the high cost of conduit.

* * *

Facts For Thinkers. In the early days of electric street railroading, railroad men were taught by the manufacturing companies and their agents that with the adoption of the electric motor all street railway problems would be solved; that the expense of operation was so slight that a road in most any locality would pay, and that in prosperous communities it would pay to sacrifice the large investments in horses, etc., and substitute electricity. It came to be believed, also, that the earning capacity of the electric system would be so large that almost any capitalization would be safe. It was not enough to capitalize at the cost of the new equipment plus the loss on that discarded, but that this could be multiplied two or three times over with perfect safety.

We have now had about six years of what may be called the electric railroad era. Statistics are not yet abundant, but enough have been gathered to establish certain facts beyond dispute. The long record of receiverships, the longer list of roads whose electric equipment is already worn out but which cannot raise the money to replace it, show that all the rosy claims were not true—that the rapid development of the electric street railway business in America was based on a fallacy, or rather on several fallacies. But notwithstanding the disastrous results of over-capitalization already manifest, we read almost weekly of schemes for new lines or consolidations of old ones, with capital watered beyond anything known in the boom period. This shows either that the honest railroad men have not learned the lessons which have been taught by experience, or that the railroad business is beset by a coterie of schemers who can only bring further discredit on this class of securities by their operations, rendering it all the more difficult for legitimate business to be carried on.

Recent cases in point are the consolidations in Philadelphia and Pittsburg. The company recently formed to control all the main lines in the former city is capitalized at about $250,000 per mile, and in Pittsburg at $255,000 per mile. ELECTRICITY has no hesitation in predicting that a default in interest is sure to follow in both enterprises. And in pointing out to investors the risks they run in making street railway investments, the need of caution and of severe analysis, we believe that we are working for the best interests of the trade we represent.

We have views of our own as to the responsibility for the inauguration of the era of ballooned capital in this business. The old horse railroads were nearly all free from this feature. It came into prominence with the introduction of the electric motor. We are well aware that those accused by us of bad faith have one defence—ignorance. Leaving discussion of the responsibility for what has been done, therefore, let us look at the situation as it is to-day in the light of results achieved.

Probably no State in the Union is better adapted for the general introduction of trolley roads than Massachusetts. In no other State is the population so dense, the towns so near together. Certainly no other State has gathered such complete statistics, and we believe it is safe to assume that the results achieved in that State are more favorable than in any other.

It is therefore of more than ordinary interest to know what an unprejudiced authority, the Massachusetts Board of Railroad Commissioners, report as their conclusions, from statistics at hand, on the relative profitableness of horse and electric railway investments, and their views on the subject of capitalization. On these subjects these commissioners are on record as follows in their annual report :

> It is too early as yet to draw exact and final conclusions with regard to the financial economy of electric power, as compared with horse power, in street railway operation. It is desirable, however, both for the investor and the public, that current opinion on this point should conform as nearly as may be to the truth, and that false or exaggerated ideas, if such have gained a footing, should be set right.
>
> The question here is not whether electricity is a success as a motive power, or whether, taking into account the convenience, comfort and dispatch of street car travel on the one hand, and the obstruction and danger to ordinary travel on the other, the electric system is on the whole preferable to the horse system. The present question is whether the electric system promises a larger return on the capital invested, and thereby a possible future reduction of the charges for transportation ; so that the new system may be fairly expected in the long run to prove not only more remunerative to the stockholder but cheaper for the public.
>
> Tables have been prepared mainly with the purpose of throwing as much light on this question as the facts and statistics now at command will allow. These tables cover the period of ten years from 1884 to 1893 inclusive. During the first half of that period, the railways were operated wholly by horse power. During the last half, horse power ha been so rapidly superseded by electricity that already more than four-fifths of the railway mileage of the State is equipped for and operated wholly or chiefly by elecric power. A comparison of the railway year just closed with that ending in 1888, the last year in which the railways were operated wholly by horse power, will evidently afford the fairest and most satisfactory test of the financial results of the two systems thus far.
>
> The data furnished by the tables referred to for the selected years (1888 and 1893), as appears in the accompanying table.
>
> The gains which the above table shows in the average net earningsper passenger carried, per mile run and per round trip, ranging from 62 to 85 per cent. in favor of the year 1893, are certainly at first view very striking ; and, if these were the only elements in the case, the financial success of the electric system might be pronounced at once to be not only assured but marvelous. There are, however, other important and decisive factors which must not be overlooked.
>
> In the first place, any increase in net earnings must obviously be compared with the increase in the cost and capitalization of the electric over the horse system. The manufacturer whose new factory brings him in twice as much net income as the old, has gained nothing in the way of return on his investment if the new plant has cost twice as much as the old. So here, the most direct and conclusive test of the net earning capacity of the two systems, is a comparison of the increase in the net earnings per mile of railway with the increase in the cost of railway per mile. Applying this test, it will be seen that, while the net earnings per mile are 57 per cent. greater, the cost and capitalization per mile are respectively 60 and 65 per cent. greater in 1893 than in 1888—the odds being clearly in favor of the horse system.

Comparative Earnings and Cost of the Horse and Electric Railway Systems.

EARNINGS AND COST.	In 1888.	In 1893.	Percen. of Increase
Net earnings per passenger carried	0.96 cts.	1.56 cts.	62.50
Net earnings per car mile run	5.56 cts.	9.65 cts.	73.56
Net earnings per round trip	40.00 cts.	74.00 cts.	85.00
Net earnings per mile of railway	$ 2,420	$ 3,810	57.44
Cost of railway per mile	33,695	53,986	60.22
Capitalization per mile	32,304	53,367	65.20

> In the second place, it must be taken into account that the electric railways, with their power stations and electrical equipment, are all of new or recent construction. Their first cost and the cost of reconstructing and electrically equipping the original horse railway lines have been charged, of course, to the construction and property accounts, and not to operating expenses. As in the case of a newly built and furnished house, the necessary repairs and renewals for the first few years are comparatively slight. For this reason, the cost of the maintenance of the new system, which is chargeable to operating expense, has thus far been abnormally small and the consequent showing of net earnings from operation has been abnormally large. The extraordinary reduction for the last two or three years in the ratio of operating expense to gross income from operation, is largely, if not wholly, to be explained in this way.
>
> The generation and distribution of electric motive power involve expensive plants, costly machinery and intricate apparatus and appliances, all of which must be kept in perfect working order. The wear and tear of roadbed and track are increased by the heavier rolling stock of the new system. As time goes on, the cost of renewals and repairs cannot but increase or be otherwise than large ; and this cost must go into operating expense. The net earning capacity of the electric system will not, therefore, have been fully tested until time and experience have demonstrated the normal and full average cost of its maintenance ; and the net results as they now appear must be qualified accordingly.
>
> One other test may perhaps be fairly applied to the working of the two systems thus far. The horse railway companies, for the five years next preceding the introduction of electric power, maintained an average surplus of 12.45 per cent. on their combined capital stock. For the five years since its introduction, this surplus has been steadily drawn down to an average of 3.51 per cent. for the five years, reaching the last year its lowest ebb at 2.09 per cent. On the other hand the average dividend for the last five years (6.44 per cent.) has exceeded that for the first five years (5.66 per cent.) by less than one per cent. This shows that the railway companies as a whole have been running closer and closer to the wind during the electric period, and have subtracted from the old surplus much faster than they have added to the new divisible income.
>
> We must conclude, then, taking everything into the account, that there has been thus far no demonstration of the superior net earning capacity of the electric as compared with the horse system, but rather the reverse. It is not, however, intended to raise the inference that the electric system is, or is likely to prove, under conservative and proper management, a serious financial failure. The conditions attending its further and fuller development will probably be found to differ in no essential respect from those attaching to the old horse railway system, or to the steam railroad system.
>
> It can and should be said, however, without hesitation or qualification, that the electric system has not shown or indicated any such margin of profit as to justify the expectation of more than moderate and ordinary returns on money legitimately invested in it. The idea, which seems to have obtained some currency, that the electric system is a bonanza of rare and inexhaustible wealth, is clearly a delusion, and has doubtless proved to some a snare. The absolute cost and expensiveness of the system, under the most conservative, able and honest management, are sufficient to task its earning capacity to the full limit. There is no margin for fictitious or inflated capitalization. It presents no safe or inviting field for speculative enterprise or manipulation, unless it be to the unscrupulous operators of an inside ring who are willing to practise on the credulity of a misinformed public. Wherever there is reason to believe that water has been, or is about to be, injected into the stock or bonds of an electric railway company, the only safe course is to let its securities severely alone.
>
> Instead of inflating the liabilities and straining the earnings and surplus for the division of ostensible profits, the manifestly safe and imperative policy for the electric companies—and that without special regard to the

present unusual stringency of the times—is to keep the capitalization and charges upon income within the narrowest practicable limits, and to set apart year by year some substantial portion of the earnings as a fund for *future contingencies*, and for the increasing burdens of expense which are sure to come and whose weight is now only partially felt or known.

The conclusions here reached must be accepted as correct. Taking into consideration what is generally *known* as to the capitalization and condition of American street railway properties as a whole, is it *not* time to hoist the danger flag? Is it not time for investors to exhibit more and more caution as to this class of securities? And is it not time for those interested in legitimate street railway work and finance to set their faces against all schemes for excessive capitalization based on a gamble as to what electricity will save in operation? We think it is.

The total capitalization of our street railways today is more than $1,300,000,000, more than $95,000 per mile of track. According to the best authorities this represents an actual investment of not over $450,000,000. In other words, these securities are based upon one-third money and two-thirds water.

Is there any doubt of what the outcome must be?

There is some wisdom in a recent editorial in the Philadelphia *Press*, concluding as follows:

"In all developments of new industry and transportation there is always a period of experiment, a period of expansion, and a period of liquidation. In electric railroads the period of experiment ended in 1888. The period of expansion is still in progress. The period of liquidation cannot be distant."

Of course we know that the periods of experiment and expansion have so far been cotemporaneous. But should not expansion end now? And will not the shock and depression entailed in the period of liquidation be much less severe if the railway men of the country realize now that the electric railway business is not a sure bonanza, but that profits to the investor can only come with careful, honest and conservative management?

The frozen truth is that scarcely a business in the country presents more obstacles against converting supposed profits into divisible cash than the street railway business, whether the motive power be electric or something else.

* * *

The Trend of Electrical Development. In years gone by, and not so many years at that, almost the entire energy of investigators into electrical science was devoted to the improvement of the primary battery. There was indeed reason for this in that its efficiency was comparable to that of the steam engine and far in advance of any known methods of obtaining available energy from fuel. Its drawbacks however were many. The fuel, which was zinc, and the atmosphere in which it was consumed, which was the acid or saline solution, were far more expensive than coal and atmospheric oxygen, and the care required to keep the batteries in working order was excessive and burdensome. It seemed very possible, however, to so improve the details of the battery as to render its care less irksome, and invention turned its attention with considerable success in that direction. How to produce a cheaper fuel and atmosphere, however, was not so apparent, and practically no progress was made in that direction. With the advent of dynamo electric machines producing electricity from ordinary coal, and atmospheric oxygen through the intermediary of the boiler and steam engine, notwithstanding an inefficiency of over 90 per cent. as against about 20, the primary battery came into disfavor and those who continued the investigation of the great problem connected with it became themselves the subject of obloquy and derision.

The dynamo electric machine has now been developed so nearly to its theoretical limit as to leave no reasonable expectation of any further advances in the way of efficiency.

In the meantime electro-chemical science has been advancing with giant strides, and many metallurgical operations which before were dependent directly upon the combustion of coal are now performed more quickly and more cheaply by the intervention of the boiler, engine and dynamo.

It is the dynamo itself that has rendered this possible, and the next step will be that the dynamo by familiarizing us with electro-chemical processes will enable us to produce electricity itself by electro-chemical processes.

There seems to be no question that galvanism is to be re-enthroned somewhere in the near future. It will not entirely supplant dynamo electricity however, for the latter will always have its field of usefulness, and there will always doubtless be conditions where, even with its 90 per cent. inefficiency, it will be cheaper than the battery method, but it is not to continue to hold undisputed sway as it has during the past decade and more.

It is idle to suppose that any method can be devised of consuming zinc to compete with coal. The economic possibilities of batteries consuming zinc have been almost as nearly reached as have those of the dynamo, and no further progress can reasonably be expected in this direction. Nor is it reasonable to expect that electricity will be generated by chemical means directly from coal.

The fuel for our boilers requires some preparation before it can be economically employed there, and it is to be expected that it will require some special preparation to adapt it to the direct production of electricity. Under our boilers the admission of atmospheric oxygen has to be carefully regulated else the results obtained are unsatisfactory. It is not unreasonable then to expect that the method of burning our fuel for direct electrical production will have to be carefully considered.

The direct production of electricity from fuel does not therefore mean the burning of an unprepared fuel in an uncontrolled atmosphere, but means a proper preparation of both, and their especial adaptation, so that the latent energy may become manifest in the electrical instead of the heat form. These are all problems for the electro-chemist, and they are problems that are being attacked by so many vigorous thinkers that their solution must be in the order of things.

Under the Searchlight.

Views and Opinions on Timely Topics.

Speculative Telephone Enterprises.

It was, of course, to be expected that with the first apparent break in the monopoly of the Bell Telephone Company there would be attracted to the telephone field a number of adventurers, schemers, chevaliers of fortune and out and out swindlers. The appearance in the field of several companies made up of this element has, therefore, created no surprise. But in the telephone business, as in any other legitimate industry, the appearance of such elements need create little alarm. Their activity is bound to be short-lived. They lack all the qualities necessary for survival in honest business, and quickly work their own destruction. Of course they should be exposed by the press whenever they hang out their signs, but even if they escape the notice of the press, they inevitably expose themselves.

It is not to telephone companies made up of men of no reputation, or worse, that ELECTRICITY calls attention this week. It is to a single company far more dangerous, because it has appealed for public favor under the names of men of the highest standing, supposed, by reason of their previous honorable careers, to be far above the methods of the ordinary swindler—men who are popularly supposed to be the apostles of probity and fair dealing.

We have already commented in previous issues on the affairs of the Harrison and Standard Telephone companies. Their conduct of their business has not been such as to warrant any confidence that they were to be of any real service to the public in breaking the monopoly of the Bell Company, or that the investor in their securities, rights or franchises would ever receive any legitimate returns on his investment.

While there are many less conspicuous companies in the field working conscientiously to do a legitimate business, free from infringement of any valid patents, it was feared some time ago that the two companies referred to were working on entirely different lines, their only reason for existence being the sale of worthless rights and stocks.

Yet the names of some of our best citizens on the boards of these two companies have been so far sufficient to ward off severe criticism.

On another page of this week's issue of ELECTRICITY will be found a photographic copy of a circular issued by the Standard Telephone Company of New York, which is worthy of careful perusal. Any extended comment on this circular, or on the company issuing it, would be superfluous. We may well pass over the impossibilities promised in the first part of it, and confine our attention to the closing paragraph, in which such sentences as these appear:

"*So that the promoters of a local telephone company, under a Standard Telephone Company's license, have $20 in cash net profit on each 'phone to play with, and a stock interest in every telephone of $34 to grease common councils, to sell to local third-floor, sub-cellar investors, etc. Yet the boys who are in the real pot, if they play their cards right, will have the control of every local telephone company's plant,*" etc.

We know of nothing to equal this, not even in the green-goods circulars confiscated from time to time in the New York post-office.

The humiliating part of the whole thing is that the Standard Telephone Company was not started by men of no reputation. It has been supported from its beginning to the present time by men of national reputation, men who are supposed to be far from the rank of common swindlers. ELECTRICITY demands of each and every one of them that they confess their participation in a disgraceful swindling scheme, or make immediate public announcement that their names have been used without warrant.

Some of the names given in the daily press of men associated with this company in the beginning were:

THURLOW WEED BARNES, President.
CARL F. BAKER.
JAMES S. CLARKSON.
A. L. CONGER,
JOHN W. CANDLER.
GEORGE CROCKER.
HENRY MERZ.
M. C. PALMER.
FELIX RAKEMAN.
JOHN E. SEARLES.
CHARLES T. STRAUSS.
LOUIS WINDMULLER.

The men comprising the Standard Company are supposed to have received about $300,000 for local rights.

We do not know what patents they claim—we do know that instruments so far turned out under their name have been practically duplicates of Bell instruments. The company does not claim to have any factory. The few instruments it has were made under contract. Local companies which paid their money for rights have been unable to secure any beginning of a telephone exchange or system. Yet the company continues its efforts to sell *rights*.

We believe that every man who has paid one dollar into the treasury of this concern has been the victim of a gross swindle. We do not believe they will ever install an exchange. We advise every investor to take steps at once to recover his money and to locate those responsible for the misrepresentations.

Such methods as those described are a disgrace to any business, and it is pleasant to know that the great majority of telephone companies are of a very different stripe. They are in the business because they believe they have a right to be in it. They are selling apparatus, not patent rights, and they will bear comparison with any other class of business concerns.

* * *

"What's In It For Me?"

A SERMON.

A few weeks ago ELECTRICITY referred briefly to the retirement of Mr. L. H. McIntyre from the service of the People's Traction Company, of Philadelphia, the reasons therefor and some of the circumstances connected therewith. Since the public announcement of his retirement, made exclusively in ELECTRICITY, there has been much discussion of all the varied questions bearing on the subject, and an astonishing variety of views have been expressed. It is held openly by some that McIntyre was fully justified, and that the giving and taking of bribes, misnamed commissions, is perfectly proper. This is the same theory upon which John Roach conducted his affairs with the United States Government, that men were merchandise, worth so much apiece, and that trading in men was as legitimate as trading in iron.

ELECTRICITY has no desire to make a scapegoat of L. H. McIntyre for all the evil in the commission thievery, but he deserves no sympathy, and his case will do as well as any other to illustrate the main features of the system.

The notion that a man entrusted by a corporation with the purchase of goods, or whose opinion as to quality is relied upon and paid for by the corporation, may accept a commission from any salesman, is not widely different from the notion held by dozens of corporation officers who would scorn to take commissions that they are at perfect liberty to make all the money they can by reason of their official positions.

Nothing went further to wreck the Brooklyn City Railway system than the application of this idea in the management of the system. The president had no hesitation in asking himself frequently, "What's in it for me?" And when Daniel F. Lewis, head of the firm of Lewis & Fowler, sold to Daniel F. Lewis, president of the Brooklyn City Railway Company, millions of dollars' worth of the manufactured product of the former company, he set an example of breach of trust which men in humbler positions could not fail to imitate.

Lessons are always more easily taught by specific examples, and we propose to call attention to a view of the evils of the "commission business," as made clear by the conduct of Mr. McIntyre.

He was a graduate from the Thomson-Houston Company's office in Boston. He had no lack of examples to follow when he started to work his system. His first position of consequence was with the Huckleberry road in New York. He applied himself at once to his special line of work—selling his influence with his company for so much cash. The company had confidence in him, trusted his judgment, and it is doubtful if any considerable purchase was made without McIntyre's hand was greased. We know of one salesman who was expatiating on the merits of his apparatus when McIntyre suddenly interrupted him, asking; "What do I care about that? What's in it for me?" He cared less about the actual value of what he spent the company's money for than he did about his "share."

Leaving the Huckleberry road, McIntyre went to Brooklyn, holding a similar position with the Atlantic Avenue system. Here he applied the same principles of business. From Brooklyn he went to Philadelphia.

It is not within the scope of this article to detail all the different trades made by Mr. McIntyre for the Philadelphia Company. We call attention to a few of them only, leaving the moralizing to our readers.

At one time when a large quantity of conduit was to be bought, four companies had expressed their intention to bid. Their representatives were sent for one after the other, and received instruction from McIntyre about as follows:

A was told to bid $450,000, allowing $25,000 for a commission;

B to bid $425,000, leaving $50,000 for commission;

C to bid $415,000, leaving $75,000 for commission.

D to bid $410,000, leaving $10,000 for commission.

D was the man who was booked for the job and who got it. This conduit deal was one wherein McIntyre failed to carry out his plan, as the successful bidders refused to pay unless McIntyre's board of directors approved of it. Thus we have one instance of the railway company paying several thousand dollars more on a certain part of their equipment than they would have paid if bidding had been done on the square.

One of the General Electric agents has confessed to having paid $25,000 commission on one trade, and a representative of the Sperry Electric Company of Cleveland paid $12,000. The payment of this commission was known to the entire board of directors of the Sperry Company, and every stockholder of the company had a hand in the sale, including Mr. Coffin (who told Mr. McIntyre to buy it), Herrick, Lawrence, Miles and Parmlee. Any one who knows what Sperry apparatus is knows that no sane business man would have bought it, and that the $100,000 or so paid for it was all wasted, in order that McIntyre might make his $12,000 commission.

It is further in evidence that supplies which could be bought on the right basis were bought without limit. All that was necessary for McIntyre was to get his commission; the interest of his employers were never consulted for one moment.

Enough has been said, we think, to show clearly that it is impossible for any man working upon the McIntyre method to give honest service to his employers, or to guard their interests. The subject therefore at once broadens into one of interest to every stockholder in railway securities.

Now we propose to show another form of injustice which the rascally commission business works upon decent manufacturers.

In January, 1894, the People's Traction Company advertised for bids for 300 cars and 250 trucks. The J. G. Brill Company had never done any business through McIntyre, because they had steadily refused to do business on his plan. On this contract they started in to make their fight over McIntyre's head, and now the Board of Directors, in spite of McIntyre's opposition, he charging that the Brill Company did not know how to build a serviceable truck. Mr. John A. Brill went before the board in person and told them in plain language just why McIntyre carried an unfavorable opinion of Brill trucks. The contract was finally divided between the Brill Company and the Peckham Truck Company. At the end of ten months not one dollar had been spent for repairs on the Brill trucks, and the Peckham trucks had cost, according to a director of the company, nearly their original purchase price in rebuilding. Notwithstanding this record, McIntyre summarily threw off all the Brill trucks, stating that they were not fit to use. A new order was placed with the Peckham Company, who took the discarded Brill trucks in exchange.

Immediately the Peckham Company began to advertise that on one of the leading railway systems of the country Brill trucks had been discarded "because they could not properly support the car bodies, and because they hammered the rail joints and special work." They also sent out circular letters to prospective purchasers, of which the accompanying is a sample.

This proceeding was, of course, only the natural outcome of the McIntyre system applied to its full limit, and so far as the Peckham Truck Company were able to do so, with McIntyre's assistance, the Brill Company was grossly injured in its business, notwithstanding the fact that the record of the Brill trucks on the People's Traction Company's system had been far better than that of the Peckham trucks. About $26,000 had been paid for the Brill trucks by the railway company, and a large part of this amount was sacrificed in the exchange. Enough has been said, we think, to show the evils which this system of accepting commission involves. It means the moral debasement of every man sanctioning it. It means that the actual purchaser pays more for his supplies than he otherwise would pay. It means that the honest manufacturer who refuses to be blackmailed suffers a gross injustice even though his product is infinitely better than that of the man who cheerfully pays commissions. If there is any good in it to offset the evil features, we would like to have them pointed out to us.

It is worthy of notice that in Mr. McIntyre's statement in defence of his actions in Philadelphia he does not deny the acceptance of commissions or salaries from the manufacturing companies, but he takes the extraordinary ground that he was fully justified, and that the railway companies were fully posted in advance. He confessed that while he was holding the position of general manager of the People's Traction Company he was drawing a regular salary from the G. E. Company and the Peckham Motor Truck and Wheel Company while at the same time he was purchasing the apparatus of these companies for use on the railway system of his employers.

GENERAL OFFICE OF THE PECKHAM MOTOR TRUCK AND WHEEL COMPANY.

1820 Havemeyer Building. 1412 Cortlandt.

Works at Kingston, N. Y. Telephone Call: 26 Cortlandt street,

Offices at
New York, Chicago, Philadelphia,
Boston, San Francisco, London.

NEW YORK, February 4, 1895.

Oakland San Leandro & Hayward Electric Company,
Oakland, Cal.

GENTLEMEN: We beg to inform you that we have for sale 125 Brill's No. 21 solid-forged trucks, fitted for G. E. 800 motors, which we have taken in exchange from the People's Traction Company, of Philadelphia, who have adopted our extra long 6 E Truck as their standard for both their 20 foot closed and 30 foot open cars. As to their reason for doing so we refer to them by permission.

These trucks have only been in service from four to six months and are practically as good as new. If you can use the whole or any part of the 125, please advise and we will quote you a low price for them. Trucks can be seen at the barns of the People's Traction Company, at 8th and Dauphin streets, Philadelphia.

Awaiting your reply, we remain,

Very truly yours,
THE PECKHAM MOTOR TRUCK & WHEEL CO.
W. E. COOKE

We do not think that in this commission business the man who accepts commissions bears the chief guilt. This rather lies with the manufacturing companies whose anxiety to sell an inferior product, and to make illegitimate profits, has led them to adopt a systematic plan of debauching purchasing agents throughout the country, and it is not at all surprising that when, as in the Philadelphia case, the briber and accepter of bribes fall out, the former does all in his power to hasten the downfall of the latter.

So far no action has been taken against Mr. McIntyre in Philadelphia, although there has been a great deal of talk of the railway company recovering the amount of various commissions known to have been paid.

Reference was made above to the $25,000 commission paid by the General Electric Company. So far as our information goes, the responsibility for the payment of this commission lies with Captain Eugene Griffen and E. D. Mullen, who arranged the matter, and it is proper to add that Mr. O. T. Crosby, who was instrumental in the sale, refused to have anything to with the commission business.

We trust that what we have said may have some influence in ridding the electrical trade of the methods described. ELECTRICITY stands ready to expose everything of the kind wherever found, and we believe that every man who wishes well for the industry should assist us in our campaign.

If there are those who defend the practice, would it not be well at the next meeting of the American Street Railway Association to have an open discussion on the subject.

Development of Street Railway Apparatus.

A RETROSPECT.

BY NELSON W. PERRY, E. M.

It is sometimes as difficult to realize what has been as it is to predict what may be, and in no direction of human progress have the years been more revolutionary than they have been since electricity became a commercial factor. So great have been the changes that this agency has wrought in our surroundings, in our methods of living and in our very methods of thought, that to go back a decade seems almost like delving into ancient history.

It would be incredible if we did not know it to be a fact, that but nine years ago the first commercial electric railroad in America started its cars. This event, which occurred in the city of Scranton in the fall of 1886, was pregnant of far greater results than even its most enthusiastic friends then dared dream of.

The three cars, the few miles of track and the investment of the few thousand dollars of that year have become 20,000 cars running on over 80,000 miles of track and involving an investment of capital in the State of New York alone of upwards of $200,000,000.

With this condition of affairs around us it may not be uninteresting or inappropriate at this time to look back to the beginning.

The city of Scranton is situated in the heart of the largest anthracite coal basin in America. Its houses are undermined by the busy miner, and many of its unbuilt-up portions, even in what would otherwise be the heart of the city, are covered with enormous and rapidly increasing piles of refuse coal.

These culm piles, however, are the present source of all the power of this enterprising city, and he who owns a culm pile, if he hold on to it long enough, may be richer than he who owns a coal mine, for as the latter is depleted the former grows.

At the base of one of these heaps of refuse is located the Suburban Electric Light Station, and it was from this station that power was furnished for the Van Depoele road. On a recent visit to this locality the writer saw the three original machines, now no longer in use, but preserved as interesting historical relics.

One looks at these massive machines with their long magnetic circuit with astonishment and awe, but when he remembers that the attributes of the magnetic circuit were not so well understood then as now, and that the dynamo designer's art was then only empiricism, he is not so much astonished to find almost every fundamental rule violated.

These machines have all been modelled over since they ceased their first usefulness in the endeavor to make them earn at least their own living. Two of them were remodelled into alternating current machines, and although at the hands of such skilled doctors as Prof. Elihu Thomson and Merle J. Wightman, and although each of them contains just about twice as much iron and twice as much copper as modern machines intended for the same output, they heated up so much after half an hour's run as to render further service from them impossible. The third machine was then rewound as an arc machine, but this, like the other two, proved more profitable as a historic relic than as an active participant in the lighting arena.

An interest still attaches to this electric lighting station quite apart from that of historical association, in that probably with a single exception it comes more nearly getting its fuel for nothing than any other station in the world.

In fact the conditions are such as would make the average street railway manager's heart rejoice. They are these:

The parties who own the station also own the culm pile, and the land upon which the latter stands is becoming exceedingly valuable. There is a demand for the land and there is a demand for the culm, and the owners of the latter are trying to supply both.

The preparation of the culm for market consists simply in running it through screens so as to divide it into products of different sizes.

In order to bring it to the sizing screens it is merely shovelled from the bank into a mechanical conveyor. The coal in its travel passes for a distance over a perforated plate, through the perforations of which the dust and other fine refuse drops. This refuse, which is scarcely a marketable product, is taken by a conveyor in the opposite direction and by this delivered directly into the bins of the lighting station, whence it descends by gravity in front of the boilers. When dampened down and used on proper grate bars it makes an excellent fuel—equal in value to about 75 per cent. of that of good egg or buckwheat coal.

The next landmark in the progress of electric traction was the Richmond road, the story of which Mr. Sprague so entertainingly told in ELECTRICITY in 1891 and repeated with some additions and omissions in the *Engineering Magazine* for September, 1894.

The story is so well known to all electric railway men that it does not need repeating here, but like the trials and tribulations of the Pilgrim Fathers, it must ever have a keen interest for those who have benefited from these pioneer labors.

It will be remembered that the contract for this, at that time herculean, undertaking was made in May, 1887, and called for the completion in ninety days of the equipment of a road having about twelve miles of track, at that time unlaid and the route determined only in part; the construction of a complete steam and electric central station plant of 375 H. P. capacity; the furnishing of 40 cars with 80 motors and all appurtenances necessary for their operation; 30 of these cars were to be operated at one time, and grades as high as 8 per cent. were to be ascended.

And furthermore, the contract was undertaken under a time forfeit.

Certainly this would be no small undertaking at the present day with all of our experience and the precedents of past successes and failures to guide us, but when we consider that there was no practice at that day except that which indicated what not to do, and not much of that, we can but wonder at the audacity which prompted the undertaking.

The track was laid with a 27-pound tram rail and the curves were many and sharp—some of them as low as 27 feet radius.

We laugh at 27-pound rails to-day, but what was there at that time to indicate that a heavier one was needed? The steam roads with their high speed, heavy locomotives and freight traffic were using 50 and 60 lb. rails, and the wisest steam railroad engineer would have scoffed at the idea of using for street railway purposes rails of 90 to 98 lbs., which even the steam roads of to-day with their increased train units have not yet come to, except in perhaps a single case.

The motors used were at first 7½ H. P. Two of these to the car it was not unnatural to suppose would be ample, but Mr. Sprague soon found that he needed more. Ten H. P. motors were substituted for the smaller ones, and these again gave way to 15 H. P. motors before the road was in actual commercial operation.

As indicating pretty closely the state of the art at this time there is given below a complete specification and bid, which electric railroad men to-day will read with interest.

SPRAGUE ELECTRIC RAILWAY AND MOTOR CO.,
185 and 187 Dearborn Street.
Western Agency.
C. E. BARCLAY, Manager.
CHICAGO, June 29, 1887.

MR. B. H. LANGLEY,
President Winona City Railway, Winona, Minn.

DEAR SIR: Herewith we send you proposal for electric equipment of your road.

You will notice that the motors can be speeded up to 10 miles per hour if necessary. That is a very safe speed to run cars operated by electric motors, for the reason that they can be stopped so quickly. One of the reasons why city councils object to street railways running at a high speed is because of the inability to stop them quickly by the ordinary brake, but this is overcome by the increased friction on the wheels by reason of the additional weight of the motor on the car as also the rapidity with which the electric braking acts. Now in view of the foregoing fact you may not need so many cars as you first anticipated, and of course there will be a proportionate difference on the total estimate for any lesser number; 10 to 12 cars would give you a 6 minute headway.

In event of an excursion, etc., being in town, an additional car can be attached to any one of these cars, but of course would necessarily have to be run at a somewhat lower speed. The item of pole line: this price would admit of operating a larger number of cars than herein estimated for. Please observe the matter underlined in proposal relative to the overhead line which will explain itself. This method is the only one to operate a single track with turnouts successfully. It may not be the cheapest in first cost, but it is the cheapest and most practical for every day work.

The cost at which you can generate steam in Winona: I figured that it would cost you 50 per cent. to operate the road by motors as against horses. Another point in favor of electrical equipment is, that each car can make more car miles per day, thus necessitating less rolling stock, less storing room and, greatest saving, a less number of men employed. This item foots up very quickly.

You will find this estimate comes out about $2,000 per car. If there are any points you wish information on, I would be pleased to supply such on hearing from you.

Very truly yours,
SPRAGUE ELECTRIC RAILWAY AND MOTOR CO.,
C. M. BARCLAY.

NEW YORK, June 25, 1887.

RAILWAY SPECIFICATIONS AND PROPOSAL FOR WINONA CITY RAILWAY COMPANY, WINONA, MINN.

DEAR SIR: We beg to submit the following estimate for the electrical equipment of the Winona City Railway according to the particulars and specifications received:

Length of line, 7 miles of single track, with 16 turnouts and 15 curves, and —— feet of double track, extending as per inclosed exhibit.

Central generating station to be at or near the east end of the line, at a distance of 100 feet to the nearest point of the road.

Gauge of track to be 3 feet 6 inches.

Kind of rail to be 27 lbs. steel tram.

Character of street to be dirt.

Make of cars, Brownell & Wight.

Number of cars to be equipped, 16.

Maximum number of cars in operation at any one time, 16.

Weight of car, 3,000 lbs.

Length of car, 12 feet.

Seating capacity, 18; maximum number of passengers to be carried, 40.

Size of car axle, 2½ inches.

Distance between center of axle and bottom of loaded car, 8 inches.

Diameter of wheel less flange, 30 inches.

Maximum speed required on a level, 10 miles.

Running speed per hour, 6 to 8 miles.

Road to be operated by overhead wires.

The cost of the entire electrical equipment of the road, based upon the foregoing details, would be:

Seven miles of special, hard-drawn copper wire, with double circuit, also double metallic main circuit, supporting brackets, insulators, etc., including poles and erection of the line, $1,600 per mile	$11,200
Sixteen turnouts and 15 curves, $50 each	1,550
Sixteen motor outfits, 7½ H. P. capacity and capable maximum speed of 10 miles an hour on a level, being placed on each car, mounted on double compression springs and centered on the axles, which are driven by means of pinions meshing into gears, both motors being controlled by single regulator switches, which may be operated from either platform, at $800 per outfit	12,800
Gears, pinions, trolleys, connecting and setting up same, turning off axles, mounting and shielding motors, $150 per car	2,400
Two dynamos of 5,000 watts capacity each, including base-frame and regulators	5,000
Total f. o. b., N. Y	$32,950

The figure quoted for the motor outfit is based upon the assumption that you are to furnish the cars, the trucks of which are to be delivered to us at any designated place in New York City. If it is desired that we furnish the cars, the figure given for this item would have to be increased by from $800 to $1,500 per car, depending upon the character of car desired. It is recommended that we furnish the running gears, wheels, axles and boxes.

We will also furnish, if desired, an estimate for a complete steam plant of the most approved pattern, suitable for operating the dynamos.

The line work will be thoroughly well done. The current is carried over double, ladder-like conductors, the main conductor carrying the greater part and the sectional or working conductor the smaller part. In this way it is impossible for any accident to the middle overhead wire in the street to disable the entire line, which is a matter of very great importance. Again, where there is an extension of the road or an additional number of cars, no change being necessary in this middle overhead wires, there is no stoppage of travel or falling off of efficiency. The current is taken from this overhead wire to the car by a very simple overhead contact, which runs with very little friction, and follows the line of the overhead wire without difficulty.

When a double-track system is used, a single wire only follows each track; but where a single track with double turnouts, two wires of the same potential are carried overhead, diverging at the switches. In this way all changing of the trolley, which is carried on the wire, is avoided when passing the turnouts. The size of this wire is independent of the number of cars operated, or the distance over which the line extends. The main current, however, is not carried by this small wire, but is carried by a main conductor running the entire length of the line, and supported directly on the poles in the same manner as a telegraph wire. The size of this wire depends upon the number of cars and the distance over which they are operated.

In attaching the motors to the cars we avoid as much as possible changing the character of the car and taking up any sitting or standing room. Belts, friction-ropes, sprocket wheels and chains are discarded entirely. The motor, of very powerful form and of very simple construction, is carried underneath the car. At each end of the motor it extends so as to grip the axle of the car, and is held in position by heavy iron caps. Inside of these are split liners to take up the wear. The axle is turned off to a smooth surface, and just outside the hangers and close to the hubs of the wheel are two split gears. These differ in character. One is keyed and bolted directly on to the axle, and is a fixture. The other is composed of four parts, two being inner webs, which are keyed on to the axle; the two outer ones form the geared section and are bolted together, and have corresponding webs projecting inwardly and fitting snugly, both on the outer edge and on the face of the webs, which are keyed to the axle. The outer and inner webs are held together partially by the method in which they are turned up, but principally by bolts passing through them, which work in curved slots. These then constitute adjustable split gears.

The cut gear wheels are of an especially fine grade of cast-iron, and have the same face as forged steel pinions carried by the armature shaft, which mesh into them. The teeth in these gears are of the involute cut, so that if the motor should be slightly moved to or from the axles the gears will still run true, with only a little more or less closeness of meshing. The pinions on the armature shaft are set so that the one is half a tooth in advance of the other. Ordinarily, it would be a very difficult matter to get the splines cut on both the armature shaft and the axle and in the pinions and gears so that they would mesh smoothly in running forward and backward, and it was for the purpose of getting rid of this trouble that the adjustable split gear was designed. It is now only necessary to key the two pinions, one fixed gear and the web of the other gear in position, without any regard to their meshings. The motor is then swung into position, the hangers made to engage the axle, the caps are put on, and the motor being moved forward and backward two or three times while the bolts of the adjustable are slack, this gear will assume a correct position. The bolts are then tightened up, and there is thus a nest of double pinions and double gears all meshing with absolute precision, no matter whether the motor runs backward or forward. The method of mounting produces a concentric motion, and by this means the driving and the driven axle are maintained absolutely parallel in two planes under all circumstances. Should it be desired we will submit estimates for the storage or conduit systems.

All rights of way must be obtained by the local company, and the process of erection of the line must not be handicapped by delays caused by the action of municipal authorities, nor will this company be responsible for any legal action involved in the procuring of these rights of way.

Drawings of any new cars to be submitted to us before construction, and any minor changes necessary made according to our suggestions, to enable the motors to be put in the most compact manner possible.

The terms of payment will be as follows: Expenses of one man to instruct employees, 60 days' satisfactory working.

Each company to give bonds for the faithful performance of its part of the contract.

Trusting that the foregoing will be satisfactory, and that we may shortly enter into an arrangement with you for the equipment of your road, we are

Yours very truly,
THE SPRAGUE ELECTRIC RAILWAY & MOTOR CO.
Per C. M. BARCLAY, Manager.

[Proposal holds good for 60 days.]

While this specification may cause all those who read it to-day to smile, it must be remembered that it was a very sober thing in those days, and represented the best judgment of those who had given most thought to the question.

Below is given another reminiscence of a later date which electric railroad men will be able to appreciate quite fully, since many of those who attend the Convention have had personal experience of it. Reference is made to the former prices of street railway material.

Many of those who equipped roads in the early days remember with sorrow the prices they had to pay for material far inferior to that now manufactured. These require no reminder, but those who came into the field later will doubtless be interested in comparing the figures which ruled then with those which hold now.

Shortly after the absorption of the Sprague Company by the Edison General, a reduction in prices went into effect. The new schedule dated from May 1, 1890, and in the following lists the figures in the first column were the prices holding before and those in the second column those holding after the date mentioned—the figures in all cases being net shop prices. To these 20 per cent. was added by agents in making up bids:

NET COST PRICE, LINE MATERIAL.

	Before.	After. May 1, 1890.
Rail bonds 30 in. long	$ .13	$ .09
Rail bonds 6 ft. long	.15	.13½
One mile single track, span work:		
Wood poles	947.50	925.10
Iron poles	2,917.50	2,949.10
Pole ratchets with bolts	.60	.51
Line insulators	1.25	1.08
Center curve insulators	1.25	1.16
5-16 inch galvanized strand	.07¼	.06
1 mile double track, span work:		
Wood poles	1,060.00	1,029.10
Iron poles	3,030.00	3,053.10
Wood poles set, painted, coned, shaved and one-half of number furnished with cross arms, pins and insulators	7.00	
Iron poles set with tops and cross arms, pins and insulators	30.00	
1 mile single track bracket work, wood poles		663.00
1 mile single track bracket work, iron poles		1,675.00
Brackets, per 100		3.75
1 mile double pole bracket work, wood poles		932.00
1 mile double pole bracket work, iron poles		1,944.60
Octagonal wooden poles		15.00

TURNOUTS.

Turnouts	49.25
Overhead switches	8.00
Pull-off brackets	1.35

CURVES.

Single track curves	55.75
Insulated eyebolts	1.00
Double track curves	87.50
Cross-overs	49.25

SUNDRIES.

Line cut-out boxes	6.75
Trolley line breakers	4.29

WIRING CAR HOUSE.

Each track for 5 cars	75.00
Construction wagon	75.00
Acute crossing	15.00
Right angle crossing	15.00
Insulated crossings, single track	20.00
Railway crossings	25.00

DYNAMOS.

No. 16, 40,000 watts	2,500.00
No. 20, 50,000 watts	3,000.00
No. 32, 80,000 watts	4,250.00
No. 60, 150,000 watts	6,700.00

STATION APPLIANCES AND LABOR FOR RAILWAY WORK.

No. 16 dynamo, complete	900.00
No. 20 dynamo, complete	975.00
No. 32 dynamo, complete	1,150.00
No. 60 dynamo, complete	1,500.00

If two dynamos were installed the net factory price was:

No. 16	1,620.00
No. 20	1,755.00
No. 32	2,070.00
No. 60	2,700.00

If three dynamos were installed, and at that time three was about the limit, the net factory price was:

No. 16	$2,295.00
No. 20	2,486.75
No. 32	2,932.50
No. 60	3,825 00

DYNAMO SPARE PARTS.

(One armature and one set of babbitt shells.)

For No. 16 dynamo	900.00
For No. 20 dynamo	975.00
For No. 32 dynamo	1,150.00
For No. 60 dynamo	2,325.00

COMPLETE CAR EQUIPMENTS, WITHOUT TRUCKS.

With one 15 H. P. motor	2,000.00
With two 15 H. P. motors	2,900.00

EXTRA CAR EQUIPMENTS.

1 set with each 10 cars	600.00

Extra car equipment parts consisting of 1 armature, 1 set field coils, 1 main gear, 1 intermediate gear, 2 pinions and 1 trolley complete.

If we add 20 per cent. to these figures, which, would give us the net selling price of material at that time, we will realize that the lot of the railroad manager who equips his road to-day is comparatively speaking a happy one, and yet there are compensating disadvantages continually threatening to creep in.

One of these is the electrolytic corrosion of water, gas and other buried conduits, for which the railroad company will likely be held responsible. While remedial measures are at hand they are expensive and at best are not radical. The damage that is stopped to-day at this point is liable to be transferred to another spot to-morrow, and do all we can, unless we revert again to the double trolley, electrolysis will continue its insidious work, perhaps slowly, but nevertheless surely.

Another danger which threatens the electric railway manager, in our larger cities at least, is that they will be compelled to place their trolley wires as well as their feed wires underground. This implies far more than the mere expense of the conduit. It means a reversion back to low potential distribution, which means a larger original investment, not only in copper, but, if long distances are to be covered, additional power stations with all that they imply both in the way of original investment and additional operating expenses.

LONDON NOTES.

(From our London Correspondent.)

HIGHER VOLTAGE INCANDESCENT LIGHTING.

A short time ago we referred to the partial introduction into the Bradford electric lighting system of incandescent lamps of a high voltage by Mr. Sydney W. Baynes, who was then the corporation electrical engineer of that town. Since then Mr. Baynes has left Bradford and taken up the position of chief electrical engineer to the St. Pancras (London) Vestry, which owns one of the most successful and extensive London installations. In his new district Mr. Baynes has, although he has been stationed there only a month or so, commenced arrangements with a view to supply 220 or 230 volt fittings. At Bradford he has had such lamps in constant use for eighteen months, and for the past seven months they have been installed in the premises of customers taking their supply from that system, with excellent results.

No alterations in the fittings or wirings were necessary. The ordinary tumbler switch has, he declares, with good porcelain cut-outs, well-insulated wire, combined with good workmanship, long since proved thoroughly sufficient and safe in carrying even a higher voltage than that he intends introducing at St. Pancras. Eight C. P. and even 6 C. P. lamps are upon the market with high voltages. Dr. J. A. Fleming, writing to the London *Times*, recommends that all fittings used in houses, even on the present systems of supply, should be so made and tested that they can stand 200 or 220 volts pressure with safety, as they are all exposed to the chance of having to bear such pressure between some portions of them.

In the St. Pancras system no sweeping change of voltage is contemplated, for consumers already supplied at 110 volts will continue to receive that voltage, and it is optional for them to change if they consider the lighting obtained from the higher voltage to be more satisfactory. Where Mr. Baynes has previously worked the system, he has had consumers owning two distinct sets of premises, one having 230 volt and the other 115 volt lamps. The result of such trials has led to the replacement of the low voltage lamps with higher voltage.

STORAGE BATTERIES—II.*

BY H. A. EARLE.

There are many ways in which a specification can be framed so that a battery of the exact size required is obtained, and there is no doubt that it is most satisfactory to all concerned if the exact capacity in ampere hours is specified, and the final voltage of the complete battery at a given rate, the number of cells being omitted. Under these conditions, if the individual cells are discharged down to a low voltage, more cells would be required, but each additional cell on a 100-volt circuit adds 2 per cent. to their number, and correspondingly increases the cost of a battery composed of cells of a given size. On the other hand a low voltage per cell on discharge enables—up to a given limit—the number of plates per cell to be reduced, and the cost of cell as well. In a competitive tender the manufacturer would therefore work out the cheapest arrangement, and I find that this would not admit of the individual cells being discharged to too low a voltage, and that the purchaser would obtain exactly what he required at the lowest price.

The actual number of regulator cells is of small moment to the user, and the additional number required, when the individual cells are discharged down to a voltage of 1.8, in place of, say, 1.9, is only two in a 100-volt battery.

When tests are made to check the efficiency and capacity of a battery, we can place no reliance on the figures obtained from a single charge or discharge. As a rule, no two consecutive discharges from a cell are identical, even when the same is discharged with the same current, and down to the same voltage; every discharge being greatly influenced by the previous treatment. The table given below clearly demonstrates this:

Charge.							Discharge.							Percentage of efficiency.	
Charge, No.	Duration of charge		Rate in amperes	Volts at end of charge	Ampere hours	Watt hours	Discharge, No.	Duration of discharge		Rate in amperes	Volts at end of discharge	Ampere hours	Watt hours	Ampere hours	Watt hours
	Hs.	M						Hs.	M						
1	3	00	15	2.68	45	..	1	7	30	15	1.68	113	218	....	....
2	9	45	"	2.68	146	..	2	7	45	"	1.70	116	227	79.4	....
3	12	00	"	2.68	180	428	3	9	25	"	1.70	141	278	78.3	64.9
4	12	30	"	2.67	187	443	4	9	50	"	1.70	148	285	79.1	64.3
5	8	45	"	2.50	131	299	5	8	40	"	1.70	130	255	99.2	85.3
6	11	15	"	2.40	169	399	6	9	35	"	1.91	144	274	85.2	68.7
7	11	15	"	2.38	169	398	7	9	32	"	1.915	143	276	85.2	69.3
8	10	35	"	2.136	159	324	8	9	15	"	1.90	139	273	87.4	84.2
9	10	35	"	2.333	159	375	9	9	10	"	1.90	138	264	87.4	70.4
10	10	15	"	2.333	154	361	10	9	00	"	1.90	135	265	87.6	73.4

This table is in no way intended to be a guide as to what can be obtained in efficiency tests, but is merely to show the irregular nature of results obtained with slight variations in time and maximum voltage of charges; the rated capacity of the cell was 15 amperes for 10 hours, or 150 ampere hours.

Charge No. 1 we can omit, as this was given to complete the formation of the cell.

Charge No. 2 was for a similar purpose.

Charge No. 3 was continued, as were also charges 1 and 2 till the voltage had practically ceased to rise; a high voltage on charge gives a good return in ampere hours on the discharge, but if a cell is forced to its maximum capacity we obtain a poor return in efficiency.

Charge and discharge No. 4 are very similar to No. 3.

Charge No. 5 was stopped when the E.M.F. had risen to 2.5 volts and 30 per cent. less ampere hours had passed through the cell. Studying the figures up to the end of charge 5, it would have been practically impossible to assume what was going to happen on discharge No. 5; on taking this discharge, we obtain 20 per cent. increase both in ampere-hour and watt-hour efficiency, and the very high percentage of the former, namely 99.2 per cent., points to the fact that peroxide, which had been previously inactive, was reduced. The first five discharges, you will note, were all taken down to 1.70 volts; this cell had never been used before, so we have its history up to the 10th discharge in the table—the strength of acid at end of charge was practically 1·300 specific in every instance.

Charge No. 6 was only continued to 2.40 volts, but it required 2½ hours longer charge to reach this voltage than it previously did on charge 5 to reach 2.5 volts, and this was, without doubt, due to the good service rendered on the last discharge.

The remaining charges and discharges show that the highest efficiencies are obtained when the cell is not charged up to a high voltage, and if worked within reasonable limits, 90 per cent. in ampere hours, and about 80 per cent. in watt hours, can be obtained with the cell in question when in good order.

Usually efficiency is not of great importance, for, presuming a central station battery to give one-tenth of the total supply, a variation of even 10 per cent. in efficiency would only represent 1 per cent. variation in the total output; but the time may come when batteries are so cheapened and perfected that they supply the whole demand of our station, and their efficiency will then be one of importance, and we may be confronted with specifications as strict as those now framed for dynamos.

The strength of acid solution to be used in a cell is an important point. In the first place, this greatly influences the voltage, as we have seen from Fig. 3; it has also a great effect upon the life; besides this, in strong acid the plates sulphate more readily, and the sulphate is more difficult to reduce; it is therefore necessary to carry out most careful tests to ascertain what strength of acid should be used in each type of cell.

Curves for four temperatures in degrees Centigrade.

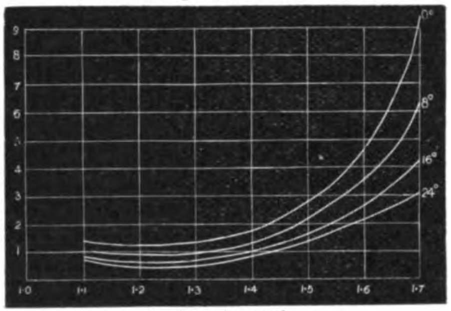

FIG. 4.

The resistance of acid solutions of different strengths is also a most important consideration, and on Fig. 4 four curves are shown giving its resistance at 0°, 8°, 16°, and 24° centigrade. Taking 16° centigrade as a mean working temperature, it will be noted that acid of about 1·250 specific gravity has the least resistance, and it might be assumed, therefore, that this was the best strength to work at, but we must bear in mind that this strength does not give us the highest voltage; and, moreover, the gravity gradually falls as the cell discharges, and when working with this strength we have falling voltage on discharge, and at the same time increasing resistance of the electrolyte; no fixed law can be laid down, as each type of cell requires a given strength for best results.

Immediately upon commencing our research with a view to ascertain the proper strength of acid, we find that we are confronted with another problem of great interest, which is, that different strengths give us different capacities from our cell. Fig. 5 gives two most interesting and instructive curves taken from two cells of the chloride type, one with positive and negative plates of .24 of an inch thick, curve A, and one with positive and negative plates of .4 of an inch thick, curve B. Each cell was discharged at a rate equal to .45 of an ampere per pound of plate. The rate per pound of active material is nearly the same for each cell, though perhaps slightly higher for the thinner plates. The rate of discharge per superficial area was, therefore, approximately 40 per cent. greater with the thick plates than with the thin.

The curves give the yield in ampere hours per pound of active material with different strengths of acid. Considering the thin plate curve first, we find that with acid of 1·070 we do not obtain more than about 3 per cent. of the maximum capacity; from this point to 1·230, at which point we obtain the maximum capacity, it rises very rapidly, each addition of 1 per cent. to the sulphuric acid present in the electrolyte giving an increase of about 1 ampere hour capacity per pound of peroxide; from 1·230 to 1·500 it falls as rapidly almost as it rose, and at the latter figure we obtain only 16 per cent. of the maximum.

Taking the thick plate curve: At 1·040 specific gravity we obtain about 6 per cent. of the maximum capacity, and it rises till 1·270 is reached; it then falls rapidly, and at 1·500 the output is practically *nil.*

Considering these two curves, we note that the thin plates give as maximum—

15 ampere hours per pound of peroxide and spongy lead, or

30 ampere hours per pound of peroxide alone, or about one-third of the theoretical value.

The thick plates on the other hand give

10 ampere hours per pound of peroxide and spongy lead, or

20 ampere hours per pound of peroxide alone, or about one-fifth of the theoretical value.

The natural question is, why is this the case? Also, why are the thick plates the best with very weak acid? and why do they give such a much poorer return with acid of the strength usually employed? I consider that up to the point at which the curves cross the better result obtained from the thick plates is due to the fact that on completion of the charge in weak acid the active material is saturated with strong acid and the quantity contained in the same would be greater with the thick plates than with the thin, and they would therefore give a better output with weak acid than the thin plates. Their increased thickness, however, is of no advantage with acid of the ordinary strength, when out capacity is chiefly dependent upon the penetration of the acid; if we study the portion of the thick plate curve between 1·150 and 1·400 specific gravity, and compare it with the thin plate curve, we find that the capacity is practically reduced inversely as the thickness or weight of the plate, and the rate of discharge of the superficial area. Quite apart from the question of the proper thickness of the active material, we can see at a glance that very different capacities are obtained with different strengths of acid.

On the top of the same Figure the mean volts during the discharge are given; these, it will be seen, rise steadily as the strength of the acid is increased; a striking feature is that the curves of voltage cross at the same point that the curves of capacity cross. Upon consideration we come to the conclusion that this is what would be expected, as the rate in amperes on discharge was the same in every case, and an increase in ampere hours per pound of material means a longer time to complete the discharge; and we see from Fig. 2 that the greater the length of the discharge, the higher the mean voltage.

It is the manufacturer's business to make as good a cell as possible, but when it leaves his hands it is judged by the service it renders during its life; this depends to a very great extent upon the treatment it receives. In the first instance purity of the electrolyte is essential; brimstone acid should be used, as this is the least likely to contain foreign substances; if this is diluted on the spot, the water must be pure, preferably rain, or if possible, condensed water.

With regard to the first charge of the battery, it is generally imperatively stated that this must commence immediately upon the acid being put into the cells; this is no doubt necessary with imperfectly formed pasted plates, or with plates which have been for some time exposed to the air, as they would readily sulphate, and require a considerable time to reduce; but positive plates which have been fully formed, and negatives in good condition, are very slightly affected.

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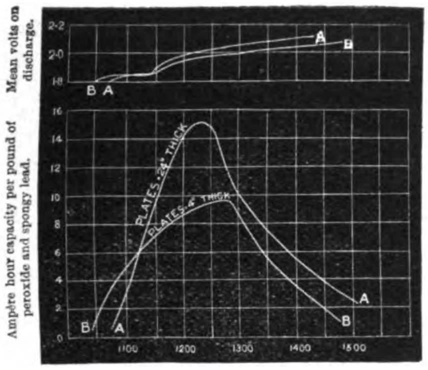
* Paper read before the British Association at the meeting September 11-17, 1895.

Fig. 6 gives five curves, which I have prepared in order to show results obtained from plates in different conditions, some having been left standing in the acid, while others were charged.

Curve A shows the specific gravity of the acid in the cell, in which the plates were allowed to stand for 22½ hours without being charged. During this period it remained absolutely constant, sulphation was therefore absent. The charge was then commenced and continued for eight hours; a rise in specific gravity took place, raising the electrolyte to a gravity above that at which it was put into the cell, which showed that sulphate was previously present in the plates.



Specific gravity of electrolyte at end of discharge.

FIG. 5.

Curve B shows what happened in another identical cell; directly the charging current was started the gravity fell rapidly. This, I presume, is due to the formation of oxide of lead from the pure lead remaining in the active material, and this is sulphated before becoming peroxide of lead. The current throughout the charge was kept constant, and from the curve we see that practically the same number of ampere hours were expended during the fall as during the rise; the specific gravity in this instance also rose slightly above its initial value.

The plates in curve C, which had been standing, sulphated slightly, and reproduced, on being charged, to a small extent a similar curve to B, and the plates (curve D) which were charged at once give a very small fall, but a considerable rise, showing that sulphate was present in the plates.

Curve E is for plates which stood before being charged, and in this instance we notice that no sulphation took place, and that they gave a small fall and rise.

My chief object in giving these curves is to demonstrate how very slight differences can give considerable variations.

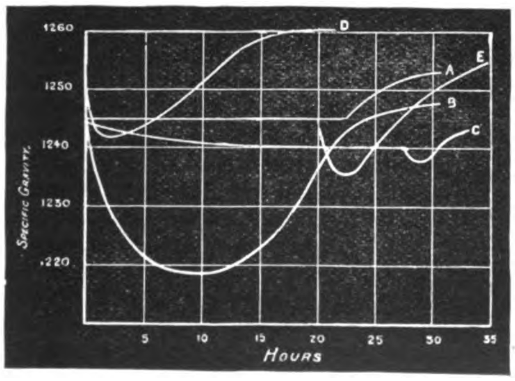


FIG. 6.

To return again to the treatment of cells. The chief causes of destruction are too prolonged, or excessive rates of discharge, insufficient charging, overcharging, long periods of rest on open circuit without charging, and allowing cells to remain after complete discharge for many hours before recharging. There is also another point which is worth mentioning. Frequently through undercharge or over-discharge the plates become heavily sulphated, the cells no longer give their proper output, and the specific gravity of the elecltrolyte falls considerably; of course, a prolonged charge will put this right, but frequently it is assumed that, as the specific gravity is low, the acid merely requires strengthening, and this is done with the best intentions; the fault is, however, aggravated, and the plates sulphate more heavily than before. I found on one occasion that acid had been periodically added, and the specific gravity rigidly maintained at 1·200, the charge being always stopped when this strength was reached; the cells were naturally working badly; a prolonged charge was accordingly given, and this raised the strength of the electrolyte as high as 1·450 in some cells, which was a clear indication of what had been done. We find, therefore, that a multitude of causes influence the working and life of storage batteries, and that many of these can be varied at will; the problem, therefore, is to combine all useful effects, that we produce the best possible article with due consideration at low cost.

It would be a natural question to ask, What do you consider the best possible article? and this is easily answered. In a secondary battery we have lead, sulphuric acid solution, and the resultant compounds, and nothing else.

The ideal cell is one that is indestructible, and this being given, the first cost and weight, if kept within reasonable limits, are of little moment.

At the present moment the life of a cell is its value, and all types are constructed with the knowledge of certain death, and in most types this lingering death is provided for, for we find at the bottom of the boxes a sufficient space to act as a receptacle for the deposit from the disintegrating plates; in other types, where the active material is held permanently in position disintegration still goes on, with consequent loss of contact. Now this disintegration is what we have to stop; the deposited disintegrated material is as good as ever, for nothing is wasted, and provided it were held in perpetual, firm, and good electrical contact with the frame, in such a manner that the free circulation and penetration of the acid were not hindered, and the internal resistance were not unduly increased, we should have produced an ideal and indestructible cell.

I have brought to your notice only a very few of the many interesting features in connection with secondary batteries, and these only in a most superficial manner; I have, however, endeavored to give a general outline of results obtained in practice, and have not entered into a discussion upon other more serious questions. Many conjectures arise in one's mind when considering the causes of different effects, and each point requires much time and study in order that a fixed law may be deduced from the results obtained; and again the results of tests are often so conflicting, and depend so much upon very small differences of condition, that it is by no means an easy matter to arrive at the truth.

ARE WE LAYING TOO MANY MILES OF TRACK TO REACH A FEW PEOPLE?*

BY W. W. COLE.

It is an established fact that as the mountain would not go to Mohammed, he had to go to the mountain. The fact is just as self-evident in the location of track, that if you stop one block from where the dividing line comes, between the settled district and the open field, the people will walk that one block to the cars; and the maintenance and operation of 1,500 feet of track for one year on a fifteen minute headway, at nine cents per car mile, means the interest at 5 per cent on $26,864, or $3.68 per day. It can be readily seen that with many lines extended just beyond the line of population the road has extended just beyond the line of dividend. It is conceded by all that when a new line is constructed we have to educate the people to ride, as they have become accustomed to depend on their horse or bicycle or to walk. Now, if we extend our lines beyond the population, we immediately become professors of education, as we must not only educate the existing population to ride, but must educate the people to build on the open territory and educate people to move into the houses built. If we keep within the lines of existing population, we have the advantage of a general located on an eminence—we can wait and see which way the population army moves, and then we make no mistake in our extension. In other words, the railroad is practically the army sutler, and there is no instance where the sutler led the army.

There is no denying that a railroad extended into open territory will increase the value of real estate, and eventually build it up; but in the meantime we are wearing out rolling stock and track for the owners of real estate, and should receive a bonus sufficient to carry the road until the open territory is sufficiently populated to support a road.

It is the general experience that by the time the fields become populated the rolling stock must be replaced and the track repaired, or we practically build a new road to suit the new condition, and outside of the benefit to the real estate owners, we only get our returns when the new road is built for the actual needs of the existing population.

A road built in an unpopulated district has to contend with more dust and mud upon its rails, which means wear and tear, and without sewers there are bound to be places in the track where it will be covered with water, which is deleterious to motors, trucks and car bodies.

We will cite as an illustration a city of 40,000 inhabitants which has twenty miles of track; five of the city lines extend 2,112 feet beyond the settled territory, or two miles of track with but little traffic. Taking an average of ten cities of 40,000 population, the riding per capita is forty-six times per year. This would give in gross receipts $92,000; operating expenses 70 per cent. of gross receipts, or $64,000; and $27,600 net receipts. The average road is bonded at the rate of $30,000 per mile, or $600,000 for twenty miles of track. The interest at 5 per cent. would be $30,000. This would show a deficit of $2,400 in interest.

Now, in this city of 40,000 inhabitants we have two miles of track operated and bonded that for the present we get no returns from, as it was built to promote the building of the city at different points; and like the man who has lived a good life on earth, we are looking forward to a future reward, but the man is invariably dead when he receives it, and the results on street railroading show that they are waiting for the sound of the horn in the hands of the receiver.

In this city of 40,000, if but eighteen miles had been built and bonded for $540,000, with an annual interest of $27,000, we could have shown at least $600 surplus, and with the modern methods of increasing traffic, this surplus could undoubtedly be increased to pay the stockholders a fair rate of interest if eighteen miles were built instead of the twenty.

If for obvious reasons it becomes necessary to extend the track beyond the populated limits, care should be taken to focus the promoting energy upon one line, and to extend no other lines until the one so extended has been so populated that that line shall be self-supporting, as with the extension of several lines in different parts of the city the various interests become separated and each line so extended only receives a very widely scattered population that must take years to promote into a paying territory.

Precaution must be observed in running out suburban lines for park and pleasure resorts, as we can only count on three months of pleasure travel, and a line built for pleasure travel only is apt to prove a problem with an unknown quantity. On the other hand, all parks and pleasure resorts introduced along existing lines, even though built at a considerable expense, if properly managed, will prove a booster to the net receipts of the lines favored.

In locating pleasure resorts, if possible they should be placed on lines connecting two towns, as then you promote traffic in both directions, and are not to a large extent paying for an empty mileage in one direction; and you are also promoting traffic to the thinly populated section of your road. To clinch my argument, I will quote from an editorial in the *Street Railway Journal*: "That the total street railway mileage of the United States is approximately 6 per cent. of the steam railroad mileage. About 6 per cent. only of this mileage is at present in the hands of receivers, as against about 25 per cent. of the steam railroad mileage. The gross earnings of all American street railway properties are probably slightly less than 15 per cent. of the combined freight and passenger earnings, but are nearly 50 per cent. of the passenger earnings alone of the steam railroad properties, while the net income applicable to dividends on capital stock is hardly less than 35 per cent. of the steam railway income. These results are surprising indeed. That 14,000 miles of street-railway track should be able to earn half as much gross on passenger traffic and one-third as much net (for dividends) on combined passenger and freight traffic as is earned on 234,000 miles of steam railroad track—this is certainly a remarkable showing, and one which points to a very reasonable cause for a capitalization per mile of track larger for the street railway than for the steam railway properties."

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* Paper read at the Albany meeting of the New York State Street Railway Association, September, 1895.

When we have carefully considered the subject of this paper, "Are we laying too many miles of track to reach a few people," the results of a comparison between the steam and street railroads are not so surprising, as there is no doubt if the cities could all be moved within a few miles of one another along the lines of the steam railroads that their passenger receipts would show an immense increase and a corresponding decrease in operating expense.

Even though the steam road charges three cents a mile, and the street railway often gets less than one cent a mile, we find that the receiver's hands and pockets are being filled by the steam roads, because even at three cents per mile enough passengers must be carried to support a lengthy mileage through the unpopulated country.

ECONOMICAL EQUIPMENT AND OPERATION OF POWER HOUSES.*

BY H. S. NEWTON.

I am going to ask the attention of the members to a few of the details connected with the economical equipment and operation of a power house which, ordinarily, do not get further than the engine room, but which might profitably, in a great many cases, be considered in the office.

A modern electric street-railway station, to deserve the name in these advanced days, should embrace in the details of its construction those features which experience has shown to be the best adapted to the service required. These details, I take it, are such as would be included by all engineers in a compound condensing station. A preference has been shown by some engineers for certain additional features, by others for features differing considerably in the means toward the end. It is not my intention to enter into a discussion of the relative merits of different apparatus, or the wisdom of different methods, but I shall confine my remarks to the ways and means which we have considered and have adopted in our power house lately constructed at Syracuse.

The Syracuse Street Railway Company's plant is made up of three double compound engines of the upright, marine type, having cylinder dimensions 16½ x 31 inches, with a 24 inch stroke. These are belted direct to multipolar generators of 300 kilowatt capacity and exhaust each into an independent surface condenser. The condensed steam from the condensers is pumped through an oil filter or separator into a hot well from which the boiler feed pumps convey it through a pipe heater to the boilers. By this arrangement not to exceed ten per cent. of the boiler feed water is taken from the outside water supply, and all difficulty with scale is practically overcome.

The boiler house contains five 90″ tubular boilers, 16 feet long, each made up of 188 four inch tubes. These are fed by a pair of pumps, one acting as a relay to the other. The whole plant has been in operation only a few months, and it has been impossible as yet for us to make an accurate test as to its economy. Our coal and water bills have demonstrated the fact, however, that we are making power at a low rate, and this, with the additional fact that we are having an entire absence of trouble, is all that I can urge as an excuse for this paper.

The feed water is introduced into our boilers through a line of 2½ inch piping connected to duplicate pumps through a pipe heater. We have found two objections to hold against the arrangement as adopted, the correcting of which, I feel, will influence somewhat the economy of the station.

The first of these is the fact that in covering the live steam pipes it was not deemed necessary to cover those carrying the warm water to the boilers. This leads to a difference of some five to ten degrees in the temperature of the water when leaving the heater and when entering the boiler, and is, consequently, a source of some little loss.

The second point is the absence (since remedied) from the feed water line of a check valve beyond the pumps to relieve the check valves at the boilers. This would seem to be of small importance, if not absolutely unnecessary, but we have found it of decided advantage in prolonging the life of the valves and doing away with the rattle occasioned in these valves by the pulsations of the pumps. An air chamber over the pumps is also of prime importance in lending elasticity to the system.

In this connection I wish to call your attention to the importance of an injector on each of the boilers. There seems to be a growing tendency to rely entirely on a relay of pumps, thus allowing the operation of the station to hinge on the efficiency of a piece of apparatus which my experience goes to show has a decided tendency to get out of order.

Concerning the economy of using over and over again for boiler feed the condensed steam from the engine exhausts, a great deal may be said. The surface condenser, the necessary adjunct to this practice, is not a particularly rare piece of apparatus, but I find that a surface condenser which is called upon to perform this one of its functions is decidedly uncommon in street railway practice. In numerous stations it is used to obtain a vacuum, but in very few is the water of condensation utilized. The character of the water around Syracuse made it very desirable that we should utilize the condensed steam if possible, and after what promised to be some very disastrous experience, we have at last succeeded and are running very successfully, as mentioned before, with over ninety per cent. of our feed from this source.

Our immediate result on starting this practice was oil in the boilers, or a mixture of oil and dark brown sediment, which caked over the bottom seams. We removed this and tried again, concluding that it might be shop grease and dirt. Again we had the same result. Examination of the oil filter showed nothing out of order, and consultation with the engine builders evolved nothing new. After endless experimenting, resulting in a leaky boiler or two, and the consumption of a vast amount of chemicals, we have located and remedied the trouble to our entire satisfaction.

The accumulation noticed seems to have been the result of three causes:

(1) The use of too much cylinder oil.

(2) The use of the wrong kind of cylinder oil.

(3) Insufficient filtration of the oil from the feed water before going to the boiler.

The first of these causes was, of course, soon remedied, and the old fashioned notions of our engineers were shocked with the order to use only three drops a minute for each engine.

The second cause we were longer in discovering the remedy for. Various expedients were tried for cutting up the grease in the boilers, such as carbonate of soda, soda ash, tri-sodium phosphate, and lastly kerosene oil. None of these expedients proved effective, however, and it was not until we changed our cylinder oil that we solved the problem. We purchased some oil of purely mineral stock, which has worked so well as to lead me to conclude that it must have been the animal fat in the other oil which was doing the mischief. We are using this oil to-day with remarkably good results, never more than a slight film being apparent in the boilers at the time of the weekly cleaning, and this readily succumbing to the action of a half pail full of soda ash pumped in with the feed water before cooling off.

The third cause of trouble we have recently largely overcome by introducing a number of partitions in our oil filter, by means of which the water is caused to flow alternately over the top of one end under the next, in this way allowing the oil to settle from its water emulsion and be collected in the excelsior filling.

The factor that after all has seemed to be the strongest in the solution of our problem in economy is the choice of fuel. We have done quite a good deal of experimenting in this line with various grades of coal and the results obtained have been such as to lead me to very strong conclusions.

The best coal, and by that I mean the cheapest fuel, we have found to be anthracite buckwheat, costing on board cars at our station $2.25 a gross ton. The dust anthracite I find will sift through the bars. When mixed with an equal amount of soft coal, it works very well, but necessitates the help of an extra man as mixer and is not so economically fired. We use thirteen tons of buckwheat a day, where it was necessary to use seventeen or eighteen of the mixture.

A great deal has been written and a great deal more said about the efficiency of special devices, such as high and low water alarms, automatic damper regulators, etc., in the boiler house. Our experience with them has been most satisfactory. We have found that the less responsibility you place on the man who shovels in your coal, the better off you are in the end; or, in other words, that as compared with human brains, the mechanical device is at a big premium. By making the engineer responsible for the operation of the devices and keeping them in repair, you are insuring yourself a great deal better boiler house economy than you could otherwise expect to obtain.

The vertical marine type of engine has given us thus far very good service. The most serious objection that we can urge to them is that they are noisy. In order that the vertical cross-head guides may not be subjected to too serious wear, we have found it necessary to lower the compression below the point usually employed. The natural consequence is more wear in the cross-head crank bearings and more noise. With more compression we get hot cross-heads and guides, and we consider that we have chosen the lesser of the two evils.

Our engines are provided with piston valves for the high pressure, and gridiron slide valves for the low pressure cylinders. They will govern to within three per cent., or about as well as the Corliss.

I don't think the true importance of good engine government is recognized by street railway men. One is apt to regard a badly governing engine merely as an inconvenience resulting in a lower speed on the cars and dim lights. The additional loss of power on the lines, viz., in the feed wires, trolley wires and rail return, resulting from the decreased voltage at the station is often entirely lost sight of. A few figures on this point might be interesting.

Given a station with generators compounded for a constant potential of 500 volts, with constant speed on the engine, and a system of feeders allowing for an average loss on the line of ten per cent. with full load on the machines. With our engines governing perfectly, ten per cent. is lost in transmission. If they slow down as the load comes on so that the dynamos show only 450 volts with the same watt output, over twelve per cent. of the total energy will be lost in transmission. With 400 volts on the machine, over fifteen per cent. will be lost. Therefore, when we couple these facts with the consideration of the loss of light and decreased efficiency of motors at the lower voltage, it is plain that too much importance cannot be given to the government of prime movers.

In conclusion, I cannot refrain from adding one more voice to the cry against cheap labor in the power house. What help of that kind we do employ, and we are not extravagant I assure you, is used in a subordinate capacity. Our present engineer in charge was employed by me after very clear demonstration that a cheap man was not capable of handling the plant. A condensing station, with the volume of detail which must be always present in its construction, requires brains for its operation; and the man with brains commands good wages. The pressure that is brought to bear on the management for reduction of wages in the power house is often severe, as I can testify, but the moment the concession is made the trouble begins, and a shutting down for repairs on your road becomes a common occurrence.

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* Paper read before the New York State Railway Association, Albany, September 17, 1895.

THE PROPOSED MAGNETIC UNITS.*—IV.

To the Editor of THE ELECTRICIAN.

SIR: Before the Ipswich discussion—if there is to be a discussion—a few additional lines (not megalines) may be useful in calling attention to a few aspects of the matter which might possibly get overlooked, judging from your "Correspondence" columns of this week. It is easy to exaggerate the oddness of a new name so long as it is unfamiliar, and once upon a time I suppose *ohm* and *megohm* suffered under this disadvantage—in fact, I myself remember that time; but the term ohm now sounds homely enough, although it does not convey its meaning on its surface so clearly as the equivalent term *volt-per-ampere* may, for the sake of illustration, be supposed to do; and this fact, so far from being an objection, is a positive aid towards its free and easy diffusion among operatives and line-testers. Again, the term *volt-ampere* would do instead of *watt*, yet the latter term has come into use; and, similarly, the term joule is simple and handier, although less self-explanatory than volt-sec-ampere.

If compound words, like ampere-turn instead of gauss, and volt-line instead of weber, are enforced for very simple and fundamental quantities, it seems to me that the policy, though plausible for the moment, will be a short-sighted one; because it will then be difficult to proceed further with the formation of compounds, such as weber-per-gauss, which is a unit of permeance, and weber-gauss, which is a unit of energy (and may easily be made a joule). Again, the term *weber-turn* seems to me likely to become in the future nearly as useful as *ampere-turn* has proved itself to be, but it cannot be introduced unless a single name (not much matter what) is affixed to the C.G.S. unit of N or to some multiple of it.

But some of your correspondents appear to hold that no unit names at all are wanted; because if asked hastily for a boiler-pressure the reply "80" is amply expressive. Similarly it might be truly said that when asked in casual conversation for the length of a lease or the age of a man, the reply "99" is completely intelligible; but surely it would be inconvenient not to be able to add the term "years" whenever for precision or completeness it was desirable? And such a term, though meaningless in itself, may be legitimately employed without always having to think what a *year* precisely means; nor would the ordinary man feel grateful if told that he might employ the more expressive phrase *earth-orbital-period* instead. Surely those who doubt the usefulness of names for units (of course introduced in moderation, and after thorough consideration, by collective authority) can hardly remember the vague era before the terms *volt* and *ampere* existed, an era when no one had any instinctive "feel" of what current they were getting out of their Grove or Bunsen cells, which were then mostly the only available large-scale source of electromotive force.

And one more point I must reiterate, though it is admittedly a matter on which a precisionist and a teacher must feel more strongly than practical men and engineers, the reason for adding "pounds per square inch" in a specification of pressure is in truth *not solely* because other countries use kilogrammes per square centimeter; part of the reason is of a much more fundamental character, lying at the basis of the whole idea of absolute measure; nor would it be at all satisfactory silently to assume the C.G.S. system in every case and record only the numerical portion of quantities, although this may be often conveniently done in colloquial haste. Perhaps it has not been clearly noticed by everybody that the unit is just as important a portion of the specification of a concrete quantity as the numerical portion. The height of *anything whatever* is 360 if the appropriate unit be chosen; the figure applies equally as well to the solar prominences, to a fly's probocis and to St. Paul's Cathedral, only the units are different.

Yours, &c., OLIVER J. LODGE.
September 6, 1895.

To the Editor of THE ELECTRICIAN.

SIR: Being so far from the center of civilization, I am afraid the remarks you have asked me to make on the subject of the correspondence on magnetic units in your columns will be late and fall rather flat after the British Association Committee have had their say.

I never can understand the objection to having authorized names for any units at all. Nobody need use them unless they like. Even Mr. Ravenshaw in his own works may, for instance, use the unsystematic units he has accustomed himself to without doing anybody else any harm. As Mr. Esson very sensibly says, "By all means let the scientists invent names for units." The proposal that they be allowed to grow, which has been made by several sensible men, has not in the past led to satisfactory results. We have ounces and grammes and leagues and versts as the result, and, though we are an insular nation, it is to be hoped that the question at issue will be viewed from the international standpoint. Even in the one matter of magnetic force we have names galore growing up. "Lines" and "scots" and gausses" and "thoms" and "hops" and "mags." There is evidently a preponderating preference for a monosyllable, and yet several consider that the names "magnetic line" and "ampere-turn" are short enough for convenience. There are, no doubt, objections to personal names, but as this has been a matter of international agreement, it will probably be best to abide by that decision and continue the system. Questions of jealousy between nations as to the name to be chosen are so amusing it would be a pity to lose these disputes. On the other hand, it is a very good rule to avoid the names of living men, especially when they themselves object.

As regards this question of giving names to units, I think the consensus of opinion is that names should be given to them, and are as a matter of fact being invented by engineers for their own convenience; and so far the appeal for help in deciding this question has been helpfully responded to by engineers, and has led to a valuable contribution to the discussion.

In respect of the much more difficult questions as to the coefficient of induction and of magnetic permeability, hardly any help has been given by engineers, or indeed by any of the correspondents. Mr. Heaviside is in favor of $\mu = \frac{d\,B}{d\,H}$. Most of the correspondents, including Prof. Ewing, to whom Mr. Heaviside appealed, *assume* that no other definition than $\mu = \frac{B}{H}$ is possible. The matter is essentially complicated. The phenomena themselves are very complicated, and there does not seem any prospect of making them simple. Personally, I am rather inclined to $\mu = \frac{d\,B}{d\,H}$, but we really want two different names for the two different quantities, and the only serious question is, to which shall the name "permeability" apply, and what name shall be given to its unit. From the almost universal agreement apparent from the answers it would seem that $\mu = \frac{B}{H}$ has been up to this always called the permeability, and if so some other name should be invented for $\frac{d\,B}{d\,H}$; for it is dreadfully confusing to have the same name for two different quantities, especially to students, whose claims in a matter of the kind are certainly deserving of consideration. Those who find it unnecessary to distinguish between $\frac{B}{H}$ and $\frac{d\,B}{d\,H}$ may stick to one or the other of them, and it is pure dog-in-the-manger for them to object to another name for a quantity that they never use.

As regards the coefficient of self-induction, I think it would be a very great misfortune if the British Association were to set itself up in any degree in opposition to the Chicago International Congress May be the "henry" is not the absolutely best unit, but a confusion of tongues, a new babel of names, would be far worse than any little inconvenience from using the "henry," and when once accredited representatives of a large number of civilized nations have settled upon a term it is most important that all civilized nations should submit to the result and substitute, in science and manufactures at all events, arbitration and agreement for war.

As regards the great 4π question, I entirely agree with Mr. Heaviside in thinking that it is a great misfortune that our units have been founded on the present definitions of a unit pole instead of upon the one he advocates, but I do not at all agree with him in thinking that a change is now possible. The existing inconvenience arising from 4π is not really very serious, and when one considers the enormous difficulty that exists in changing our really terribly inconvenient weights and measures, which costs our country so many years of the life of each child, and so many millions of money in keeping calculators at work who might be employed in something useful, I see no possible prospect of changing our present very seriously inconvenient system of electromagnetic units. There are so many other things better worth doing that I would be very sorry to see my scientific friends engaged in putting their shoulders to this wheel with that expenditure of time and energy that would be required to accomplish anything, especially when the prospect of accomplishing anything is so very minute. Yours, etc.

GEO. FRAS. FITZ GERALD.
Fernbank, Howth, Co. Dublin, Sept. 10, 1895.

THE TELEPHONE SITUATION.

A correspondent writes us, under date of September 23, a very full letter in regard to telephone matters. The letter itself is marked "Not for publication." but since there are so many points raised that are of general interest, we abstract freely from it, but withhold all marks of identification.

The letter is in part as follows, the various points raised being numbered to facilitate reference:

> Is the organization of the Eastern Protective Association completed yet? (1) If so, will you kindly give me the address of its secretary?
>
> The knowledge of the art, as shown in the Berliner patent looks very thin from the present standpoint. Must the development of eighteen years give way to that description of what one does not know about a transmitter? Is there an electrician to-day who can take that specification and make an instrument which will transmit speech, much less receive it? (2) Wherein does his show development beyond the Reis transmitter, descriptions of which were published several years before the Bell telephone was known? (3) If you make a practical one from Berliner's description or in fact a transmitter at all from it, you must make the sensitive contact points of *carbon* (4), instead of *metal* as described. (The word *carbon* is not in the patent.) Do the same from the old descriptions of Reis's instrument and you will have a very efficient transmitter, fully equal or superior to the Blake. I am using one on my switchboard which does not differ in principle from the Reis except that it has carbon contact, and it is a very efficient one.
>
> I hope and trust that all interested will unite, as you advise, and show one solid front against the Bell Company and hit it whenever it shows itself.
>
> The Berliner patent out of the way—what about the call bell? Watson's patent has stood, and will stand nearly four years and a half longer.

---

* From the *Electrician* (London).

The 5th claim seems to cover any kind of a switch which *alternately* connects the line with the ringer magnet, or the 'phone, according to the position of the switch. It seems strange that every maker, so far as I know, clung to the *divided circuit* and switch of some kind, trying only to avoid the *automatic part* of it. Yet the 5th claim does not mention telephone, gravity, automatic or anything of the kind. It *plainly* covers a *divided circuit* and *switch* of any kind. A method for getting around this has been devised as follows: The main circuit is permanently wired through the ringer magnets and 'phone in series, and remains so. No rusty springs; no broken or imperfect contacts; simpler, much cheaper, and very much better than any switch arrangement.

This device has been tried on a circuit 8 miles long with 15 stations besides an extension bell permanently on each line in the central office, working when connected through 17 ringer magnets in circuit, and yet it works nearly as well as a short line with a single station. The equipment in these 15 stations is 7 carbon transmitters, 4 magneto transmitters, and 4 where the receiver is used for both transmitting and receiving, and none have any difficulty in making themselves heard. The system is so much better that I have never known a case where half that number of stations could be well worked by Blake transmitters through Watson call bells (5).

Replying to the above according to bracketed numbers:

(1) The Eastern Protective Association has completed its organization. The address of the secretary is A. F. Stanley, 32 Frankfort street, New York.

(2) (3) (4) The difference consists mainly in this that Reis had not conceived the idea that an uninterrupted current was necessary to the transmission of speech. It is not necessary for the transmission of musical notes, and since that was what Reis was striving for and because by means of an interrupted current greater volume of sound could be obtained, he devised an instrument which was intended to interrupt the circuit at each air vibration. If it failed to interrupt the current, it failed to act as intended, and would certainly be capable under these conditions of transmitting speech. Reis did not understand this, however, and although his instrument probably did at times transmit electrical undulations similar to those necessary for articulate speech, Reis did not discover the reason. The essentials to speech transmission were not discovered until later and were first made known by Bell. He found among other ways that by varying the resistance of the circuit in consonance with sound waves the latter could be reproduced.

Berliner claims to have invented *one way* of varying the resistance of the circuit, viz., by varying the pressure between two electrodes always in contact. His method therefore differed materially from Reis's in that the latter endeavored to *insure* the breaking of contact with each sound wave, while the former endeavored to insure and specified that such break should *not* occur.

That Reis's instrument sometimes failed to work as he wanted it to work, and did something else which he tried to prevent its doing, does not constitute it an anticipation of the utilization of that principle which of all things he was trying to avoid. Nor does the fact that Berliner's early instrument sometimes or frequently did interrupt the current, which of all things it was intended that it should not do, and acted as Reis's instrument was intended to do, constitute a trespass upon Reis's method.

If the two instruments were contemporaneous, Reis and Berliner might both have gotten out valid patents for what they severally claimed and neither instrument would have infringed the other so long as each was used as it was intended to be used.

Our correspondent seems to think that because the contacts in Berliner's instrument are both metal, or at least are both carbon, that it will not act as a transmitter. This is a mistake. It will transmit speech just as it is described in the patent—provided the contact is not broken, as also specified. Were one or both of the electrodes of carbon it would be a far superior instrument and have much wider range, but it was not necessary to use the word "carbon" in the patent to make it operative. In fact the claim is far broader by the omission of the name of any specific substance.

(5) The method suggested for getting around the Watson patent is practicable but will not give so good articulation, as when self-induction is introduced into a telephone circuit it very greatly interferes with the articulation. It acts also like a choking coil, and if there be sufficient present, it will be impossible to speak at all. For this reason, the calling apparatus, which as usually constructed has high self-induction, is best cut out of circuit when the latter is in use for conversation.

We have already expressed ourselves rather fully in regard to the Watson patent as a patent.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER XIII.

The Owatonna Electric Co.

The stock and bond deal to which we devote our attention this week is again one of the smaller affairs which went to make up the long record of Mr. Byllesby and the Northwest General Electric Company in their capacity as agents in Mr. C. A. Coffin's grand and comprehensive scheme of electrical financing.

Almost every feature of the plan for manufacturing stocks and bonds and getting rid of them to the credulous Eastern investor, which we have pointed out with so much detail in previous articles, is exhibited in the progress of the Owatonna plant from nothing up to something, then from something back to almost nothing, during which transformations $25,000 to $50,000 of other people's money was transferred to the pockets of the schemers, and an equal or greater amount lost by the legitimate stockholders of the parent manufacturing company through the uncollectible merchandise debts of a lighting plant whose only reason for being was that it was a good thing to bond.

Owatonna is the county seat of Steele County, Minnesota, and had, in 1890, a population of 3,849. It has no advantages over other similar towns in that section. It has no manufacturing enterprises of consequence, but is merely the trading center for the farmers of the county. The houses are thinly scattered over the territory comprised within the town limits, though not so conspicuously so as at Faribault.

In the summer of 1888 Messrs. S. H. and W. S. Pierce, two young men of the section, who had some money and considerable enterprise, and who had heard large stories of great possibilities for making money in central station lighting, decided to embark in the business. Their first venture was at Austin, and the second at Owatonna, where they procured a franchise and a contract for city lighting in the summer of 1890. The original franchise and contract are incorporated herewith:

[COPY].

ORDINANCE NO. 90.

An ordinance establishing an electric light and power plant in the City of Owatonna.

The Common Council of the City of Owatonna, State of Minnesota, do ordain and establish as follows:

Section 1.—In consideration of the benefits that will accrue to the City of Owatonna, of the State of Minnesota, and the inhabitants thereof, it is hereby granted unto Henry Birkett, of the City of Owatonna, State of Minnesota, or his successors or assigns, permission and authority to erect such buildings, machinery and apparatus within the corporate limits of said City of Owatonna as may be necessary for the production and transmission of electricity for the purpose of lighting, heating and furnishing power; and the permission and authority for the period of fifteen years from and after the passage of this ordinance, five years of which first following the date of said franchise shall be exclusive, to place the necessary poles, wires and operating fixtures within the streets, alleys and avenues of said City of Owatonna for the purpose of conducting said electric light, power and heating, said poles and wires to be erected under the direction of the City Council, and said City Council shall have power to direct such changes as it shall deem proper, at the expense of said Henry Birkett, his successors or assigns.

Sec. 2.—The said Henry Birkett hereby agrees not to charge any person or persons more than one cent per hour for each sixteen candle-power lamp by them used, or not more than $5 per month for each arc light of 1,200 candle-power used until 8.30 P. M., or $6 per month until 9 P. M., or $6.50 per month until 10 P. M., or $7.50 per month until 11.30 P. M., and that the said Henry Birkett, his successors or assigns will light the city with as many or as few arc lights as may be desired from time to time for the following prices, to wit:

$7.50 each until 12 o'clock midnight, or $9.50 for all night, each lamp of 1,200 candle power, on the Philadelphia moon schedule; it being understood that no contract for street lighting will be entered into for a less period than five years, and that all halls or public places who may want incandescent lighting shall not be charged over two cents per hour for each sixteen candle power lamp by them used.

Sec. 3.—It is further ordered that in consideration of the benefits hereto accruing to said Henry Birkett, his successors or assigns by this ordinance, the said Henry Birkett shall erect and operate said electric light plant within nine calendar months from the date of the passage of this ordinance.

Sec. 4.—It is further ordered that if said Henry Birkett, his successors or assigns shall at any time after nine months from the date of the passage of this ordinance cease to operate the said electric light plant and it shall not be operated for the period of four months, such inaction and delay shall cause a forfeiture of all rights and privileges acquired under this ordinance, unless otherwise ordered by the said City Council of the City of Owatonna.

Sec. 5.—It is further ordered that nothing in this ordinance shall be construed as forbidding the establishment of private light plants erected and maintained for the purpose of lighting only the property of the owner of said plant.

Sec. 6.—This ordinance shall take effect and be in force from and after its publication.

Passed December 3, 1889.

Attest: E. M. MOREHOUSE,
Mayor.
C. E. LUCE,
City Recorder.

Officially published December 6, 1889.

COPY OF CONTRACT BETWEEN PIERCE BROS. AND THE CITY OF OWATONNA.

This agreement made and entered into this 5th day of August, A. D. 1890, by and between S. H. Pierce and W. S. Pierce, co-partners, doing business as Pierce Bros., successors to the Owatonna Electric Light Company, parties of the first part, and the City of Owatonna, party of the second part, witnesseth:—That for and in consideration of the covenants and agreements on the part of the said party of the second part and their faithful performance, the said parties of the first part hereby covenant and agree to furnish for the said party of the second part ten arc lights of 1,200 normal candle-power for the period of one year from and after September 15, 1890, and to be located as directed by the Common Council of the City of Owatonna, and to be run until midnight according to the Philadelphia moon schedule, including moonlight nights when clouded and dark. The said party of the second part, in consideration of the faithful performance of the foregoing covenants and agreements on the part of the said party of the first part hereby covenants and agrees to pay the said parties of the first part the sum of $7 per month for each light used during the year, payable monthly. It is hereby mutually covenanted and agreed by and between the parties hereto that this contract shall be a waiver of the provisions of Ordinance No. 90, entitled "An ordinance establishing an electric light and power plant in the City of Owatonna," so far as said ordinance relates to the question of the time of contract. In testimony whereof both parties have hereunto signed their names and affixed their seals on the day and year first above written.

S. M. BYRNE,
City Recorde
E. M. MOREHOUSE,
Mayor.
S. H. PIERCE,
W. S. PIERCE,
(By S. H. PIERCE).

Signed, sealed and delivered in the presence of
I. W. BURCH,
BENJ. E. DARBY.

ARTICLES OF INCORPORATION OF THE OWATONNA ELECTRIC COMPANY.

We, the undersigned, for the purpose of organizing and becoming a body corporate under and by virtue of the laws of the State of Minnesota, in such case made and provided, have adopted and executed the following Articles of Incorporation.

ARTICLE FIRST.

I. The name of this corporation shall be the "Owatonna Electric Company."

II. The general nature of its business shall be (a) to construct, maintain and operate a plant or plants for manufacturing and generating electricity. (b) To deal in, furnish and supply electricity for light, heat and power. (c) To carry on any and all business in anywise appertaining to or connected with the manufacturing and generating, distributing and furnishing of electricity, for light, heat and power purposes, including the transaction of any and all business in which electricity is now or hereafter may be utilized and all matters incidental or necessary to the distribution of electric light, heat and power. (d) To manufacture and repair any and all necessary appliances used in or which may be required or deemed advisable for or in connection with the utilization of electricity or in any wise appertaining thereto or connected therewith. (e) To lease, purchase, hold, sell, convey, mortgage and exchange real or personal property or contracts, and to do any and all other things, and carry on any and all other business operations which may be necessary or advisable in connection with the manufacturing, generating, distributing, selling and furnishing of electricity, or the apparatus and appliances connected therewith as aforesaid.

III The principal place of transacting the business of this corporation shall be the city of Owatonna, in the county of Steele and State of Minnesota.

ARTICLE SECOND.

The time of the commencement of this corporation shall be the fourth day of December, A. D. One Thousand Eight Hundred and Ninety-one (1891); and the period of continuance of said corporation shall be thirty (30) years from said date.

ARTICLE THIRD.

The amount of the capital stock of this corporation shall be Twenty-five Thousand (25,000) Dollars, and the same shall be paid in within fifteen days after the same shall be subscribed for and not later than January 1st, 1892.

ARTICLE FOURTH.

The highest amount of indebtedness or liability to which this corporation shall at any time be subject shall be the sum of Twenty-five Thousand (25,000) Dollars, exclusive of bonded debt, and this corporation may issue and negotiate its bonds at such time in such amounts and secured by mortgage or otherwise as its Board of Directors may deem best, but not to exceed in the aggregate the sum of Fifty Thousand (50,000) Dollars in addition to the above mentioned Twenty-five Thousand (25,000) Dollars of indebtedness or liability.

ARTICLE FIFTH.

The names and places of residence of the persons forming this association for incorporation are as follows: Henry M. Byllesby, St. Paul, Ramsey County, Minn.; George C. Duffie, St. Paul, Ramsey County, Minn.; Wentworth P. Johnson, St. Paul, Ramsey County, Minn.; Benjamin F. Meek, Jr., St. Paul, Ramsey County, Minn.; Howard C. Levis, St. Paul, Ramsey County, Minn.

ARTICLE SIXTH.

I. The government of this corporation and the management of its affairs shall be vested in a Board of five Directors, each of whom shall be a stockholder, and in the following officers, viz., a President, Vice-President, Secretary and Treasurer, and such other officers and agents as the Board of Directors may from time to time appoint.

II. The Directors shall be elected at the annual meeting of the corporation on the first Monday in December in each year.

III. The officers of this corporation shall be elected annually by the Board of Directors at their first meeting each year immediately after the annual meeting of the stockholders.

IV. The President, Vice-President, Secretary and Treasurer shall each be Directors, and their terms of office and the term of office of Directors shall be one year and until their successors are duly elected and qualified.

V. The names of the first Board of Directors of this corporation are: Henry M. Byllesby, George C. Duffie, Wentworth P. Johnson, Benjamin F. Meek, Jr., and Howard C. Levis, and they shall hold office until the first annual meeting in December 1892.

ARTICLE SEVENTH.

The capital stock of this company shall be divided into two hundred and fifty (250) shares of the par value of one hundred (100) dollars each.

In witness whereof we have set our hands and seals this fourth day of December, A. D. 1891.

H. M. BYLLESBY.
GEORGE C. DUFFIE.
W. P. JOHNSON.
B. F. MEEK, JR.
HOWARD C. LEVIS.

Signed and sealed in the presence of
ALICE A. BARRY.
R. V. PRATT.

State of Minnesota, County of Ramsey, ss.

On this fourth day of December, A. D., 1891, before me personally appeared Henry M. Byllesby, George C. Duffie, Wentworth P. Johnson, Benjamin F. Meek, Jr., and Howard C. Levis, to me well known to be the same persons who executed the foregoing instrument, and each for himself acknowledged that he executed the same as his free act and deed for the uses and purposes therein expressed.

[Notarial seal] ROSWELL V. PRATT,
Notary Public, Ramsey County, Minnesota.

Register of Deeds Office, Steele Connty, Minn.

I hereby certify that the within instrument was filed in this office for record on the fifth day of December, A. D. 1891, at 8 o'clock A. M., and was duly recorded in Book "B" of Micl., pages 372 and 373.

G. E. SLOAN, Register of Deeds.

Filed for record in this office December 8th, 1891, at 11 o'clock A. M. F. P. BROWN, Secretary of State.

The magnitude of the operation and its brilliant prospects are manifest. The plant started out with a *sure income* of $70 per month and a one-year contract.

The Pierces were not, however, quite as foolish as their action in starting this plant might denote. They had money, but spent very little of it. They bought their outfit of the Northwest Thomson-Houston Company on long credit, agreeing to pay at least $100 a month. The station was a very good one for a town of the size, but there were not then enough customers for light to make it pay. While Pierce Bros. were trying to educate the people, they were running behind. About a year later their debt to the Northwest General Electric Company was upwards of $7,000, and was increasing.

At length Mr. Byllesby had got his plan in operation, he having come to St. Paul in the early part of 1891. Wherever he had found a railway or lighting plant losing money on a small capital and with careful management, he lost no time in applying the Coffinesque method of making plants pay. In accordance, therefore, with this general plan, the Northwest Company took over the Owatonna station, and Mr. Byllesby proceeded to organize and incorporate the Owatonna Electric Company on December 4, 1891.

The articles of incorporation of this company are herewith placed in evidence. The names of the incorporators and first board of directors are familiar, each and every one being an employé of the Northwest Thomson-Houston Company, working directly under the general orders of C. A. Coffin.

It will be noted that the capitalization was planned at $25,000 stock, $50,000 bonds, and that a further debt of $25,000 was authorized. However, only $25,000 of bonds were actually issued and sold. But the indebtedness of the company was speedily run up above the legal limit, as will be shown by the official records.

Taking up now the record of this Owatonna plant as a commercial enterprise, we find a repetition of the old, old story—plenty of money raised from the sale of bonds, floating debt of the company rapidly increased, apparatus supplied on credit by the Northwest Company, default of interest on notes and bonds—one more of the practical examples of the T.-H. exploiting work added to the "sick list."

During the first year under Mr. Byllesby's direct control some changes were made in the station, some new machinery added. So we will pass over the unfavorable record of results for this year, and merely record the situation at the close of 1893 when the plant had had twelve months' operation without drawbacks of any kind. First let us look at the "Trial Balance."

[COPY.]

OWATONNA ELECTRIC COMPANY.

TRIAL BALANCE FOR SIX MONTHS ENDING JUNE 30, 1893.

Plant account	$61,611.98	
Steam plant	7,550.84	
Electric plant	492 15	
Buildings	6,527.59	
Meters	1,258.36	
Transformers	1,078.24	
Street lines and wire	774.18	
Motors	41 00	
Tools and fixtures	277.73	
Wiring	194.55	
Cash	182.37	
Organization expenses	315.85	
Real estate	50.00	
Accounts receivable	572.37	
Salary of superintendent	225.00	
Wages of engineer and fireman	600.00	
Fuel	1,398.38	
Oil and waste	38.46	
Carbons	70.90	
Boiler compound	56.80	
Lamps	60.30	
Discount	139.05	
Traveling expenses	12.00	
General expense	191.66	
Repairs to electric plant	59.17	
" " steam plant	39.71	
Insurance	274.97	
Taxes	105.00	
Interest	755.37	
		$81,988.98
Credits.		
Capital stock	$25,000.00	
Bonds	25,000.00	
Notes payable (Northwest General Electric Co.)	29,931.66	
Earnings	3,563.05	
Profit and loss	1,182.93	
Surplus (previous year)	341.34	
		$84,988.98

Almost the first thing to occur to the student of the Northwest system is that the debts of the concern were already $4,931.66 more than the law justified. The "plant account, $61,611.98," is no doubt what the concern was carried for as an asset on the books of the Northwest Company.

The earnings and expenses had been as follows:

OWATONNA ELECTRIC COMPANY.

STATEMENT OF EARNINGS AND EXPENSES FOR TWELVE MONTHS ENDING DECEMBER 31, 1893.

Earnings.

	Inc.	Arc.	
January	$382.27	$274.60	
February	382.90	270.00	
March	314.03	264.00	
April	305 95	266.10	
May	271.85	281.50	
June	232.35	287.50	
July	194.75	278.00	
August	234.15	287.50	
September	333.15	282.50	
October	436.15	282.75	
November	586.55	272.75	
December	709.63	277.50	
	$4,383.73	$3,324.70	$7,708.43

Expenses.

Salary officers and clerks	$630.00	
Wages engineers and firemen	1,176.81	
Fuel	2,673.25	
Oil and waste	54.06	
Carbons	135.90	
Boiler compound	95.42	
Lamps	221.25	
Discount	368.18	
Traveling expenses	27.35	
Repairs to electric plant	90.36	
Repairs to steam plant	99.45	
Insurance	274.97	
Taxes	132.48	
General expense	319.45	$6,298.93
Surplus		$1,409.50

This shows an apparent profit of $1,409.50, but no account has been taken of interest, etc.

The fixed charges were as follows:

Interest on $25,000 bonds at 6 per cent	$1,500.00
Interest on $29,931.66 notes at not less than 10 per cent	2,993.16
	$4,493.16
Deduct profits from operations	1,409.50
Deficit	$3,083.66
And to show how far the plant fell short of being a sound enterprise, we must add:	
6 per cent. depreciation on plant account	3,696.71
6 per cent. interest on stock, $25,000	1,500.00
Total deficiency for one year	$8,280.37

The official records show that on December 31, 1894, the situation had not changed materially, but what change there was was in the wrong direction. "Notes payable" had increased to $32.314.31, or $7,314.31 more than the legal limit. Gross earnings were $7,423.21 and operating expenses $6,252.87, leaving $1,170.34, net earnings from operation, or a decrease of $239.16 from the previous year's results.

BOOK REVIEWS.

THE STANDARD DICTIONARY. New York: Funk & Wagnalls Co.

There is but one book that can be said to be more important and necessary to the intelligent man than any other, and that is a dictionary of the language. If a person or family can buy but one book, this is the one which should be bought, and it is important that it should be the best of the kind. When the Century Dictionary made its appearance it was generally felt that the acme of dictionary making had been reached, but there is an old saying that there is nothing so good but that there may be a better, and so it has proved in this case.

Messrs. Funk & Wagnalls have in their Standard Dictionary produced a work which must commend itself to all who give it examination. It is more than a dictionary. It partakes largely of the nature of an encyclopedia, and in this way its utility is much enhanced. To the technical man it commends itself, especially by reason of the care which has been bestowed upon the definition of technical terms. In electricity, for instance, it is a complete electrical dictionary, quite as full, as far as words are concerned, as Houston's Electrical Dictionary, and devoid of the innumerable cross-references which have detracted so largely from the usefulness of the latter.

This part of the work was entrusted to Mr. Ralph W. Pope, and the result has been just what might have been expected at his hands. We have endeavored to find an omission in the electrical vocabulary, but even when we put it to the test of such slang words as "bug" and "nigger," it answers the requirement.

Next to the electrical, the chemical vocabulary seems to be the most complete, and great care has been exercised in its preparation. Here more than anywhere else, perhaps, has the reformed spelling of the American Association been authoritatively represented. The vocabulary of light, heat and optics is nearly, if not quite as full. Thus the student of physical science will find in this one book a complete dictionary of the terms belonging to the various branches underlying the general science of engineering.

The book contains many thousands more words than even the Century Dictionary, and is sold in one and two volume editions at a cost of $12 and $18 respectively, in half Russia. For our own use it is by far the best dictionary thus far published.

OUR discriminating contemporary, *The Electrical Review*, prints the following:

"It is recorded that the first Ural miners were much disgusted with platinum, and did not know what to do with the hard, dirty-looking metal, says a London contemporary. They thought that they had solved the problem of successful utilization when they had made bullets of it for their sporting muskets. The annual platinum consumption of a few years ago of four tons has, of course, increased very considerably with the development of electric lighting."

This may be all right, but the question naturally arises, how did they melt the platinum?

C. A. Coffin on the Shores of White Bear Lake.

To bond, or not to bond: that is the question,
Whether 'tis a surer thing for me
To steal this dummy line outright
And sell it as so much old junk
Or to organize a company and float bonds on it.
To sell: to steal no more; for by a steal
We can gobble up a few thousand good, hard rocks
That several orphans in New England
Are heir to. 'Tis a scheme cleverly to be pushed.
To bond: dead sure thing. To sell: perchance
To lose: ay, I'm no dub.
For we can buy the road with bonds
Then sell these people enough new stuff
To let the T.-H. Co. out.
In this deal no chance will come
That we'll have to wriggle out of legal toils.
Why should we pause?
There's the respect of the law that makes some men poor;
But that don't bother us.
The lawyers wise, slick and shrewd,
They themselves can a quietus put on any kicker
Who would fables bear to investors in the East,
Or tell them that this road can never earn enough to pay interest.
In our prospectus much shall be said
Of the undiscovered country to whose bourne
We will have heavy "induced" travel--
Of Byllesby's bears and our grand pavilin.
'Twill make them mortgage all their property
And fly to Boston to buy at 80 the bonds that cost us 60.
And thus we'll get a heavy haul,
And thus we'll work the "exploiting" game
In other enterprises in the great Northwest.
With this "expansion" of our business
The bond mill in the East will not lose the name of action.

The Science of Circulation.

W. J. Johnston Has A Counterpart at Brownsville.

(From Results, a Chicago Advertising Paper.)

I am business manager of the Brownsville *Daily Weakling*. I am also editor and proprietor of the paper, reporter and book-keeper, but the experiences I am about to relate refer only to my capacity as business manager, so I will simply call myself manager of the business department of this well-known daily.

When I bought this paper, eighteen months ago, it had 380 actual daily circulation. I turned over a horse that I owned for the press and outfit of the paper—no questions asked on either side. We concluded that the ill will of the paper offset the advertising unpaid, and the debts more than wiped out the balance of the assets. The trade was, therefore, easily accomplished. Up to that time I had been selling garden truck about town for a living, and I had always considered my job harder than the editor's. He in turn envied me. So he took my horse and cart and I took his newspaper and launched myself out as a journalist.

The change did not benefit the paper greatly. Nobody seemed to want to pay for it. There was no difficulty in keeping up the 380 circulation so long as I didn't try to collect for it, but the moment I asked pay for the paper the subscription was dropped. I finally concluded that 250 copies were all I could afford to put out in this way, so I let the circulation drop to that point.

This discovery necessitated keeping a pretty stiff upper lip in order to support myself and the paper from the advertising. The claimed circulation when I took the paper was 1,500 copies. With the new blood in it and the new management of course the circulation should increase. Up to this time I had always been pretty honest; in fact it was hard to be otherwise in my old business. But the first thing I learned about the newspaper business was that honesty wasn't expected in this line. Certainly it could never be profitable; so I shortly raised the circulation figures to 2,000, and most of the newspaper directories the next year credited me with that. Thus for the first time the circulation of the *Weakling* was ahead of the Brownsville *Courier*. The *Courier* had for a long time claimed 1,800, and held there. But as soon as I began telling advertisers about my 2,000 circulation, the *Courier* came up to 2,200, and still held ahead of me. This, of course, forced me up to 2,500, and another similar move on their part brought me to 3,000. We had now reached about the limit.

Lately I have reduced my circulation claims a little. I call it 2,875, and say frankly that it has fallen off somewhat in outside towns. This sounds honest, and I find it a great deal better than claiming an even 3,000. The only part that troubles me is the expense of printing 250 copies daily, but I do not see how I can well cut it down. It takes half that number to go to my advertisers, and I must make a little show outside. I think it well to be cautious on this point. When one has the advertising business that I have, he doesn't care to risk it simply to save a few papers. I think that I shall keep the circulation up to where it is.

LATE TELEPHONE NEWS.

THE efforts which a number of independent telephone manufacturers in New York have been making to obtain permission and authority to assume the defence in the suit of the Bell Telephone Company vs. the Bay State Telephone Company of Boston have come to naught. In the proposed assignment of interest in the case the Bay State Company insisted upon such exacting conditions that the New York people found it impossible to accept them, and the deal is now off. It is declared by those in a position to know that the Bay State Company will now permit the suit to go by default, and that the injunction will issue as a matter of course.

COMMUNICATION.

"I."

To the Editor of ELECTRICITY.

DEAR SIR: "An Englishman in America should always try to retain his Englishness—otherwise in a year or two he will be reduced to the level of an average American."

As Mrs. Partington said of the doctrine of total depravity, "this is a good doctrine if it is only lived up to." It is proclaimed by Professor George Forbes in his recent contribution, "Harnessing Niagara," and in this instance at least, it must be conceded that he has lived up to it. The perpendicular personal pronoun occurs in the course of the article no less than one hundred and sixty-five times, by actual count, one unfortunate result of which is that no room is left to so much as mention the name of any other electrician or engineer connected with the design or execution of the work, with the exception of a brief allusion to Nikola Tesla. Forbes *fecit!*

"There are two great mistakes commonly made," says Forbes, "as to Americans. One is that they are original inventors; the other is that they are humorous. Neither of these propositions is true. It is true that if asked to create a knitting-machine or a type-writer, or a reaper, they will put together well-known mechanical devices to accomplish the result. But this is designing, not inventing." "It was therefore perhaps natural," says Forbes, "to have recourse to a European [to wit, Forbes,] to take hold of this great and entirely novel problem." It was also for this reason that "one of the ablest American engineers said in public three years ago that it was impossible to transmit the power of the Falls to Buffalo. some twenty miles, so as to make it pay; whereas *we have now established the fact* [italics ours] that the limit of distance is to be counted by hundreds of miles." This last statement cannot truthfully be said to be lacking either in invention or humor, but then it was not made by an American.

Viewing the Niagara scheme as an entirety, one would imagine that its most characteristically original feature was that of placing the turbines at the bottom of the shafts excavated in solid rock, and causing them to discharge into a tunnel serving as a tail-race, which Professor Forbes admits to have been a thirty-year old conception of an American engineer; and next to that may be placed the two-phase system of alternating current distribution due to the labors of the Montenegron Tesla. Professor Forbes claims to have put these two ideas together to accomplish the result, and lo! we have, in this case, not a mere "design," like that of the type-writer or the knitting-machine or the reaper, but an "invention."

In this article the Professor recounts with great minuteness the various trials and tribulations which beset him in carrying out his great enterprise. "At first, says he, "I declined this invitation [to submit competitive plans] on the grounds that the method of competition is contrary to my professional practice, and also that with so novel a problem I would not accept any man or combination of men to adjudicate upon the project which I might decide upon." Finally, however, he thought better of this, and submitted complete drawings, specifications and estimates of cost. "The Commission," says the Professor, "sat upon these plans"—apparently in the slangy American sense of the term—inasmuch as they "denounced the alternating current." Worse than this, Lord Kelvin, as well as "the highest scientific authority in the States"—whoever he may have been—took the same ground, although the latter, it seems, underwent a subsequent conversion to the true faith, owing, as stated here, to the successful results of the Frankfort-Lauffen installation, but according to another account, to which some reference has recently been made in the columns of ELECTRICITY, by reason of a fat retaining fee proffered by the management of the Cataract Construction Company. "Until *I* went to America, the manufacturers of electrical machinery never had a consulting engineer to reckon with, but dealt directly with the financiers who knew nothing about cost or efficiency of machinery. When they knew that *I* was to advise the Niagara Company, they tried by every means in their power to revert to the old plan. Every game of bluff, bounce and threats was used, but without the least effect." Then again, "I had at times great difficulty in keeping the president and vice-presidents in hand. One of the latter, after he had learned a little about ohms and volts, believed himself capable of instructing *me* as to which tenders I ought to recommend for acceptance." But the Professor gleefully tells us that he had a short and easy method of dealing with such cattle. "On such occasions," he says, "I would write to *my* millionaires, and tell them if they did not do what I told them they would be personally answerable for any disasters that might occur." One crack of the Professor's whip-lash over the heads of his well-broken team of millionaires never failed to make them pull as steady in the harness as the most docile of donkeys; as he succinctly says "this always had the desired effect." Incredible as it may seem, after his experience with the millionaires, he became so emboldened that he even attacked a coterie of six New York Central Wagner-car conductors, who were having a quiet cigar together in one of the smoking-rooms of the train in the early morning hours. We learn that he merely cast one withering gaze over the assemblage, and observed, "I want to smoke, but pray don't disturb yourselves; I am only a passenger." Thus did he, to use his own happy phrase, "retain his Englishness," and put the dismayed car-conductors, "the most insolent men in the country," to instant flight.

Some of the facts brought out in this paper shed light upon certain aspects of the Niagara enterprise which are beginning to excite no inconsiderable amount of discussion in the technical press. Among other things, it is stated that the capital subscribed amounted to $10,000.000, and about half of this has been expended—the first approximate estimate of the actual cost of the works which we remember to have seen. "I got the bids," says the Professor, "for the appliances for the transmission of power to Buffalo. I decided on all this transmission plant, and it is not now put in *only because the Buffalo people* want to get the power for next to nothing."

Is it not possible that the Professor may have stated this proposition wrong end first? How would it accord with the actual facts if we put it in another way, as for example thus:

"The Buffalo people want their power at a price which will justify them in abandoning their steam-plants. Deducting from this price the amount necessary to pay interest and depreciation on a due proportion of the investment of $5,000,000, and of administrative and other necessary expenses, the amount of profit remaining for the Niagara Company is next to nothing!"

We hazard the conjecture that if five years had been allowed to elapse before Professor Forbes had been called upon to render a public account of his doings at Niagara, the numerical repetition of the personal pronoun would have been diminished perhaps 90 per cent., and some portion at least of the credit of designing the electric dynamos would have been conceded to their "disingenuous" manufacturer. We may be mistaken. Time will show.

Yours truly,
AN AVERAGE AMERICAN.

GENERAL NEWS.

What is Going on in the Electrical World.

Le Sueur, Minn.—This city has voted to issue $20,000 bonds for water and electric light plants.

Delevan, Wis.—The village board has decided to contract with the Electric Light Company for the lighting of the streets.

San Jose, Cal.—At a meeting of the board of trade a resolution was adopted favoring city ownership of the lighting plant.

Cromwell, Conn.—The selectmen have granted the Middletown Electric Railway Company the privilege of a trolley system in this town.

Wellsboro, Pa.—The Wellsboro borough council have resolved to contract for 20 arc street lights of 2,000 candle-power at an estimated cost of $2,000.

Oshkosh, Wis.—The Central Wisconsin Electric Company has negotiated a loan of $300,000 to enable it to complete the local and interurban electric railway systems.

Homestead, Pa.—A fly-wheel at the electric light works here burst on the 4th inst., killing John Bowman, the engineer, and doing considerable damage to the building.

Meridian, Miss.—The city boards have granted a franchise to W. R. Hall, of Chattanooga, and associates to construct and operate an electric street railway in this city.

Holyoke, Mass.—There is a fair prospect of an electric railway being built to South Hadley from Holyoke early next year. The course will be surveyed and laid out at once.

Millbury, Mass.—It is stated that several concerns in town who need a small amount of power will put in electric motors as soon as they can be provided with electricity in the daytime.

Hicksville, L. I., N. Y.—The Long Island Electric Company intends to establish a plant at Hicksville and supply the villages of Jericho, Syosset, Central Park, Farmingdale and Westbury.

Paris, Tex.—The streets have been graded for the new electric car line. The line to West Paris will be constructed first and after that is completed the reconstruction of the old line will begin.

Pittsburg, Pa.—The Second Avenue Traction Company has completed the laying of its tracks from Brinton to Wilmerding, and cars are now running direct between the latter place and Pittsburg.

Johnstown, N. Y.—George A. Streeter, of Johnstown, and parties from New York will soon erect an electric plant to furnish this city and its business places and private residences with light and power.

Burlington, Vt.—The Sunset Electric Company have asked permission to build and operate a railway in certain streets of this city, and state that they are willing to bid for the franchise if put up at auction.

Bay Shore, L. I., N. Y.—George B. Studley and Archibald J. Martin have applied to the town board for a franchise to run a trolley line from Brentwood to Bay Shore, thence to Oakdale and west to Babylon.

Bradford, Vt.—A preliminary organization has been effected in Bradford for the purpose of erecting an electric light and heating plant and carrying on the business of an electric lighting and heating company.

Los Angeles, Cal.—The Los Angeles and Pasadena Electric Railway Company proposes to extend its line from Pasadena to Altadena and has applied to the board of supervisors to advertise a franchise of the route for sale.

Saginaw, Mich.—At a meeting of the township board of Bridgeport, a 30-year franchise was granted to the Saginaw Street Railway Company to run a line along the Genesee plank road from the city limits to Bridgeport.

Urbana, O.—W. H. Hanford & Co. have accepted the franchise for an electric railway granted them by the council. This is the line intended to connect this city and Springfield. The entire right of way has been secured.

Menasha, Wis.—The Citizens' Electric Light and Power Company, having declined to accept the franchise granted by the council, that body has decided to advertise for bids for lighting the city with between fifty and sixty arc lights.

Omaha, Neb.—The South Omaha Electric Light, Heat and Power Company's plant and privileges have been purchased by the South Omaha Water Works Company, of which John A. McShane is president and B. S. Scannell is secretary.

Augusta, Ga.—The Augusta Street Rilway Company is in the hands of a receiver. The action is a friendly one preparatory to reorganizing the company and putting the railway on a dividend-paying basis. D. B. Dyer is the receiver.

Seattle, Wash.—Sealed proposals will be received by George F. Meacham, secretary of the board of public works, at the office of the board, until October 31, for furnishing street lights to the city of Seattle according to plans and specifications now on file.

Philadelphia.—According to "The Press," the street car companies' receipts from "trolley parties" in this city during the past summer amounted to $70,000. Allowing 10 cents for each passenger, this shows that 700,000 persons indulged in that kind of enjoyment.

Alton, Ill.—The town board of Upper Alton have accepted the proposition of George C. Morgan, of Chicago, to build a complete water works and electric light plant for the sum of $53,432. The contract, as accepted, calls for thirty-five arc lights.

Kingston, N. Y.—If right of way is secured, the Port Jervis, Monticello and New York Railway Company will extend its line to Kingston. This would give the people of the Rondout Valley a trolley service between Port Jervis and Kingston by way of Ellenville.

Chicago.—Dr. J. W. Wass, of West Pullman, says he has discovered a cure for diphtheria which far exceeds anti-toxine in efficacy. Dr. Wass's remedy is electricity, which is applied directly to the throat. A conference of physicians will be held to pass on the alleged cure.

Toledo, O.—Work has been commenced on the right of way for a new electric line from Toledo through Sylvania, Metamora, Lyons and Fayette to Pioneer. M. I. Wilcox, James M. Ashley, Jr., and other Toledo capitalists are interested. The road will be pushed rapidly.

Bay City, Mich.—The Consolidated Street Railway Company of this city has made contracts with both the Rapid Transit and Interurban Company, which propose to build lines between Saginaw and Bay City, and the new companies will reach the business center over its lines.

Middletown, Md.—Work on the permanent survey of the Frederick and Middletown Electric Railway has begun and the grading of the road will be in progress by the latter part of this month. A call has been issued for 20 per cent. of the capital stock, payable on or before October 15.

St. Louis.—All the local street railway lines, with the exception of the Suburban, will send delegates to the Convention of the American Street Railway Association to be held in Montreal October 15-17. The delegates will make a strong effort to have the convention brought to St. Louis in 1896.

Ellicott City, Md.—The preliminary work on the station and other necessary structures for the Ellicott end of the Edmondson Avenue, Catonsville and Ellicott City Electric Railway has been commenced. A force of hands is now at work grading and placing the foundations for the railroad buildings.

Milford, Mass.—The Electric Storage Battery Company of Philadelphia is reported to have purchased the three shops and all the patents, machinery and cars of the Hopedale Electric Company, and will make Milford their New England station. W. L. Stevens has been engaged as superintendent of the Milford plant.

Brooklyn, N. Y.—The Nassau Electric Railroad Company has been improving its plant at the power house at a cost of $50,000. In addition to this, it is stated that General Manager J. J. Coleman has ordered 200 open cars from the J. G. Brill Company of Philadelphia, for use next summer on the new Manhattan Beach road.

Elyria, O.—The city council has granted a franchise to James A. Mauldin, representing Cleveland capitalists, to construct an electric railway through the city, beginning at the southern limit. It will be extended to Lorain and North Amherst, making the second line to connect Elyria and Lorain. Work on the line is to begin at once.

Sherman, N. Y.—Active steps are being taken in an electric street railway project which is practically an extension of the recently proposed electric road from Barcelona, on Lake Erie, via the Gulf to the Chautauqua Assembly Grounds. A. B. and W. L. Minton of Westfield, F. A. Ellis, J. L. Thayer and T. S. Marion of Sherman, are interested.

Benton Harbor, Mich.—Paw Paw Lake, situated one mile from Watervleit and twelve miles north of Benton Harbor, which is so fast becoming a beautiful summer resort, will soon be connected with this city by an electric railway, which was decided upon only a few days ago by several capitalists who are interested. A survey of the new route has just been completed.

Logansport, Ind.—A new electric road is to be constructed connecting this city with Rochester, Fulton County, and Burlington, Carroll County. The road will be about thirty-five miles long. J. T. McNary, formerly manager of the Logansport Street Railroad, is at the back of the new road and has interested several Eastern capitalists. A company will be organized in a short time.

Paxton, Ill.—Articles of incorporation have been filed by the Danville and Paxton Electric Railway Company, and capitalists are being interested in the plans of the company. The cost of building the forty-three miles of proposed road is estimated at $9,000 a mile or a total of $387,000. At a recent meeting here C. Bogardus, W. T. Patton and L. Corbly were appointed a committee to secure twelve miles right of way.

San Francisco.—The "Call" states that the proposition for municipal ownership of water works, gas works and electric lighting plants is steadily growing in favor in this city, and petitions are being circulated having this purpose in view.—The opposition to the use of electric cars on the steep grades of the Piedmont Hills has apparently ceased and a contract has just been signed by which that branch of the system will at once be changed from a cable to an electric road. The change will be experimental so far as using the cable is concerned. The cable will be kept in repair and will probably be operated when it is necessary to carry more passengers than the electric service can accommodate.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Boston, Mass.—J. Pickering Putnam, architect, has prepared plans for a hotel to be erected on Commonwealth ave., beyond the Three Roads; Charles Francis Adams is one of the trustees.

Brooklyn, N. Y.—McLaughlin Bros. will erect an eight-story printing house on the north side of South 11th st., east of Wythe ave.; to cost $60,000 .. The plans and specifications of the new building for the Brooklyn Institute of Arts and Sciences have been approved by Building Inspector Wesley C. Busch; the structure will be located on Eastern Parkway; Architects McKim, Mead & White, 160 5th ave. New York City....The Morris Building Company will erect a three story brick house on east side of Clinton ave., south of Willoughby, to cost $30,000.

Buffalo, N. Y.—Herbert J. Myer, proprietor of the American Theater Roof Garden, New York City, has been in Buffalo, looking over the situation and making arrangements for the erection of a Music Hall....Architect George J. Metzger has prepared designs for a six story brick building to be built on west side of Pearl st., between Eagle and Court sts., for Philip Becker & Co., grocers.

Dunbar, Pa.—There are indications that there will soon be erected a large business block in Dunbar, at a cost of $50,000 or $60,000, consisting of a large opera house and a hotel on a new and improved plan.

New York City.—Ground will be broken for a new theater, southeast cor. of Lexington ave. and 42d st., next spring, to be erected by the Goelet Estate, and when completed will be managed by Frank Murtha....The Harlem Wheelmen have appointed a committee to procure a site on the west side of the city for a club house to be erected after plans prepared by Robert D. Morrison....The Bohemian Gymnastic Association, "Sokel," 533 E. 5th st., will erect a four story brick clubhouse at 420-424 E. 71st st., to cost $55,000; Architect Julius Franke, 287 4th ave....John T. Williams, purchaser of the Lawrence Estate property, Broadway and White st., will remove the present buildings and erect a modern fire-proof and commercial building on the site.... David L. Newborg has sold J. C. Lyons, 81 E. 125th st., property at 491-493 Broadway and 446 Broome st., fronting on Broadway; the old buildings on the site will be torn down on February 1 and a modern 12 story business building erected on the site....Blake & Nally will erect 4 five story flats on south side of 88th st., west of Amsterdam ave., from plans prepared by Architects Webster & Thompson, 215 W. 125th st.; specifications include steam heating appliances, electric bells, etc. .. James B. Brown, 124 W. 90th st., will erect two five story brick flats on north side of 102d st., west of Amsterdam ave.; Architect, C. Steinmetz.... Robert Ferguson, 743 8th ave, and Wm. Cummings, 405 McDonough st., Brooklyn, will erect a four story and basement store and flat building on east side of Amsterdam ave., cor. 108th st.; Architect George F. Pelham, 503 5th ave... An apartment house is to be built northwest cor. Madison ave. and 89th st., by Nicholas Cotter, builder....Charles A. Rich, 265 Broadway, will build a four story dwelling on north side of 91st st., east of West End ave.; Architects Lamb & Rich, 265 Broadway.....Mrs. Margaret F. Mace (Maggie Mitchell) has purchased two lots southwest cor. of West End ave. and 102d st., and will build an eight story fireproof apartment house from plans by Wm. H. Day, 1 Madison ave .. T. C. Smith has purchased the northwest cor. of Madison ave and 108th st., and will build four five story flats with stores, 100 x 87....Nicholas Cotter will erect three five story apartment houses, southeast cor. of Manhattan ave. and 103d st., on site which was recently purchased from Adler & Herman.

Philadelphia, Pa.—A six story office building is to be erected by Contractor S. B. Riley at the northwest cor. 4th and Merchant sts....Alterations are to be made to Handel and Haydn Hall, at 8th and Spring Garden sts., by Contractor Matthew Schmid; an elevator is to be installed and the property otherwise improved.

Providence, R. I.—A modern residence will be erected here for President Andrews of Brown University.

Saratoga, N. Y.—Ground has been broken at 1 Marion place for a new residence for Addison E. Curtis, of the Citizens' Bank.

St. Louis, Mo.—Architects Kirchner & Kirchner are preparing plans for the erection of a building which will be a swimming tank, ice skating rink and bicycle school; a stock company is being organized with a capital of $200,000 to carry out the scheme.

INCORPORATIONS.

The Enterprise Company, Portland, Ore.—to buy patent rights or inventions, to manufacture machines for affixing stamps, to acquire sailing craft, electric, cable, and steam railroads and novelties in general. Capital stock, $12,000; Incorporators: Stephen W. Aldrich, Henry C. Allen and John B. David.

The Metropolitan Electrical Development Company, Jersey City, N. J.—to manufacture, purchase, sell, hire, own, let or maintain motor engines, electric or otherwise, etc. Capital stock, $1,000,000. Promoters: John R. Dos Passos, Thomas D. Jordan, Chas. J. Canda, Wm. L. Moore, New York City; Conrad N. Jordan, Brooklyn, N. Y.

The Wilson-Bates Electric Company, New York City—to make and sell electrical or magnetic machinery, devices, etc. Capital stock, $1,500. Promoters: W. C. Wilson, G. B. Bates, H. G. Issertel, New York City.

The Sunset Electric Company, Swanton, Vt.—to manufacture, sell and furnish heat, power and artificial light. Capital stock, $15,000. Promoters: E. W. Jewett, A. J. Ferris, J. B. Jewett, Swanton.

The Central Construction Company, Oshkosh, Wis.—to construct electric railway lines. Capital stock, $300,000 Incorporators: E. E. Stevens, W. F. Gruenwald and N. A. Greenlaw.

The Munson Electric Conduit Company, Davenport, Ia.—to build and equip electric railways and handle all sorts of electrical supplies. Capital stock, $10,000,000. Incorporators: John H. Munson, James E. Merritt and William F. Roberts.

The McBair Electric Heating Company—to manufacture electric heating apparatus in Middletown, N. Y. Capital stock, $2.000. Directors: Henry C. McBair, Thomas E. Hayes and Harry M. Hayes of Middletown.

The Horton Obtunding Company, Cleveland, Ohio—to make an electric apparatus for dulling the sensibilities so as to make surgical operations painless. Capital stock, $30,000. Incorporators: W. P. Horton, M. C. Horton, J. J Shipherd, E. W. Badder and M. H. Solloway.

The Bethel Electric Lighting and Power Company, Bethel, Vt., has organized with a capital stock of $15,000. Mr. Stafford, president; W. H. Creamer, treasurer and general manager.

The Bordentown Electric Light and Motor Company, Bordentown, N. J.—to construct, maintain and operate works for supplying electricity for electric light, heat and power. Capital stock, $50,000. Promoters: James S. Gilbert, Wm. C. Steele, Geo. B. Gilbert, Bordentown, N. J.; Thos. Bennett, Amos G. Little, Philadelphia, Pa.

The Kansas City and Leavenworth Railway Company, Kansas City, Kan.—to maintain a double track standard gauge railroad, either steam or electric. Capital stock, $500,000. Promoters: W. A. Bunker, Arthur Johnson, H. A. Keefer, C. F. Hutchings, Kansas City; James Stone, Jr., Leavenworth.

The Clearfield Light, Heat and Power Company, Clearfield, Pa.—to supply light, heat and power by means of electricity to the public in Clearfield. Capital stock, $5,000. Promoters: H. A. Kratzer, J. F. Powell, G. S. Hughes, Clearfield.

The Canca Valley Development Company, San Francisco, Cal.—to supply water, gas and electricity, etc. Capital stock, $1,000,000. Promoters: Carl W. Elfving, Victor F. Seawell, Arthur Elliott, Bion S. Gregory, Adolfa Canal, San Francisco; M. Hubbard, Los Angeles.

The Victor Electric Company, Chicago—to manufacture electrical appliances. Capital stock, $2,400. Incorporators: C. F. Samms, J. B. Wants and E. P. Vickers.

The Niagara Falls Street Railway Company—to construct a street surface railroad in the city of Niagara Falls. Capital stock, $50,000. Directors: Arthur C. Deniston, Charles S. Hinchman, George L. Estabrook, Jr., Joseph S. Clark, Robert J. Byron, of Philadelphia, Pa.; James S. Simmons, E. H. Stewart, Walter H. P. Horne and Spencer J. Lawrence, of Niagara Falls.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

OCTOBER, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	1.40 A. M.	1	5.10 A. M.
2	2.40 "	2	5.10 "
3	No light.	3	No light.
4	"	4	"
5	"	5	"
6	6.00 P. M.	6	7.30 P. M.
7	6.00 "	7	8.10 "
8	6.00 "	8	8.50 "
9	6.00 "	9	9.50 "
10	6.00 "	10	10.50 "
11	6.00 "	11	12.00 M.
12	6.00 "	13	1.00 A. M.
13	6.00 "	14	1.10 "
14	5.50 "	15	2.30 "
15	5.50 "	16	3.50 "
16	5.50 "	17	5.30 "
17	5.50 "	18	5.30 "
18	5.50 "	19	5.30 "
19	5.50 "	20	5.30 "
20	5.50 "	21	5.30 "
21	5.50 "	22	5.30 "
22	7.00 "	23	5.30 "
23	8.00 "	24	5.30 "
24	9.20 "	25	5.30 "
25	10.20 "	26	5.30 "
26	11.00 "	27	5.30 "
27	11.30 "	28	5.30 "
28	...... "	..	....
29	12.30 A. M.	29	5.30 "
30	1.30 "	30	5.30 "
31	2.30 "	31	5.30 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCTOBER 8, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

547,457. Trolley-Track. Antony Shumacher, Millington, N. J. Filed March 21, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

547,536. Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed Dec. 24, 1894.

547,537. Electric Car-Lighting. William Biddle and Harry E. Dey, Brooklyn, N. Y., assignors to said Biddle. Filed Jan. 9, 1895.

547,659. Electric-Arc Lamp. Harold E. Bradley, Pawtucket, R. I. Filed July 1, 1895.

547,753. Cut-Out for Arc Lamps. Daniel Higham, Boston, Mass., assignor to the Higham Electric Company, Portland, Me. Filed June 27, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

547,460. Telephone System. Frederic D. Shepard, Milwaukee, Wis., assignor to Frederick S. Ilsley and James Sawyer, same place. Filed Feb. 18, 1895.

547,613. Telephone Switch. Willard M. Miner, Plainfield, N. J. Filed June 4, 1895.

547,755. Automatic Telephone System. George K. Hutchins, Baltimore, Md. Filed May 6, 1893.

MISCELLANEOUS.

547,240. Electrical Safety Apparatus for Railways. Lewis W. Briggs, Chicago, Ill., assignor of one-half to William F. Cody, North Platte, Neb., and Nathan Salsbury, New York, N. Y. Filed Aug. 24, 1893.

547,358. Electric Synchronizer for Clocks. Henry S. Prentiss, Elizabeth, N. J., assignor to the Prentiss Clock Improvement Company, New York, N. Y., and Jersey City, N. J. Filed Aug. 10, 1892.

547,441. Electric Bicycle. Hosea W. Libbey, Boston, Mass. Filed Oct. 9, 1894.

547,476. Motor-Truck. John A. Brill and Walter S. Adams, Philadelphia, Pa. Filed Jan. 3, 1894.

547,568. Electric Key-Action for Pipe-Organs. Edwin S. Votey, William B. Fleming and William D. Wood, Detroit, Mich., assignors to the Farrand & Votey Organ Company, same place. Filed Jan. 21, 1895.

547,591. Switch and Fuse-Box. Joseph B. Smith, Manchester, N. H. Filed April 12, 1895.

547,660. Insulator-Pin and Insulator. Charles F. Carroll, Manistee, Mich., assignor of one-half to Thomas Scott, same place. Filed June 6, 1895.

547,683. Phase Modification. Henry A. Rowland, Baltimore, Md. Filed May 19, 1894.

547,714. Time-Controlled Electric Heater. Levitt E. Custer, Dayton, Ohio. Filed Dec. 22, 1894.

THE "A-B" ARC LAMP.

Early in May there was noticed at some length in this journal an account of the formation of the Adams-Bagnall Electric Company, of Cleveland, O. This company was organized by a number of gentlemen who long held important positions in the engineering and business departments of one of the leading electrical manufacturing companies and who have been prominently identified with many departments of electrical work. Since the formal announcement of the organization of the company nothing has been heard of its operations. It has not, however, been idle, but has been busily at work completing the designs and perfecting the details of the special apparatus it will place on the market. The preliminary work is now completed and the company makes its bow in introducing the "A-B" Arc Lamp to the trade.

The accompanying illustration makes it plain that in construction of arc lamps many new ideas have been evolved by the designers and inventors of the "A-B" Lamp.

The term "arc lamp" has always seemed to carry with it an idea of ungainliness—a device having no form or shape and strung out over 45 to 50 inches of space, divided up into sections of chimneys, rods, globes and sheet-iron drums—for reasons known only to the manufacturer. The trade has always looked upon an arc lamp as a necessary evil. The demand for something better is universal.

The "A-B" Arc Lamp is only 32 inches long over all and burns from 14 to 18 hours. It is a single carbon lamp with only one side rod, which causes only one shadow to be thrown. This shadow can be taken care of against the pole or building, leaving the light intended for the street entirely unobstructed.

A valuable feature about the operation of the lamp is in the cutout. It is well known that there are some standard lamps on the market which operate and cutout perfectly at any number of amperes provided that the lamp has previously been adjusted for a certain number of amperes. The "A-B" Lamp will, however, operate and cutout perfectly at any number of amperes from 5 to 10, without any adjusting whatever. The accomplishment of this feat renders it feasible and easy for the station manager to run either 1,200 or 2,000 candle power lamps as suits his convenience, with a change of nothing except the ampere output of his dynamo. Since the invention of the cutout itself, some twenty years ago, no step in the development of the arc lamp has been of greater importance.

Second in importance only to the above mentioned feature is the fact that the series lamp of the "A-B" type can be changed instantly into a constant potential lamp and that again into an alternating current lamp simply by an exchange of spools. All of the working parts of each lamp are mounted on one frame, which frame is attached to the lamp casing by a single bolt and nut. By loosening this nut the working parts of the lamp are removed and those of another can be readily substituted. One style of lamp only need be carried in stock by the station manager and with the addition of several kinds of spools he will be prepared to furnish a lamp for any kind of circuit.

The "A-B" Lamp will be furnished in any finish desired—black japan, yellow brass, XVIIth century brass, oxidized brass, oxidized copper, oxidized silver and aluminum. This provides an arc lamp good enough to hang in a parlor—it being possible to match any style gas fixture or decoration. The aluminum lamp complete weighs only nineteen pounds. The casing being of cast iron provides a solid back ground for ornamentation, giving the lamp a dignified, substantial appearance, quite different from the brass and sheet-iron spun work usually adopted where ornamentation on arc lamps has been attempted heretofore.

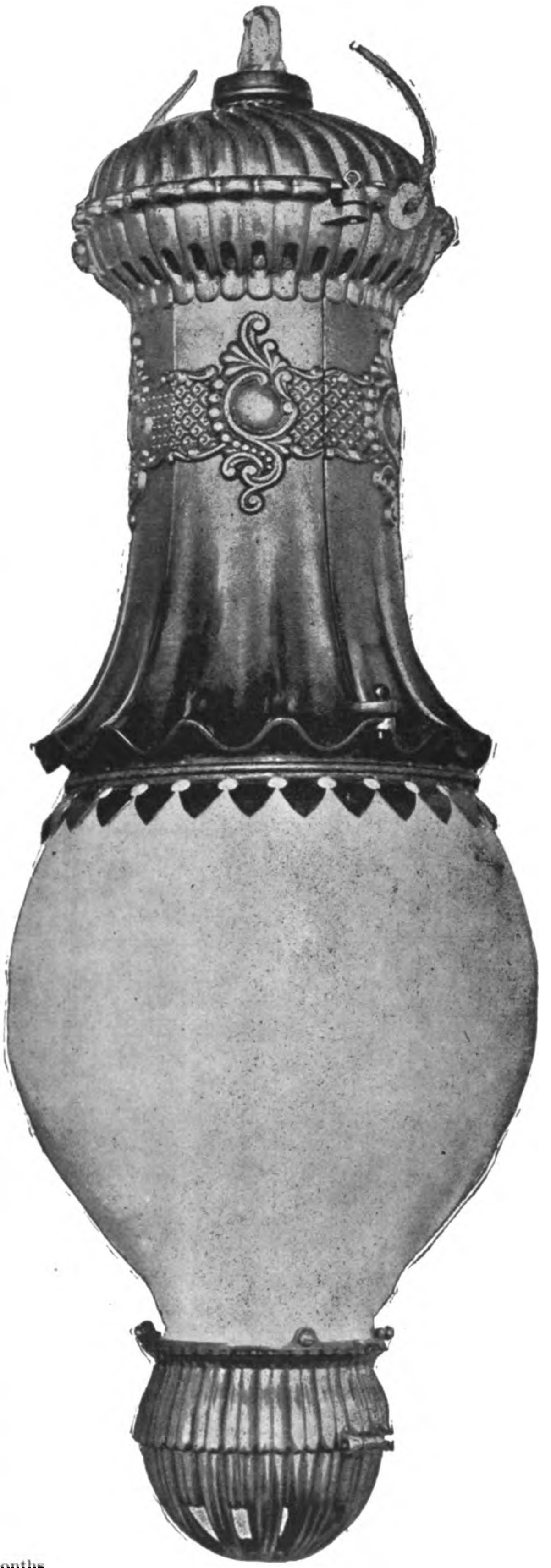
The "A-B" Lamp is the direct result of several months of close study and application by the engineering corps of the Adams-Bagnall Company headed by T. E. Adams, the well known inventor of the Brush-Adams lamp. The results obtained point to a lamp which will certainly take its stand at once among the leading lamps of the day, which assuredly means success for the new company.

The officers of the Adams-Bagnall Electric Company are as follows: Charles G. Hickox, president; Geo. W. Howe, vice-president and treasurer; L. H. Rogers, manager; S. E. Cox, secretary; C. W. Phipps, superintendent.

The Okonite Company, Limited, make a specialty of feeder wires for street railway use. They are tough and tenacious, and are not affected by extreme changes in temperature. Okonite has made an enviable record both in this country and abroad, and is deservedly the most popular insulation known to the electrical fraternity. It is strictly high-grade and "never disappoints."

A reorganization of the W. C. Leffel Company, water wheel manufacturers, Springfield, O., has been effected by the election of the following officers:

President, John J. Hoppes; vice-president, Wm. Conklin; general manager, Fuller Trump; treasurer, Paul A. Staley; secretary, Percy Norton.



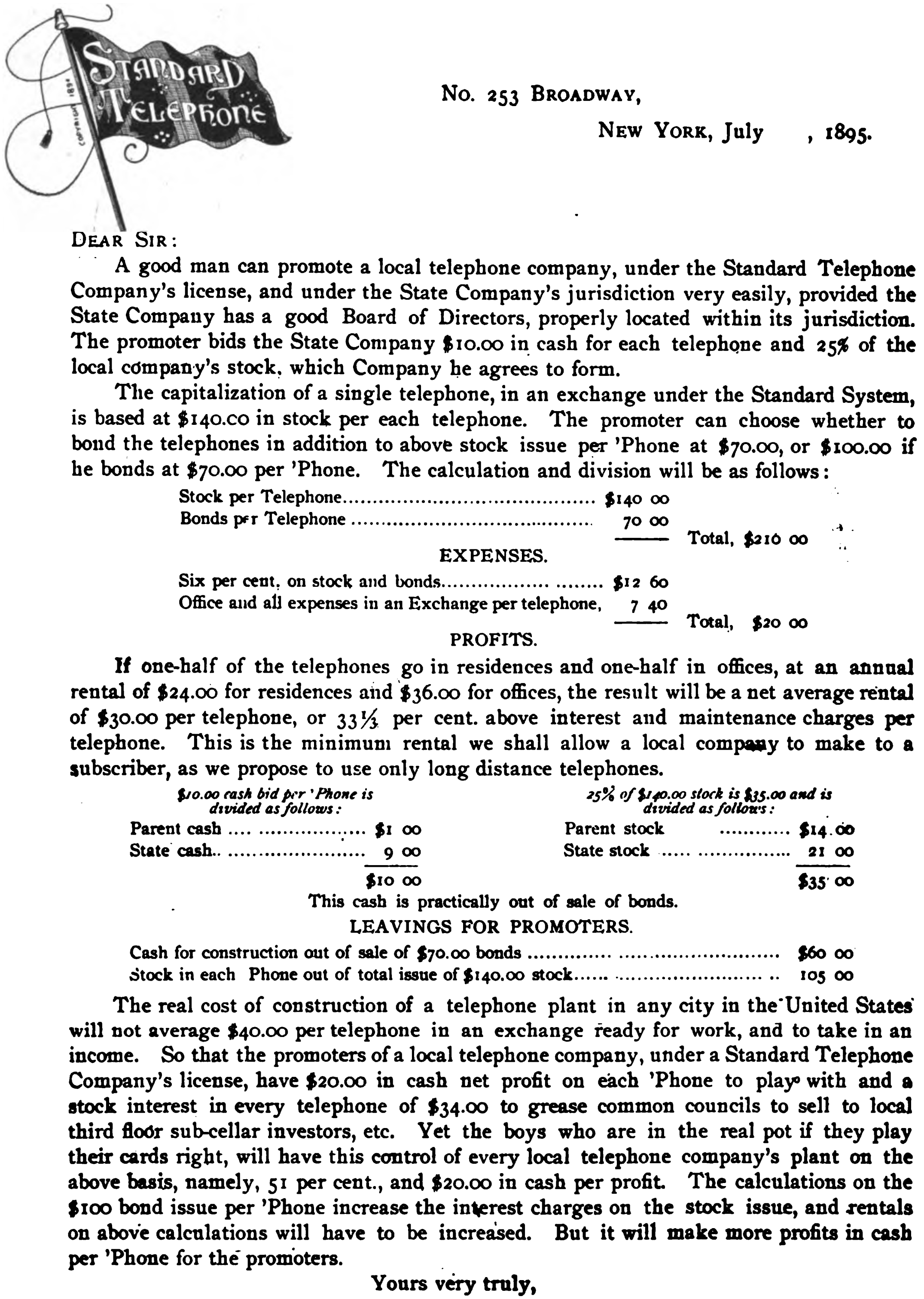
THE "A-B" ARC LAMP.

The new company will be styled The Trump Manufacturing Company, with a capital stock of $100,000. The same line of goods will be manufactured as heretofore and especial attention will be given to the manufacture of Fuller Trump's new water wheel.

THE TELEPHONE WORLD.

How to Promote Telephone Companies.

A Fac-simile of the Standard Telephone Company's Circular Letter of Instructions to "The Boys who are in the Pot."



STANDARD TELEPHONE
COPYRIGHT 1894

No. 253 Broadway,
New York, July , 1895.

Dear Sir:

A good man can promote a local telephone company, under the Standard Telephone Company's license, and under the State Company's jurisdiction very easily, provided the State Company has a good Board of Directors, properly located within its jurisdiction. The promoter bids the State Company $10.00 in cash for each telephone and 25% of the local company's stock, which Company he agrees to form.

The capitalization of a single telephone, in an exchange under the Standard System, is based at $140.00 in stock per each telephone. The promoter can choose whether to bond the telephones in addition to above stock issue per 'Phone at $70.00, or $100.00 if he bonds at $70.00 per 'Phone. The calculation and division will be as follows:

Stock per Telephone	$140 00	
Bonds per Telephone	70 00	
		Total, $210 00

EXPENSES.

Six per cent. on stock and bonds	$12 60	
Office and all expenses in an Exchange per telephone,	7 40	
		Total, $20 00

PROFITS.

If one-half of the telephones go in residences and one-half in offices, at an annual rental of $24.00 for residences and $36.00 for offices, the result will be a net average rental of $30.00 per telephone, or 33⅓ per cent. above interest and maintenance charges per telephone. This is the minimum rental we shall allow a local company to make to a subscriber, as we propose to use only long distance telephones.

$10.00 cash bid per 'Phone is divided as follows:		*25% of $140.00 stock is $35.00 and is divided as follows:*	
Parent cash	$1 00	Parent stock	$14.00
State cash	9 00	State stock	21 00
	$10 00		$35 00

This cash is practically out of sale of bonds.

LEAVINGS FOR PROMOTERS.

Cash for construction out of sale of $70.00 bonds	$60 00
Stock in each Phone out of total issue of $140.00 stock	105 00

The real cost of construction of a telephone plant in any city in the United States will not average $40.00 per telephone in an exchange ready for work, and to take in an income. So that the promoters of a local telephone company, under a Standard Telephone Company's license, have $20.00 in cash net profit on each 'Phone to play with and a stock interest in every telephone of $34.00 to grease common councils to sell to local third floor sub-cellar investors, etc. Yet the boys who are in the real pot if they play their cards right, will have this control of every local telephone company's plant on the above basis, namely, 51 per cent., and $20.00 in cash per profit. The calculations on the $100 bond issue per 'Phone increase the interest charges on the stock issue, and rentals on above calculations will have to be increased. But it will make more profits in cash per 'Phone for the promoters.

Yours very truly,

The Fittest Will Survive.

Once in a while, and then more by accident than design, the lay press stumbles on to a truth touching the commercial side of the electrical trade. A case in point is a recent article in the *Chicago Record* on the telephone situation, as follows:

"It is to be feared that a good many people will have their fingers burned before the telephone business, which is just now about the most risky branch of industry that anyone can handle, comes down to a sound and healthy basis. The country is full of 'promoters,' most of whom have fixed such low rates for telephone service that the public has been led to think that the business is all income and no expense. Persons who are figuring with the companies are advised to scan closely the telephone contracts presented to them to sign. Some of these contracts bind the parties for several years to take and use a service which must of necessity be inferior at the price named. The average promoter always has plenty of loopholes through which he can retire in his own good time. The truth is that the public has been suffering so long from high telephone rates that now, when good service at moderate rates is in sight, they have rushed to the other extreme and embraced the idea that telephones can be had for next to nothing. This idea has been encouraged and disseminated by interested persons, who have lost no time in turning it to their own ends. New telephone companies have been started which could not possibly do a permanent business at the rates they promise, and whose only object has been the sale of stock as soon as the appearance of active demand for instruments has been worked up. Other companies have put cheap telephones on the market only to find that they have left no margin of profit, and the loss has come upon the manufacturer, whose bills have been left unpaid. It is probable that by far the majority of small telephone companies will gradually die off, either from infringement suits or because they are built on sand. The fittest of the non-infringing will probably survive."

A Talk Meter Needed.

J. R. Malloy, manager of the Central Pennsylvania Telephone Co., Williamsport, Pa., is of the opinion that "acrying need in the telephone business is a talk-meter—that is, some sort of an automatic arrangement by which language can be measured off by the yard. What is required is a regular 'gas' meter, with a stopcock for profanity, old jokes, and endearing names for the telephone girls. I think an arrangement of this sort would be more valuable than an automatic device for making the connections. Many a wordy tale would be cut short, many a delicious but unprofitable confab nipped in the bud. A comfortable share of the telephone investment would go to the man who would invent a talk-meter."

One Way of Stifling Oppositi

The Citizens' Telephone Company of Pen
concluded a contract with the Southern Bell
Co. by which the business of the Citizens' Co.
the hands of the Bell Company. The lat
agrees to maintain a first-class exchange and
at not more than $30 a year for residences an
for business stations, with a discount of 10 per
it is agreed not to use any other 'phone for a
years.

H. P. Strause is organizing a telephone comp
derson, N. C.

It is proposed to organize a telephone comp
capital of $10,000 at Meridian, Miss.

Bellville, Smithton, Hecker and Red Bud, Ill.,
telephone connections with St. Louis.

The Saginaw Valley Mutual Telephone Com
asked for a franchise at Bay City, Mich.

Chase Brothers, of Grand Rapids, have been
franchise for a telephone exchange at Ionia, Mich.

The Mercer County Telephone Company of K
Ill., will extend its lines from Reynolds to Rock I

The city council of Seattle, Wash., has decreed
graph and telephone wires must be placed under
certain parts of the city.

The Central District and Printing Telegraph Co
Pittsburg has adopted a three-minute limit rate
loudly condemned by subscribers.

The Missouri and Kansas Telephone Company
build its plant in Joplin, Mo., and extend the
Galena, Webb City and Carthage.

The Chrisman Telephone Exchange Company,
Ill., has completed connections with Dana, Da
Newport. An extension to Clinton is contempla

A telephone exchange is to be established at
Mont., by a stock company composed of B. H. H
A. L. Babcock, C. M. Bair, Louis Fenske, Dr. M.
Charles Spear and others.

The Wolf River Telephone Company, organiz
anwega, Wis., some time ago, with Dr. E. H. Jon
eral manager, now has its lines extended to Fr
hula, Poysippi, Berlin and Waupaca.

B. M. Burke, of Carlinville, Ill., has petitioned
of way to build a telephone line from Hillsboro
field. The Montgomery County Telephone Com
already been granted a permit over the same rout

The Southern Michigan Telephone Company is
to connect Kalamazoo with a new circuit, which
twenty-five additional towns in southern Michiga
the connections will be Gull, Long, West and G
lakes.

The opening of E. B. Overshiner's new tele
change at Logansport, Ind., has forced the local
pany to reduce rates to $9 and $20 per year. Th
change has 212 subscribers under a three-year c
$12 and $18 per year.

W. C. Swift, president of the Northwest E
Company, St. Paul, is interested in the moveme
progress at Mill Bank, S. D., which has for its
establishment of a telephone exchange to conn
ville, Big Stone City, Simpson, Mill Bank and oth

The Pittsburg papers are the authority for the
that the Standard Telephone Company will build
in that city for the manufacture of telephone
General James S. Clarkson, Col. Conger and Ge
Naught, representing the Standard Company, hav
Pittsburg to conclude negotiations.

The Central District and Printing Telegraph C
and the Westmoreland Telephone Company are
in a rate war at Greensburg, Pa. The Westmorela
pany is a new concern, and is connecting Mount
Latrobe, Jeannette and many other towns in the
The Westmoreland company have appealed to the
stating that if they are given fifty more subscrib
will reduce their annual rates to $20 and $16.

To determine which applicant is more deserving
phone franchise the city council of Richmond, Va.,
pointed a committee consisting of the city engi
the superintendent of the Fire Alarm Departmen
electrician to be chosen, the duty of which shall be
a test of the instruments of the several companies
the privileges of establishing an exchange. The
Telephone of Richmond and the Standard Telepho
pany are applicants for the franchise. The Home C
proposes to use the Mason telephone.

The Marquette County Telephone Company,
already has exchanges in operation at Ishpemi
Negaunee, Mich., has strung wires to the city li
Marquette, claiming legal right to enter that place
a franchise and in disregard of the franchise grant
months ago to N. M. Kaufman and other local cap
The common council has decided to resist the ent
the Ishpeming Company and has applied for a rest
order. So far the Kaufman Company has done
more than secure renewal of its franchise and make
to keep out its would-be competitor. As the latter ev
means business, public sentiment seems to favor it
prise.

New Companies Incorporated.

The Oceana Belt Telephone Company has been i
rated at Hart, Mich.

The Altoona Phœnix Telephone Company, Altoo
Capital stock, $15,000. Directors: H. Price Graffius,
Dively, and John Flanagan.

The Jacksonville Telephone Company, Jacksonvill
Capital stock, $100,000. Incorporators: W. N. Shine
B. Collins of Tallahassee and A. H. King of Jacksonv

ELECTRICITY.

VOL. IX. NEW YORK, OCTOBER 16, 1895. No. 14

Insulating Conduit

BRASS AND IRON ARMORED.

Two wires in one Iron Armored Tube—the Standard Method of Interior Wiring.

LUNDELL FAN & POWER MOTORS.

Lundell Direct Connected Plants for Isolated Lighting.

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527—534 West 34th Street, . . . New York City.
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CHAS. P. GEDDES, Sec'y and Treas.

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INSULATED
WIRES AND CABLES.
GLENWOOD WORKS,
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New York Office, 15 Cortlandt Street. Telephone Call, 191 Cortlandt.

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PARTRICK & CARTER CO.
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125 South 2d St. Philadelphia
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Send Business Card and mention 'Electricity.'

Be thou just with thy neighbor and furnish the Standard system of electric lighting, for therein is ease of operation, low cost of maintenance, with contentment and riches.

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OKONITE
TRADE MARK.

INSULATED WIRES AND CABLES.

THE OKONITE CO., Limited,
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COLUMBIA LAMPS,

UNEQUALED IN QUALITY.

We guarantee that Columbia Lamps will maintain their Candle Power to A HIGHER DEGREE THAN ANY OTHER MAKE ON THE MARKET when operated at the same economy and under like conditions.

Do not take our word for it; before making contract make test and compare.

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CUT $\frac{\text{IN}}{\text{OUT}}$ YOUR
Lamps, Converters, Transformers, Motors
FROM YOUR CENTRAL STATION.
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Grimshaw White and Black Tapes,
Competition Line Wires,
Raven White Core Wires,
Vulca Electrical Wire Ducts,
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Chicago, 320 Dearborn St. New York, 15 Cortlandt St. Boston, 134 Congress St.
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CONNECTORS AND TERMINALS
FOR ALL ELECTRICAL PURPOSES.
Incandescent Lamp and Cutout Terminals for all makes of Lamps.
GENERAL ELECTRICAL SUPPLIES.
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12-14 Franklin Street, Newark, N. J.

M. & B. Telephones
Do Not Infringe
and are the best.
U. S. TELEPHONE CONSTRUCTION CO.,
Bullitt Bldg. Philadelphia.

PLATINUM FOR ALL PURPOSES
Scrap and Native Platinum Purchased.
BAKER & CO., New Jersey Railroad Ave. NEWARK, N. J.
New York Office, 121 Liberty Street.

WAGNER
TRANSFORMER.

See Page iii.

SINGLE AND DOUBLE POLE, 5 TO 50 AMPERES.
HART SWITCHES.
THE HART & HEGEMAN MFG. CO., Hartford, Conn.

ELECTRIC WIRES AND CABLES FOR ALL CLASSES OF SERVICE
STANDARD UNDERGROUND CABLE CO.
PITTSBURGH. NEW YORK. CHICAGO.
Underground, Aerial, Submarine.

OKONITE

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Wires are the best for aerial, underground, and submarine use.

Railway Feeder Wires a Specialty.

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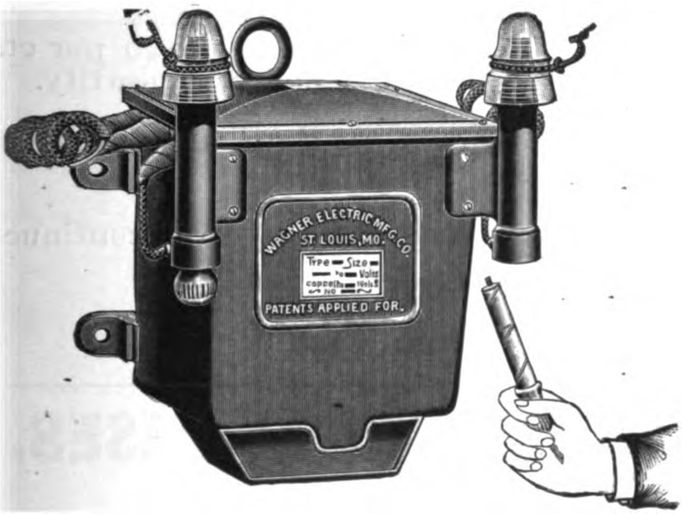
For six days each week, the manufacture of **IMPERIAL INCANDESCENT LAMPS** goes on. Three years ago it was unknown; to-day it is the leader. More **IMPERIALS** are made each day than by any other two independent factories.

Successful in every public competition, it stands unrivalled. *Adopted by the West End Street Railway after long-continued tests.*

BRYAN-MARSH COMPANY,

Office, 136 Liberty Street, New York. Factory, Marlboro, Mass.



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WAGNER

Switches.

Switchboards.

ELECTRIC MANUFACTUIRINC CO.

Transformers for all purposes.
First in every Competitive test.
Acknowledged by all Engineers to be the most efficient and most nearly perfect in mechanical design.

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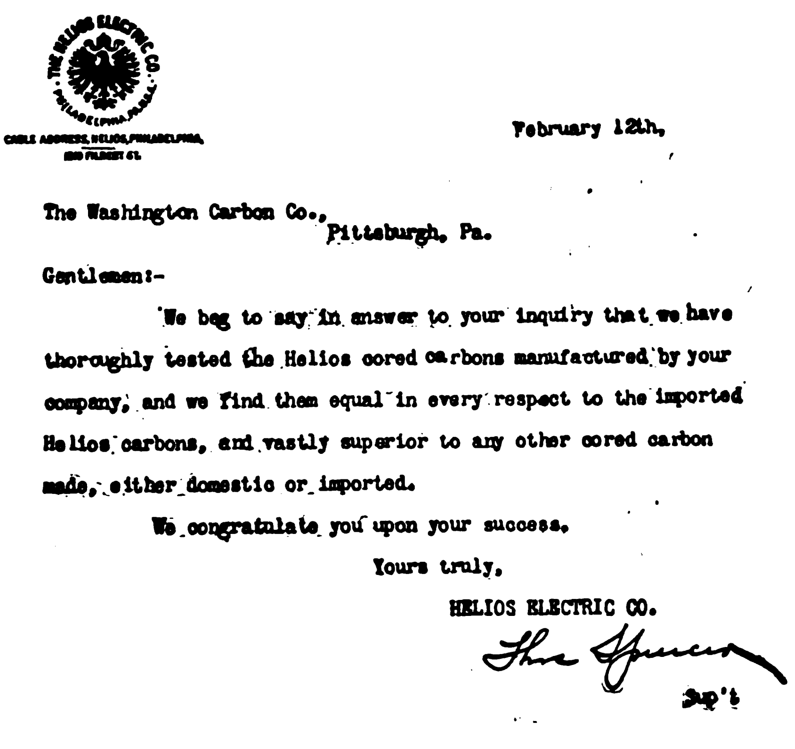
- SAN FRANCISCO, 35 Market Street.
- BUFFALO, 126 Erie Co. Bank Building.
- TORONTO, Canada, W. A. Johnson Electric Co.

STORE ROOMS: BOSTON, PHILADELPHIA, SAN FRANCISCO, ST. LOUIS.



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CABLE ADDRESS, HELIOS, PHILADELPHIA,
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February 12th,

The Washington Carbon Co.,
Pittsburgh, Pa.

Gentlemen:-

We beg to say in answer to your inquiry that we have thoroughly tested the Helios cored carbons manufactured by your company, and we find them equal in every respect to the imported Helios carbons, and vastly superior to any other cored carbon made, either domestic or imported.

We congratulate you upon your success.

Yours truly,

HELIOS ELECTRIC CO.

Thos Spencer

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For Direct and Alternating Currents.

SOLID CARBONS

For Series Arc Lighting.

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That Excel All Other Makes.

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Reduced Prices on Solid Carbons for Series Arc Lighting.

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ARC LAMPS CARBONS AT BOTTOM PRICES.

Arc Lamps.

Standard "Ward" 110 Volt, Direct Current, 6 1-2, 8 and 10 amperes,	. . . . .	$9.50 net.
Short " " "	. . . . .	$9.50 "

With Hoods $1.25 additional.

Long "Knight" 110 volt, dir. cur., 4 to 10 amp..	$9.50 net.	Medium "Knight" 110 volt, dir. cur.,	4 to 10 amp.,	$9.50 net.
Short " " " "	$9.50 "	Alternating " " "	10 to 14 "	$9.50 "
Twins—Long, " " 5 amp.,	$12.50 "	Twins—Short, " "	5 amp.,	$12.50 "

"Ward" Photo-Engraving Lamps, 20 amp., for 110 volt direct current, with stand, reflector and resistance, $40.00
" for 220 volts direct, ... $50.00

"Ward" Searchlights, with Parabolic Reflectors, 20 amp., 110 volt, dir. cur., $125; with ground glass lens, $175.00

Carbons.

18,500 Crouse-Tremaine Co.,	$7.50 per 1000	62,850 Nurnbergs,	Below list prices. Discounted 5 to 40 per ct. according to quantity.
31,000 National,	7.50 "	22,900 Siemens & Halske,	
26,200 Fidelity,	6.00 "	12,075 "LaCombes,"	
		3,200 Hardtmuth,	

A complete stock of parts for "Ward" Lamps at reduced prices, and all styles of Arc Lamp Globes.

Having purchased from the Receiver all the stock of the Electric Construction and Supply Company, I will continue the business, giving prompt attention to all orders.

O. B. GREENE, 14 Cortlandt St., New York.

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Portable Direct Reading **VOLTMETERS** and **WATTMETERS** for Alternating and Direct Current Circuits are the only standard portable instruments of the type deserving this name.

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The ILLUMINATED DIAL STATION VOLTMETERS, POTENTIAL INDICATORS and AMMETERS, and ISOLATED PLANT VOLTMETERS and AMMETERS are the best offered.

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THE SEMI-PORTABLE LABORATORY STANDARD INSTRUMENTS ARE STILL BETTER.

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Vols. 1, 2 and 3 of the series have been published and have met with a reception that fully justifies the publisher in permanently continuing the series, the scope of which is to broadly cover all electrical cases coming before the courts in all sections of the country.

In Vol. 2 there were 130 cases, and of these 69 pertain to the duties and liabilities of telegraph companies as carriers of news. In Vol. 3 the telegraph cases number 42.

The subject of Interference of Electrical Currents, usually made prominent in actions brought by telephone companies whose weaker currents are unfavorably affected by the powerful currents used by light and power companies, is represented by one case in Vol. 1, two cases in Vol. 2, and ten cases in Vol. 3.

The RIGHTS OF ABUTTING OWNERS, as affected by the maintenance of electrical apperatus in highways, are considered in six cases in Vol. 2, while in Vol. 3 there are eighteen upon that subject.

In Vol. 3 Telegraph Companies were concerned in sixteen cases, Electric Light Companies in eighteen, Telephone Companies in twenty, and Electric Railway Companies in twenty-five, or nearly one-fourth the whole number of cases in the volume, a surprising proportion when we recall how recently the electric railway first came into use.

The subject being of such practical and increasing importance in its legal aspects, the convenience and even necessity of keeping abreast of it must be evident to the profession.

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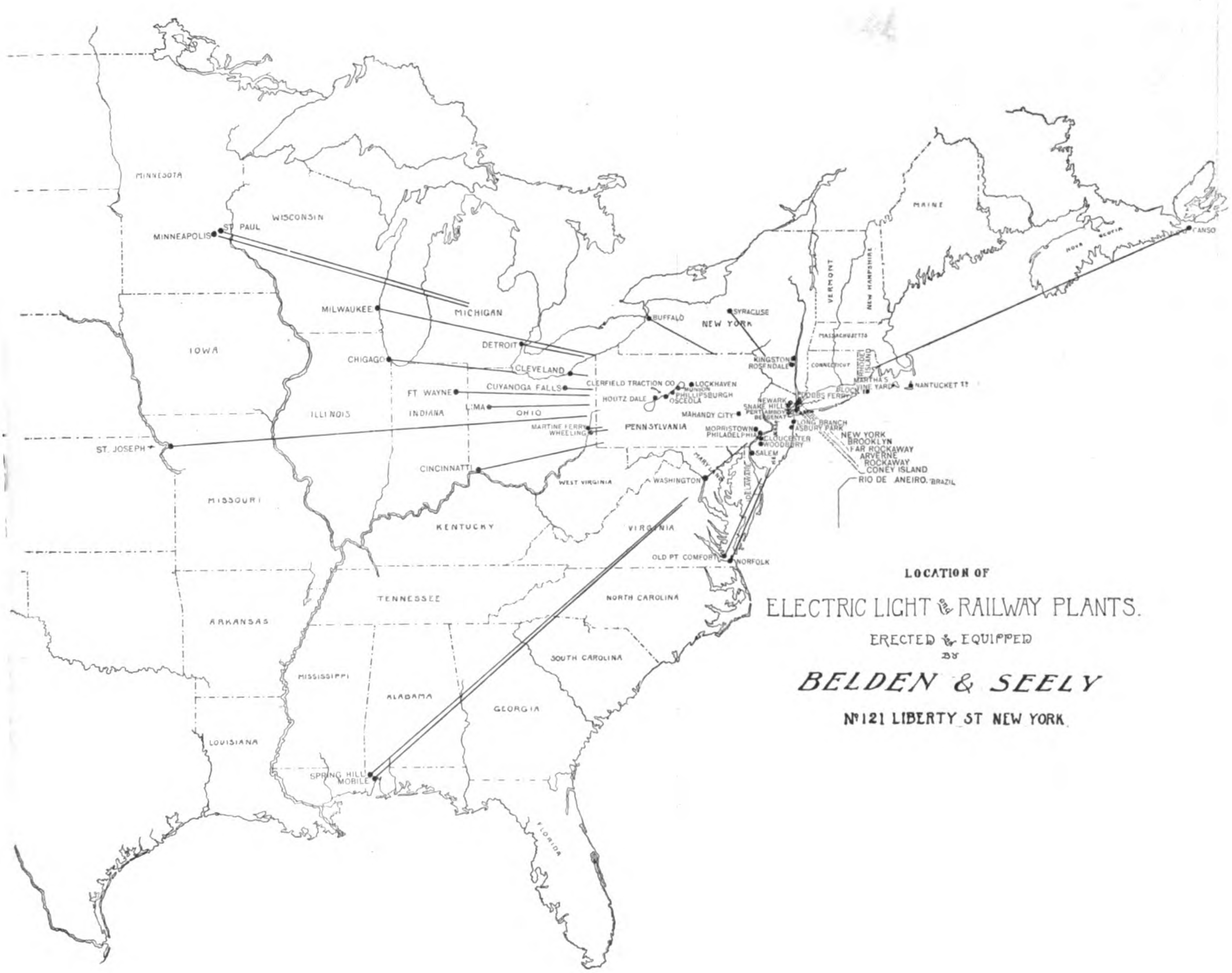
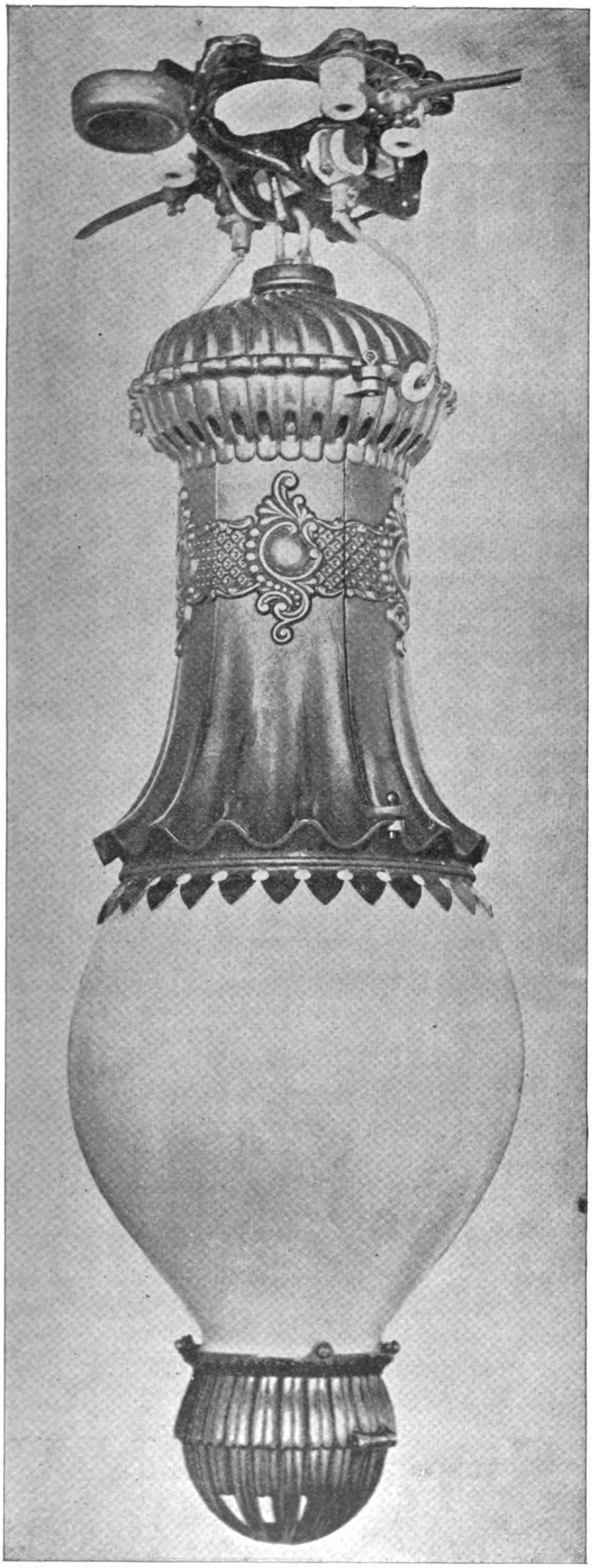


New York City and Syracuse, N.Y.

Electric Railroad Construction a Specialty,

ALL OTHER ARC LAMPS ARE OUT OF DATE.



"A--B" Arc Lamp.

The same **LAMP** operates perfectly on **EITHER 1,200 or 2,000 C. P.** Circuits **WITHOUT CHANGE** or adjustment.

Single Carbon, 32-inch 14-hour lamp changed to Parallel or Alternating in 5 minutes by changing coils.

Any finish from Black Japan to Aluminum.

Design Handsome.
Operation Perfect.

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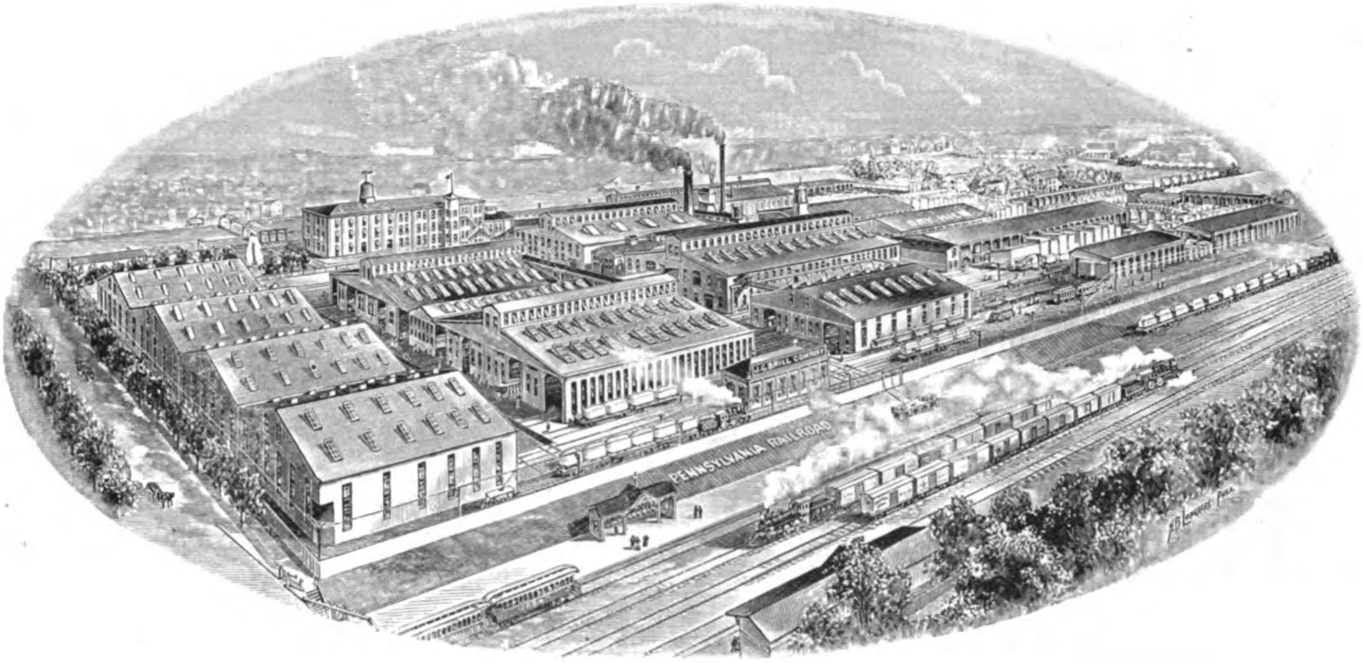
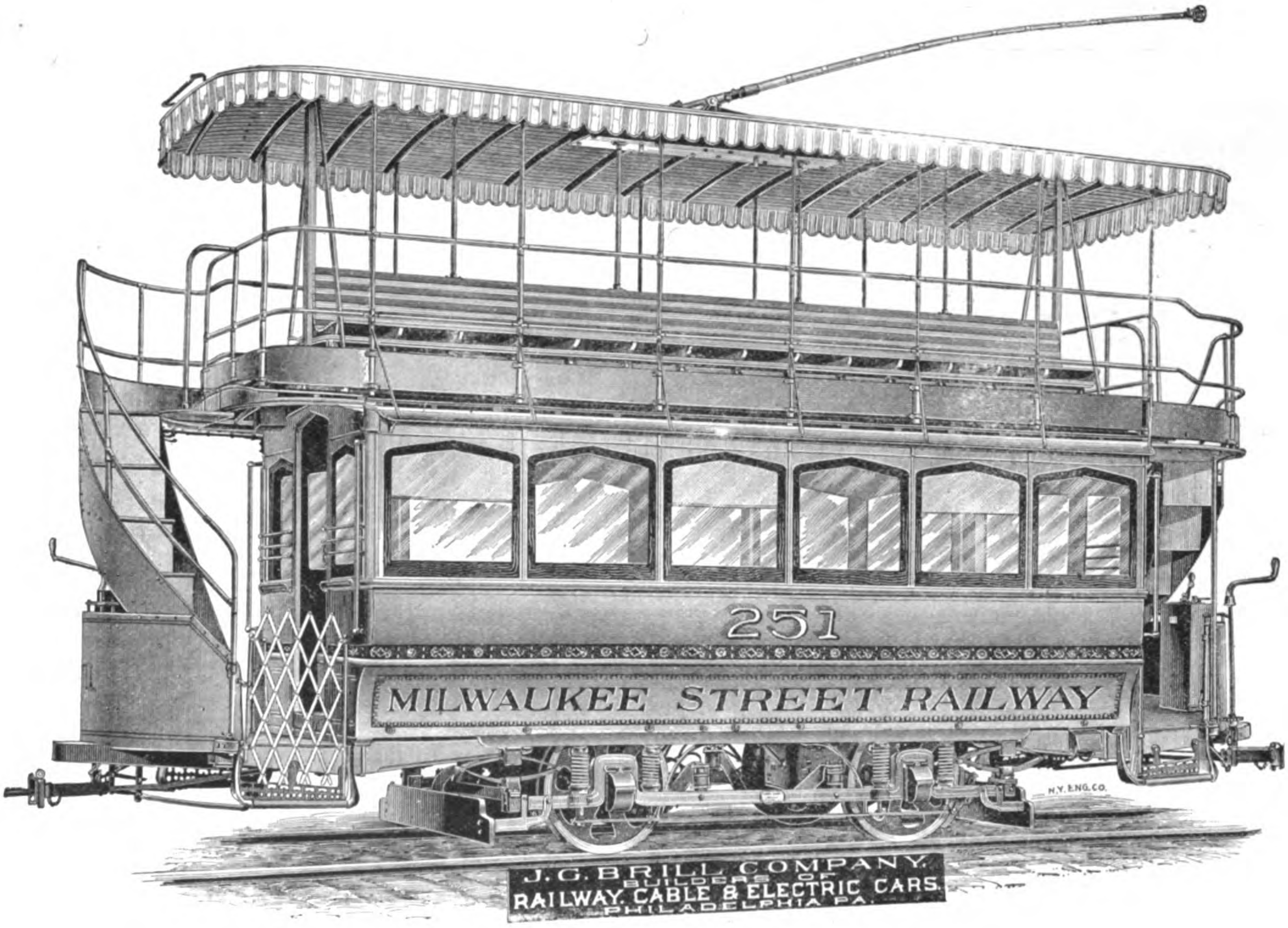


Office and Works.



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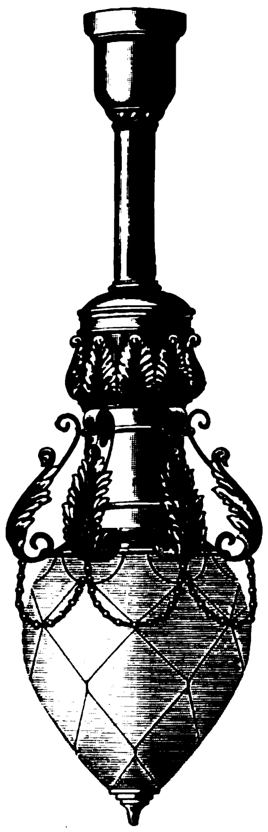

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For every Circuit, including Direct, Alternating, Series Arc, Focusing and Railway.

Handsomest and Most Complete Line of Ornamental Lamps manufactured.

IMPORTED CARBONS.

Our Sun-Schmelzer-Nurnberg Carbons are the Highest Grade brought to this Market.

Write for New Price List.

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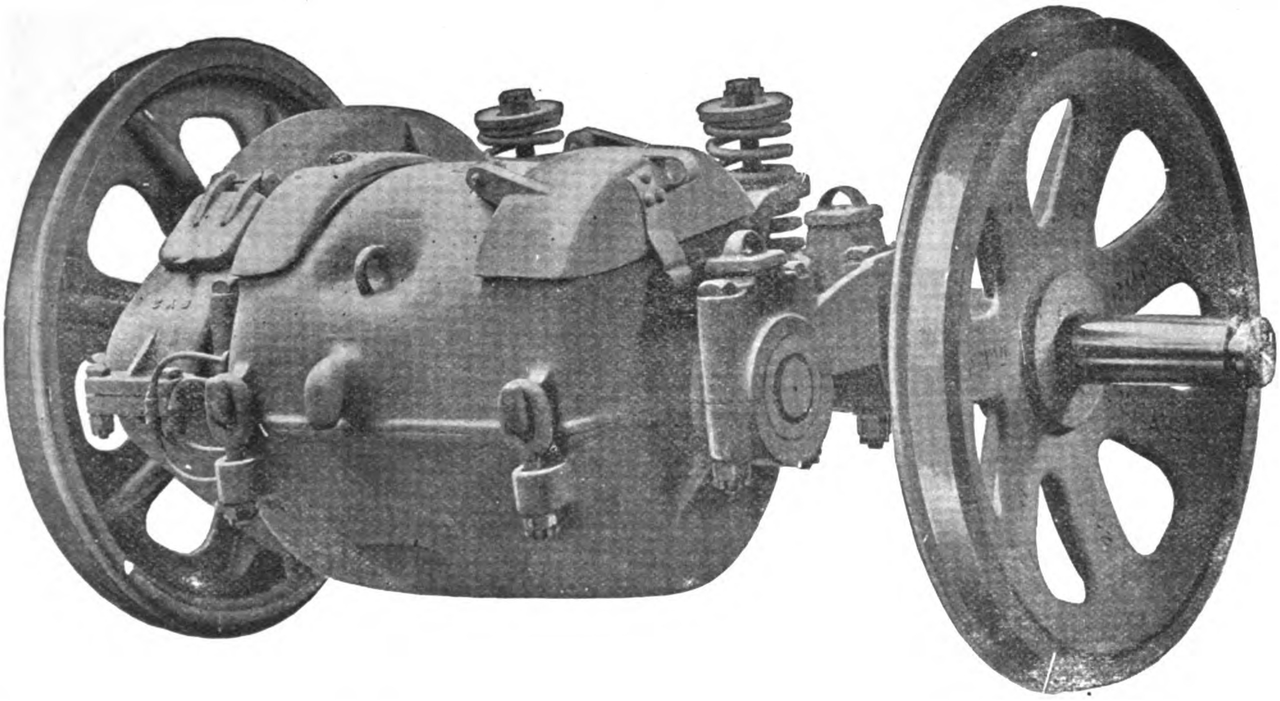

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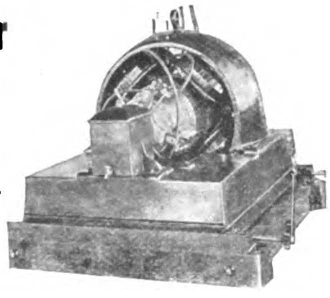

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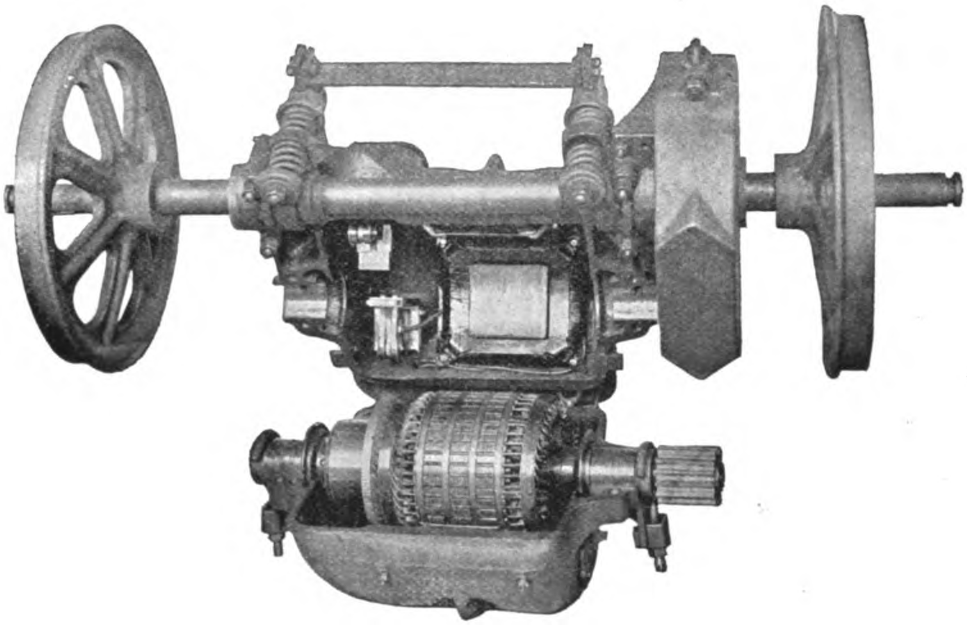

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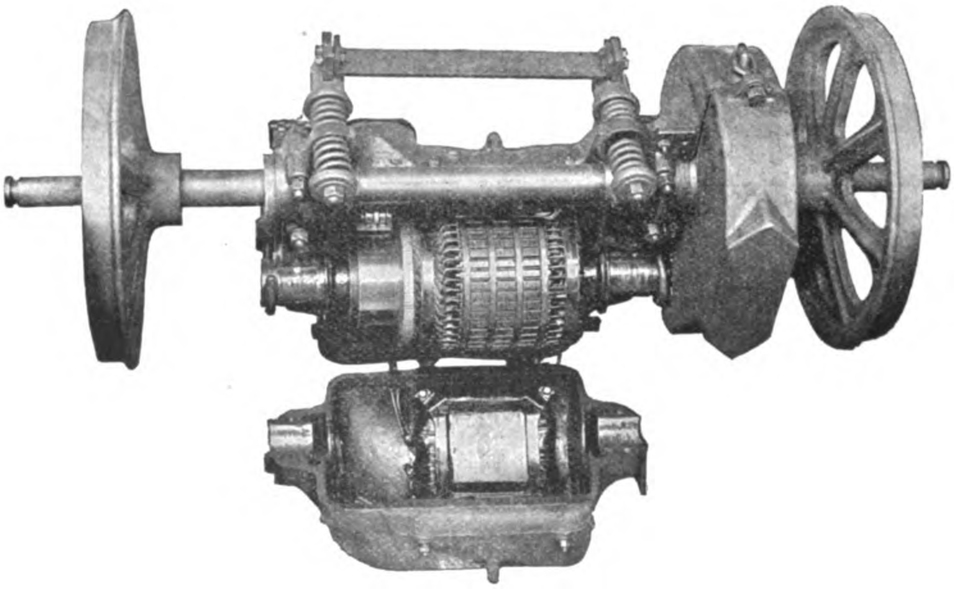

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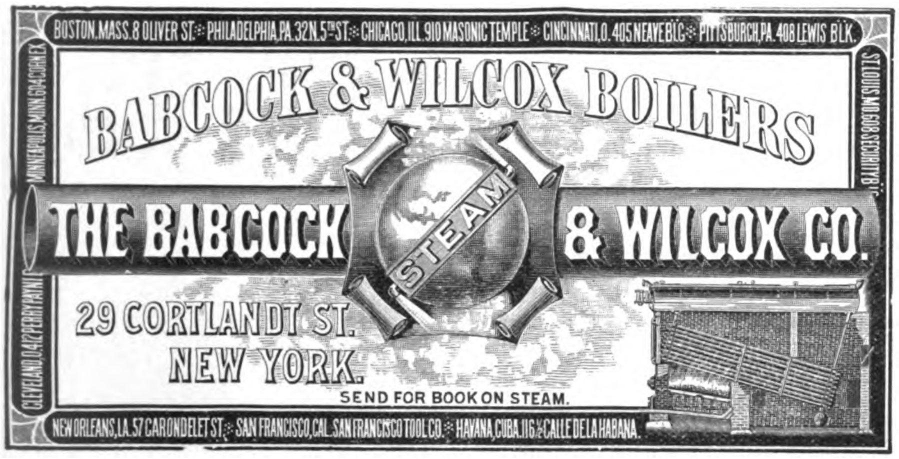
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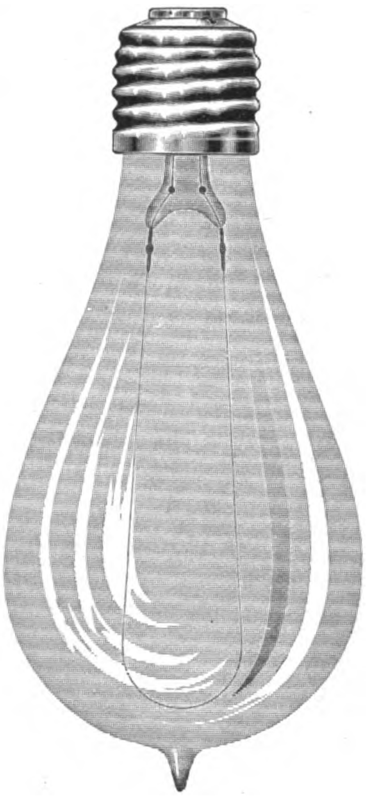

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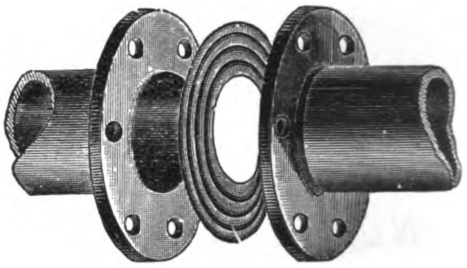

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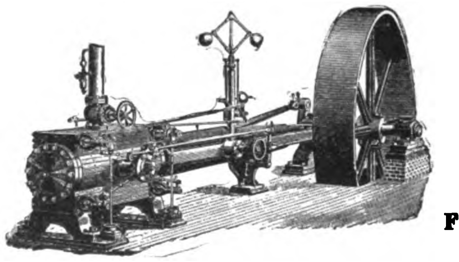

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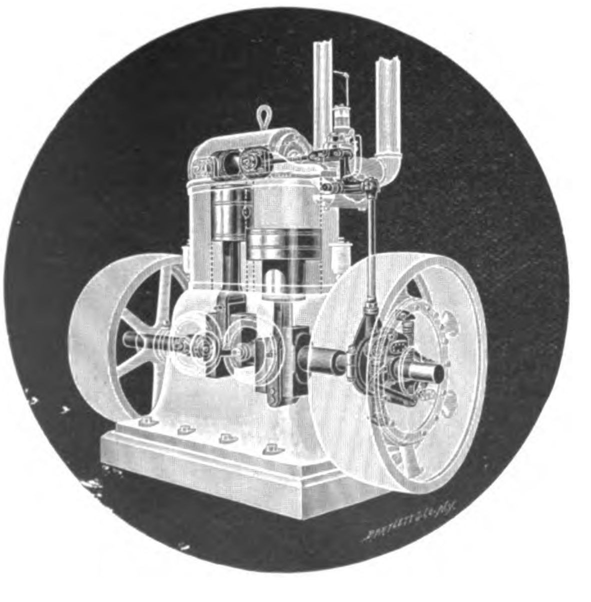

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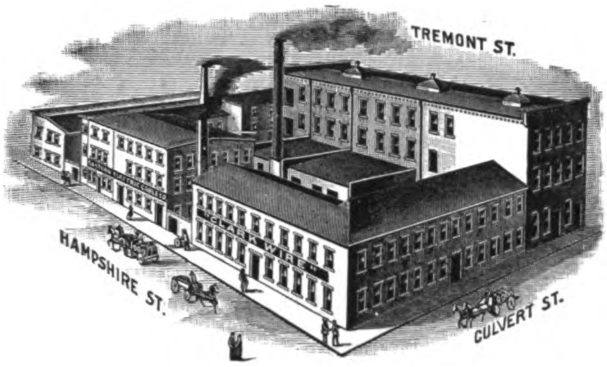
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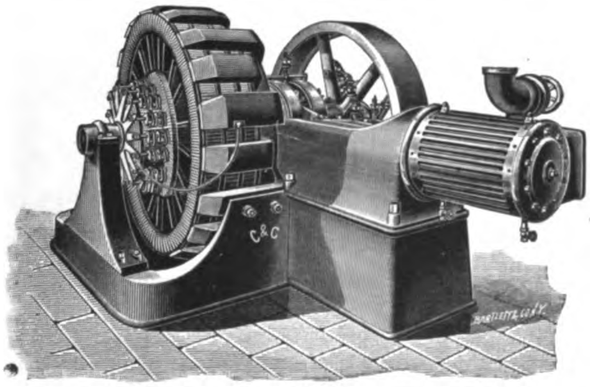

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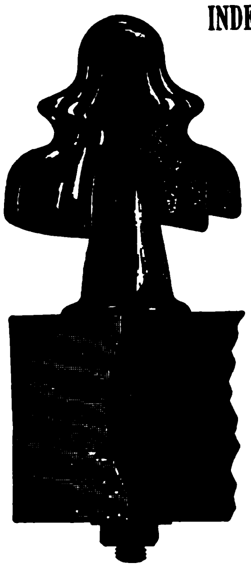

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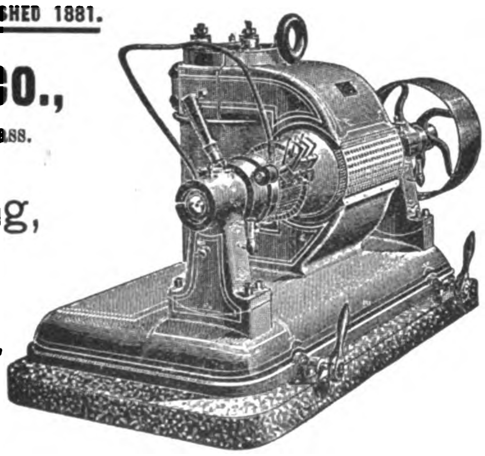

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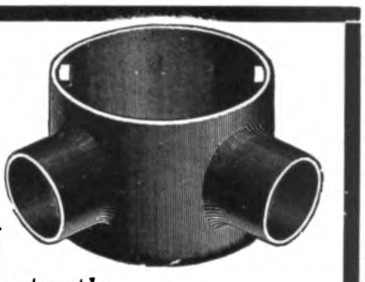

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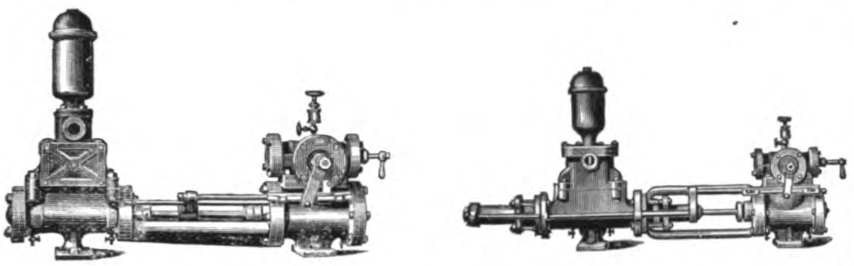

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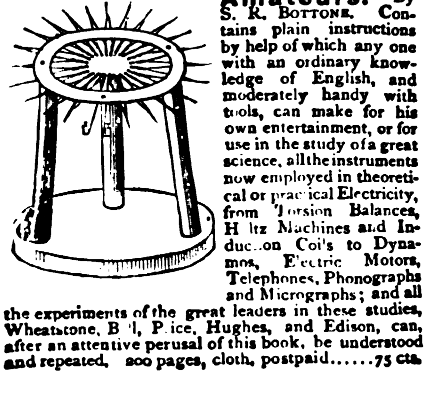

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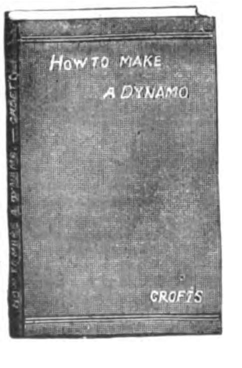

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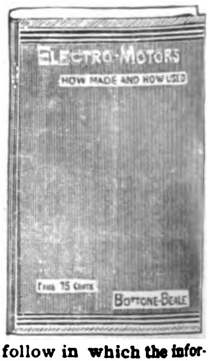

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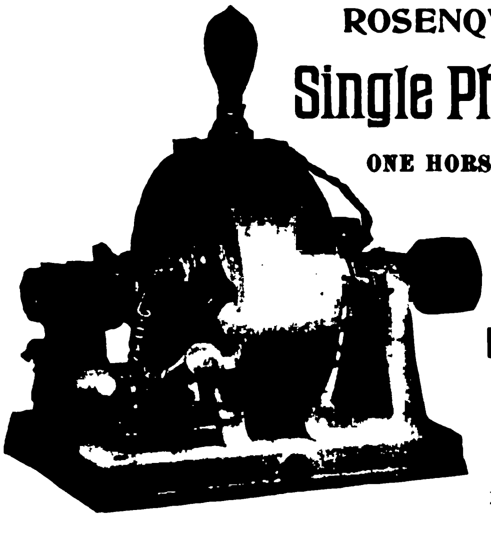

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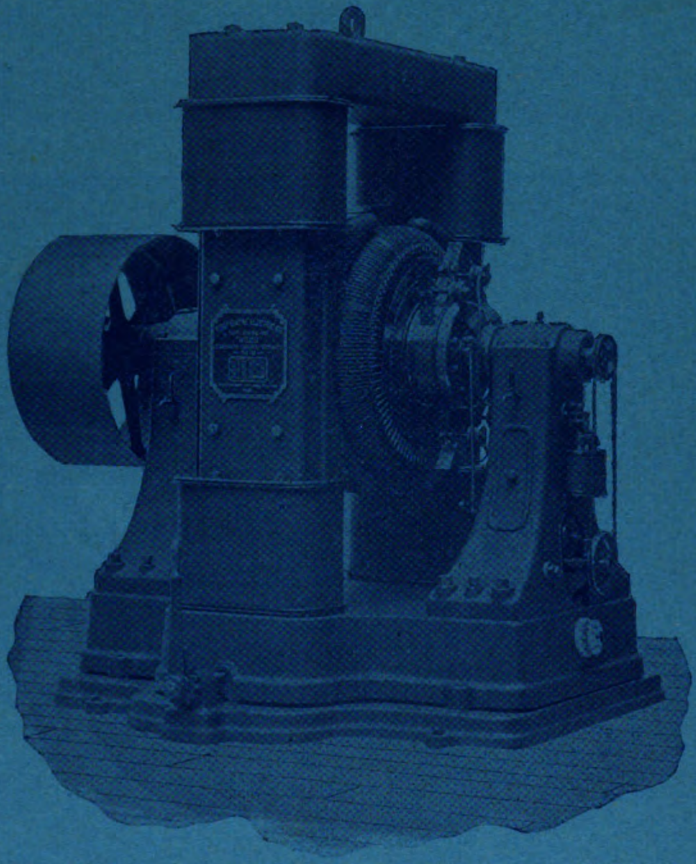

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EDITORIAL NOTES.

The Railway Convention issue of Electricity (Oct. 16) was entirely exhausted four days after its appearance, with special orders for more than 1,000 copies still on the books.

The type is now being reset, and a second edition will be printed this week.

Any further orders for extra copies should be sent in at once.

The people know a good thing when they see it, and the best thing in the trade-paper line last week was Electricity.

An Unfortunate Mistake at Atlanta.

One of the most regretable mistakes of the administration at the World's Fair was the granting of a monopoly of the photographic privileges to the highest bidder. Had this highest bidder been a competent artist it would have been bad enough, but as it happened then, and is likely to happen again, the highest bidder was by no means proficient in the art, and were it not that the restrictions were relaxed somewhat towards the end of the Exposition so that outside artists were, under certain conditions, permitted to ply their trade within the grounds, the world would to-day be without a presentable photographic record of that most beautiful of all architectural triumphs.

But entirely aside and apart from this aspect of the case, the concentration of the camera privileges in the hands of a single individual or company was an unfortunate mistake. All enterprises such as this are dependent upon popular favor, and the press—the illustrated press more than any other—is necessarily a potent factor in arousing popular interest. The World's Fair management spent hundreds of thousands of dollars in advertising, and yet after all this was done placed an embargo upon a class of advertising which was at least quite as effective, but which cost them nothing. The illustrated press, technical and otherwise, with commendable enterprise, sought to lay before its readers pictorial representations of the grand display. This they were willing and anxious to do without cost to the Exposition, but they wanted good photographs, and these they could not buy from the official photographer, simply because the latter could not take good photographs. In some cases they offered to pay the official photographer as much as he charged for his prints for the privilege of sending their own artists there to do the work in their own way, but even this proposition was declined, and they had to take what they could get or go without.

Another annoyance that was the outgrowth of this arrangement was this: Among certain classes of papers, chiefly the technical press, there is and was an intense rivalry and a constant endeavor to outdo one another. It happened more than once that one electrical paper, for instance, employed the official photographer at extra expense to take a given view, and that a rival procured prints from this same negative, either simultaneously with or before the party for whom the picture was taken.

One noteworthy instance is called to mind. The General Electric Company had promised all the electrical papers that if they would refrain from illustrating the tower of light until the proper time it would, at its own expense, have a large photograph taken and distribute it to them all simultaneously. The papers respected this request, and one Sunday when Electricity Building was closed to the public the photograph was taken. Copies were to have been distributed on the following Wednesday afternoon, but lo and behold, one of the papers, more enterprising than the rest, or having more pull with the official photographer, appeared at noon that day with a full page half-tone made from that same negative.

These are but a few of the occurrences that were the almost inevitable consequence of the policy pursued. The mistake was so fully realized that towards the latter part of the Exposition the directory did all that it could to rectify the evil.

We are surprised that in view of the general recognition of the mistake made at the World's Fair, the officials of the Atlanta Exposition should have committed the same blunder, only in a more offensive form.

It seems that there, too, there is an Official Photographic Company, and this one is clothed with more autocratic powers of censorship than was even that one at the World's Fair. Before the illustrated press can make even so much as a sketch on the grounds, it has to make application to this photographic company, agreeing as follows:

"That all pictures taken shall be submitted to the Official Photographic Company, which shall decide (sic) if it is the desire of said company to copyright such picture, which said company may do, that should we" (the press) "desire to purchase from said official company any copyrighted photographs" (even if they be our own photographs) "we will preserve the same from any other use than that for which they are bought, to wit, for illustrating said Exposition in the columns of said publication only;

that after any negatives bought from said company have served the purpose of illustrating, all such negatives shall be destroyed: that we will not permit any such negatives to be used in any other publication whatsoever."

In the first place this is asking the illustrated press to promise that which they cannot fulfil. In the second place, such restrictions as these will kill the goose that is expected to lay the golden egg. It is the shortest sighted policy possible, and we regret exceedingly that the Atlanta Exposition authorities have been led into this mistake. We feel sure that unless this obnoxious and unreasonable restriction be abrogated, the pictorial press will let the Atlanta Exposition severely alone. Better could the authorities require of the Official Photographic Company, in consideration of their privileges, that they furnish free to properly accredited representatives of the press all the photographs they wanted. The illustrated press does not ask this, however. It merely asks unrestricted privileges of taking their own photographs in their own way and at their own time. Unless this be granted, it is certain that the Exposition must suffer.

* * *

Franklin Leonard Pope. On Monday morning, October 14th, the electrical world was inexpressibly shocked to learn from the daily press that Franklin Leonard Pope had been killed in his own home at Great Barrington, Mass., by electric shock from accidental contact with the high potential alternating current mains.

That the contact was accidental, and not through carelessness or ignorance, was of course apparent to every one, for no one was more familiar with the apparatus and the precautions necessary to its handling than Mr. Pope himself. It was he who first brought the alternating current to this country, having, as the representative of the Westinghouse Company, purchased the original Gaulard and Gibbs patent. Further than this, the Great Barrington plant was Mr. Pope's own creation, he having recently remodeled it and changed it over from a three-wire direct current to the high potential alternating current, so that every detail was personally known to him.

As general manager of the installation he had obtained a special permit to have the transformer located in his cellar in order that he might the more conveniently make the necessary tests and watch the operation of the circuits.

On Sunday evening, upon turning on the lights in his house, they failed to come to full brilliancy, and it was this defect that led Mr. Pope to go to the cellar to detect and remedy the fault, if possible. A few minutes later, members of his family, hearing a fall, went to the basement and found him a corpse. Medical aid was promptly summoned, but all methods of resuscitation proved unavailing.

Just how he came to his death is still and will probably remain a matter of conjecture, but careful tests of the transformer and circuits, made shortly afterwards by Messrs. Edward Weston and Wm. Stanley, showed that the primary was grounded outside the building, and also on the secondary and on the transformer case. The marks on the body consisted of a slight burn on the knuckle of the thumb, a long scratch-like burn around the base of the thumb, and a slight burn on the index finger. There were no burns on the soles of the feet, but the soles of his shoes were perforated with many small holes as though pierced with bird shot.

In another place we give the theory of the accident which is held by his brother, Mr. Ralph W. Pope. We understand that Messrs. Weston and Stanley do not agree entirely with this, and it is probable that their version may appear in our next issue.

Death in any form is always a sad thing, but when it comes suddenly, although it may be painless, it seems to carry with it among those who survive greatly intensified emotions. When, also, it strikes a man so prominent in the community and so respected as was Mr. Pope, the loss becomes a personal one to a very much broader circle than could otherwise be the case.

There does seem a gruesome irony in the fate which chose as its victim one who had done so much with and for the very agency that caused his death. This is, we believe, the first case on record where one thoroughly conversant with the dangers attaching to the high potential current has met death at its hands.

Mr. Pope was in his 56th year, and during a long and successfu professional practice of the most varied character so conducted himself as to command the love, respect and confidence of all with whom he came in contact. His sense of honor was of the highest order, and in his honorable career he has left his family a legacy far more precious than mere worldly wealth. Appearing often before the courts as an electrical expert, he was such in the highest sense of the word, and looked with disgust upon those who prostituted that high office to personal ends. So strong were his feelings on this point that when we, some months ago, attacked in unsparing terms the practice of electrical experts appearing really as associate counsel, in violation of their oaths, Mr. Pope wrote us a highly appreciated and appreciative letter, endorsing the stand we had taken.

We are among the mourners for Mr. Pope's death, and as such we extend the most heartfelt sympathy to those who have not only lost what we have lost, but who have also been bereaved of a husband, father and brother.

* * *

Thoughtless Criticism. Our esteemed contemporary, *Electric Power*, has an editorial in its last issue, under this title, which reads as follows:

> In most of the discussion that has taken place since last February regarding the application by the Niagara Falls Power Company to the city of Buffalo for a franchise for the use of the streets for the purpose of distributing power, it seems to have been freely assumed that the Niagara Company was bluffing when it refused to state a limiting price for its power previous to any grant, and that engineers stood ready at any time to determine the losses in transmission, and that, of course the company must know what the installation was to cost.
>
> Now, granting that all these facts were perfectly well known to the company, will some one inform us how they were to determine what to add to such losses and charges for cost of franchise in the way of payment to the city, or how to determine the fixed charges when it was not known what sort of construction for carrying the conductors would be demanded by city authorities? People, and sometimes engineers, are thoughtless.

Referring to the last paragraph, we have this to say. When the Niagara Company made its first offer to the city of Buffalo to sell to the latter undeveloped power, power on the turbine shaft, or electrical power at the terminals of the dynamo at Niagara, for $10, $13 and $18 respectively, did it not know that however desirable such a consummation might be to itself, it was not a commercial proposition for the city of Buffalo?

Does *Electric Power* not know that in the Niagara Power Company's original letter to the Common Council these words were used: "The company cannot name a price for electrical power transmitted to the *Buffalo line*, as in the question of *transmission* are involved the uncertainties of the losses and cost of operation and maintenance"?

If the editor of our contemporary does know this, why does he bring in the question of cost of franchise and other city expenses, which are not involved in the question at issue at all?

The Niagara Company in this same letter states that it "has made a contract with a large electrical power user for not less than $20,000 per annum for 1,000 electrical H. P. developed on the company's land."

Now the distance of transmission in this case was less than a mile. For this transmission the Niagara Company have added $2 per H. P. Assuming the distance to have been just a mile, and that increase be maintained for further distances, there would have to be added 15 × 2 = $30 for a H. P. delivered at the Buffalo city line, making $48 as the cost at that point. This may be and probably is, an unfair way of estimating the cost at Buffalo before distribution, but the Niagara Company seemed to fear that its statement that it had contracted to deliver power at a distance of less than a mile in 1,000 H. P. lots at the rate of $20 would not be believed, for it adds: "As this statement has been called in question, the company *now offers to submit* this contract to the inspection of the Mayor of the city of Buffalo."

But when we consider that the power when delivered at Buffalo is not yet in an available form, but must be transformed down, and when distributed in this transformed state is still not in an available form for the customer, but requires an additional investment on his part in the way of further transformers, motors and wiring, making an investment nearly or quite equal to that of a steam plant, it is not clear how either the Niagara Company or the city of Buffalo could afford to sell power even on a 24-hour basis in competition with steam. But when we consider 10-hour power, such competition would seem to be entirely out of the question.

It must be remembered that by far the largest number of power consumers use it not more than 10 or 12 hours a day, and that absolutely none of them ever use it 24 hours a day for 365 days in the year. The Niagara Company's figures have thus far been exclusively on a 24-hour and 365-day basis, so that no matter what figures they have given, or may give, they are meaningless on a horse-power hour basis because it will never be used to the limit.

It is not, therefore, that the engineers who have condemned the Niagara scheme are thoughtless, as our contemporary suggests, but that those who have accepted it as a commercial project are thoughtless, or worse.

* * *

The Railway Convention. It is to be hoped by every one interested in the success of the street railway industry, and this should mean about every man, woman and child in America, that the Montreal meeting of the American Street Railway Association has marked a turning point in the history of that body. The Convention at Atlanta last year, from an educational standpoint, was a flat failure, as was reported in ELECTRICITY at the time. The one at Montreal, viewed in the same light, was little better than a failure; yet at the latter meeting there were conspicuous signs of a new life, of renewed interest on the part of those whom the Association was primarily designed to benefit; and when the railway companies make voluntary contributions of over $4,000 to cancel the debt of this Association, it shows conclusively that, even if the body has so far failed to accomplish its mission, there is strong hope that it may go forward to full accomplishment.

The trouble with the Association seems to have been that it got into a rut. Long after the railway men discarded horses and adopted electricity, their National Association continued to be run on the horse-railroad plan.

But after the Montreal awakening all criticism should cease. Our railway friends must have a fair show, and we recommend them to copy somewhat the National Electric Light Association, which of late years has been admirably managed.

It is not enough that first-class papers are prepared, read by title, and afterwards distributed among the members and printed in the journals. These papers should be read in full at the meetings, and DISCUSSED. There is no more effective way to disseminate knowledge than by a thorough discussion of the papers presented. And in the discussion last week of the question of admitting supply men as members, it was conclusively shown that the Railway Association has fully as ready and bright talkers as any other body.

Give them a chance to talk, not on a really dead question, but on live issues, and every railway man in the country will realize that he cannot afford to be absent from these meetings.

As to the arguments pro and con on the supply men question, few of them were new. One, however, seems worthy of some comment. This is that the *supply* men should be kept out because the railway men desire to discuss a great many of their affairs in secret session. This embodies the height of absurdity.

What in the name of Joel Hurt have the railway men in their bosoms which will not bear the light of day? What have they to fear from open confession of trouble and sin?

American railways are managed by public corporations; their affairs *cannot* be kept secret. ELECTRICITY will agree to print every detail of the business of any one of them on very short notice.

We don't believe the supply men can do the American Street Railway Association any harm. The money of the supply men is good money, and the Association needs it.

The Propagation of the Magnetism of Iron.*

BY W. PEUKERT.

When a long straight iron bar is excited by a magnetizing coil situated at the center, the lines of force, all of which pass through the coil, do not keep in the iron up to its extreme end, but emerge into the air at all points along its length, so that the induction in the bar falls off continuously as the distance from the central source of magnetization is increased. With a periodically varying magnetizing force the same effect is produced, and, moreover, the corresponding periodic changes in the induction induce eddy currents in the iron. These cause a lag in the phase of the induction which increases as the end of the bar is approached.

Experimental proof of this was carried out on rods of about one meter length of wrought and cast-iron, and on a large bundle of soft iron wires of 1 mm. diameter. The induction at various points was measured by search coils placed at intervals on the bar, and readings of the instantaneous values of the induction were taken through a complete period for each coil. The readings were obtained by means of a contact-maker fixed on the alternating-current dynamo used for exciting the magnetizing coil, the momentary currents being indicated by a Wiedemann galvanometer. Magnetomotive forces of 288 and 1,306 ampere-turns were used.

The curves of induced E.M.F. obtained from all three samples show a shift of phase which increases with the distance of the search coil from the center of the bar, both at the lower and at the higher values of the induction. The curves are not symmetrical with the zero axis, the difference being attributed to residual magnetism. There is no marked difference between the changes of phase produced in the solid and in the laminated specimens, the amount of shift not being sufficiently clearly defined to show any distinct difference. The magnitude of the deflections continuously falls off along the bar, showing the diminution in the induction.

An Electric Theory of the Solar System.

M. C. V. Zeuger, professor of astronomy and physics at the Prague Polytechnic School, contributed a paper on this subject at the recent meeting of the Association Francaise pour l'Avancement des Sciences at Bordeaux. M. Zeuger has been experimenting with a hollow copper sphere suspended in an asymmetric field produced by one, two, or three electro-magnetic poles, and finds that the movements of the sphere present an absolute analogy to the motions of the planets. He proposes, therefore, "to replace Newton and Kepler's laws by the law of Gauss." It follows as a consequence of the theory that the periods of revolution of the planets and comets must be a multiple of half the period of rotation of the sun, and a similar law would apply to the revolutions of satellites round their primary, except in so far as they may be affected by perturbations of the sun or other planets.

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* Abstract from the *Elecktrotechnische Zeitschrift*, Sept. 19.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

CHAPTER XIV.

The Owatonna Electric Co.—II.

In our last week's analysis of the affairs of the Owatonna Electric Company, it will be remembered that we showed from the official records a deficit for the year ending December 31, 1893, of $8,280.37 in operation. This, we think, disposed of any claim that the earning capacity of the plant justified the capitalization of $50,000.

In the official balance sheet as printed the plant account was placed at $61,611.98, this being the amount which outside stockholders were led to believe was the value of the plant.

We present this week the inventory of all the property owned by the company two years after the money was raised from the sale of bonds, which is presented herewith. The valuations are made by experts, and we challenge any one connected with the Northwest bond steal to dispute their accuracy:

OWATONNA ELECTRIC COMPANY, OWATONNA, MINNESOTA.

SCHEDULE OF PROPERTY: MARCH 1, 1893.

(Photographs and Plans on File.)

REAL ESTATE.

Lots 8, 9 and 10 in block 3, McNamara's addition.
Brick station, 86 ft. 4 in. x 43 ft. 4 in.
Including engine and dynamo room, 40 ft. x 46 ft.
" boiler room, 40 ft. x 36 ft.
Frame building (former station), 20 ft. x 40 ft.; coal shed, 14 ft. x 64 ft.

POLE LINES (ERECTED).	
159 30 foot poles. 76 40 " " 295 4 pin cross arms. 900 glass insulators. 100 break arms.	
LINE WIRES.	
4,200 feet No. 8 pressure wire. 4,200 " " 10 " " 2,640 " " 12 " " 4,200 " " 1 Okonite. 700 " " 1 weather proof wire. 26,580 " " 6 Okonite wire. 1,800 " " 4 " " 25,540 " " 6 K. K. " 5,000 " " 8 " " 2,160 " " 10 " " 390 " " 4 Habirshaw wire. 1,500 " " 10 " " 5,000 " " 6 weather proof wire.	$6,730.00
ELECTRIC PLANT.	
One L. D. arc dynamo, No. 2,999; capacity 50 1,200 C. P. lamps. Two A. 6 alternating dynamos, Nos. 118, 241; capacity 650 16 C. P. One 188 exciter dynamo, No. 996. One 18 exciter dynamo, No. 1,168. One oak switchboard, 8 ft. x 8 ft.	$4,125.00
INSTRUMENTS.	
One ground detector, No. 416, Class A. Four current indicators, Nos. 5,425, 5,429, 5,421, 4,437, 40 amperes. Two potential indicators, Nos. 2,134, 2,153, 64 volts. One rheostat, Type 148, No. 12,601. One " " 165, No. 15,699. One " " 148, No. 13,042. One " " 165, No. 15,700. Two transformers, F, Nos. 30,924, 30,928, Class F. S, 1,000 volts. Four 1,000-volt feeder-boards. Two two-circuit D. P. switches, 1,000 volts. Two single pole exciter switches. One four-circuit arc plug board. Four Type F lightning arresters, Nos. 2,994, 3,020, 3,019, 3,036. Four Thomson's Type A lightning arresters, Nos. 9,102, 9,107, 4,760, 4,708. One automatic regulator, No. 3,140. One ammeter, No. 1,037. One spring jack. One magneto. Fifty arc lamps, 1,200 C. P.	$2,050.00
TRANSFORMERS (ERECTED).	
Eleven 5 light; seventeen 10 light; five 12 light; fifteen 15 light; four 20 light; fourteen 25 light; three 30 light; eight 40 light; one 50 light; one 75 light. Total, 79.	$3,437.00
METERS.	
Forty-five 10 ampere; twelve 15 ampere; one 25 ampere; thirty-five 30 ampere; five 50 ampere. Total, 98.	$1,349.00
Total..	$17,691.00

Brought forward	$17,691.00
STEAM PLANT.	
One McIntosh & Seymour compound engine, 10½ in. x 16 in. x 12 in. One Ideal single cylinder engine, 19 in. x 12 in. Two Babcock & Wilcox water tube boilers, 184 H. P. One iron smokestack, 42 in. x 70 ft., with cast iron base. Two Davidson steam pumps, 5 in. x 3¼ in. x 8 in. One Wainwright water tube heater, 200 H. P. Three new belts. Two old belts. One Hazleton tripod boiler, 100 H. P., (Old Station). One Robinson & Cary boiler, 4 H. P., (Old Station). One Phœnix Iron Works heater, (Old Station).	$8,125.00
TOOLS AND FIXTURES.	
1 iron coal dump car; 1 platform Howe scale; 230 feet of track; 1 16 ft. ladder; 1 8 ft. ladder; 1 4 ft. ladder; 5 pole spuds; 1 blow torch; 1 pair of climbers; 1 filter; 2 60 gallon Hub oil cans; 1 waste can; 1 sealing tool; 1 12 in. bellows; 1 set of ½ in. rope and tackle; 1 5 ft. crowbar; 1 spoon shovel; 1 round point shovel; 1 tree trimmer; 2 18 in. x ⅝ in. bitts; one 1½ in. chisel; 1 bracket saw; 1 corner brace; 4 socket wrenches; 2 cast iron wrenches; 3 monkey wrenches; 2 Stillson pipe wrenches; 1 pair tinner snips; 1 pair pliers; 2 spanner wrenches for arc lamps; 2 spanner wrenches for engine; 5 cast iron wrenches; 1 socket wrench for pump; 50 feet ¾ in. hose; 50 feet linen hose.	$314.05
SUPPLIES ON HAND MARCH 1, 1893.	
500 carbons. 40 16 C. P. incandescent lamps. 70 32 C. P. " " 2 fan motors. INSIDE WIRING MATERIAL. 1 roll No. 10 Okonite wire. 1 " " 16 " " ½ " " 12 " " 100 feet No. 10 Grimshaw tape. ½ roll " 14 Okonite wire. 1 " " 8 K. K. " 1 " " 6 " " ½ " " 6 weather proof wire. ½ " " 18 " " " 30 yards No. 16 cord. 10 porcelain rosette cutouts. 15 key sockets. 5 5-ampere switches. 12 curved cutouts. 6 25 ampere M. L. cutouts. 2 10 " " " 4 rolls tape. 2 colored arc globes. 5 clear globes. 4 opal globes.	$808.65
	$26,438.70

The above showing disposes of any possible claim that there was any such value in the plant as would justify the capitalization. In further proof of the slight basis upon which Byllesby and Coffin sought to raise $50,000 of money from ignorant investors, we present herewith a reproduction of the station plan. Those familiar with the business will recognize at once the justice of our charge of gross swindling in connection with this Owatonna plant.

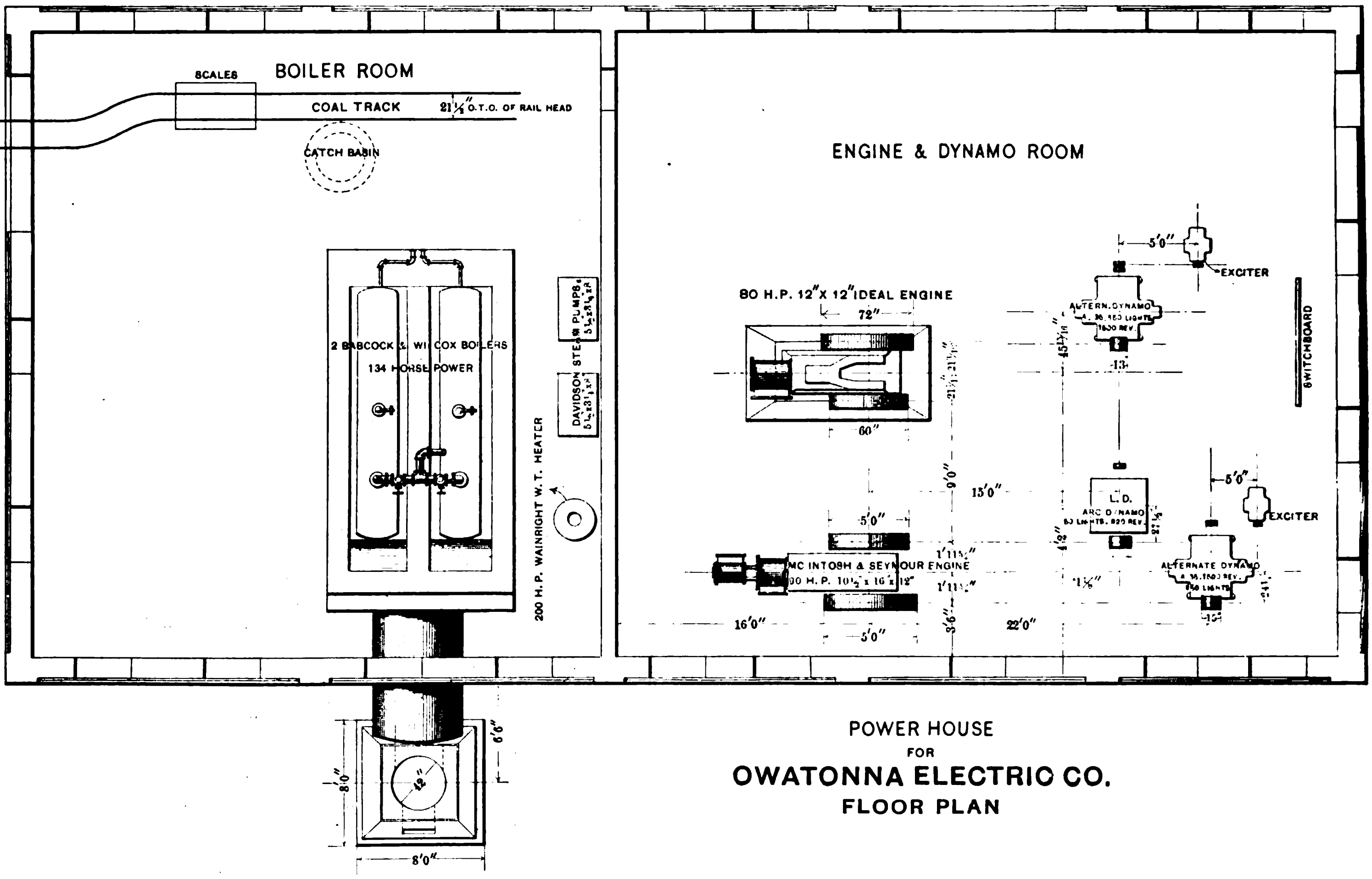
It is more than difficult to conceive how any manufacturing company, working on legitimate lines, could have taken the Owatonna electric plant as a groundwork upon which to float an issue of bonds. The town was small, with no prospect of rapid growth. The plant had lost money from the beginning, and would have been closed down had it not been for the application by Mr. H. M. Byllesby of Mr. C. A. Coffin's great plan of financiering. Neither of these gentlemen was ignorant of the situation of this company, nor of the general conditions of the electric lighting business. They knew that the ultimate end must be failure. Their only object was to raise money, no matter how or by what methods—to prolong a swindling game as long as possible.

The Owatonna Electric Company was saved from a receivership because the bondholders knew that the expenses of such a proceeding would only swell the losses. The plant was finally sold to Mr. Geo. C. Duffie for $12,000, and has since been disposed of by him. Thus there was left to divide by the Northwest General Electric Company $12,000 against the following:

Notes		$29,981.66
Bonds		25,000.00
Total		$54,981.66
Add plant account	$61,611,98	
Less notes	29,981.66	
		31,680.31
Total		$86,611.98
Deduct the proceeds of sale		12,000.00
And we have a loss of		$74,611.98

of some one's money for their pleasure in becoming acquainted with the grand Coffinesque scheme of exploiting work and lending assistance to local enterprises.

Next week we shall take up the affairs of the Austin (Minn.) Electric Company.



POWER HOUSE
FOR
OWATONNA ELECTRIC CO.
FLOOR PLAN

THE PROPOSED MAGNETIC UNITS.*—V.

To the Editor of THE ELECTRICIAN.

SIR: When any one presumes to offer an opinion on such a subject as this, either he should be a well-known man whose views already have weight in the estimation of others, or he should present some credentials to show that although his qualifications may not be generally recognized, yet he has entered into the matter sufficiently and done enough work in the field to show that he ought to know what he is talking about.

Although I have written a good deal on electrical subjects, it has been almost entirely on what is called the practical side, and, therefore, when attempting to say anything publicly on a theoretical question, it is perhaps desirable to mention briefly the grounds on which my opinions are formed, and the nature of the practice which has led me on to form those opinions. This is my apology for entering rather more fully into personal matters than modesty would dictate under other circumstances. I also think that often general truths are better conveyed in a personal narrative, particularly when they are of a complicated and debatable nature. . . .

Now, as I do not pretend to be an original thinker, I have had to go for my knowledge to standard works, and of them I have found none which can bear comparison with Dr. Lodge's "Modern Views of Electricity" and Mr. Oliver Heaviside's "Electromagnetic Theory" for giving clear and comprehensive views on theory, and no work on the practical side to compare with Mr. Kapp's two volumes. The great value of other works, such as Dr. Fleming's, I also thoroughly recognize, but the above works I have gradually come to constitute my standards, as I have found them the most helpful in case of need and difficulty. In speaking thus I do not for a moment wish it to be understood that I understand everything Dr. Lodge, and especially Mr. Heaviside, say. I only wish to have it inferred that, so far as I have been able to understand them, I have found their views and explanations reliable and of the greatest value, and having fully ascertained this, I naturally am ready to accept their lead and guidance in further developments, which in some measure may be beyond my scope.

Now, in all my work in this field I have felt more and more the absolute necessity of a clearer understanding and definitions of electromagnetic quantities and actions. It is possible to wade through the design of an alternator by the use of various 10^8ths or 10^9ths, plus or minus as the case may be, and with the aid of that horrible mystifier the "coefficient of self-induction," which has played such a conspicuous part the last few years; but it is not the right way to go about it, and it is all the more roundabout and difficult when one tries to explain results to others. Things must have names if they are there, and the simpler ones the better, and the magnetic units have just as firm and as sound a basis as the physical ones.

Most alternating work is now designed in a rough manner, and without attention to the finer points, and this is why the efficiency of alternating plant is not as good as it should and might be. Again, to this confusion about electromagnetic quantities, and the basis on which they rest, is due the fact that people not clearly grasping them cannot measure them accurately, and do not feel proper confidence in the results even when they are properly measured.

To introduce certain units which define these quantities, and allow them to be explained clearly, is, therefore, not to add to complication, but to get rid of it, and besides that the everyday problems of electricity would be much better treated by the use of such units and the banishing of that miserable term "lines," and the inaccurate and misleading ampere-turn into the background.

I must own that I found so many new terms very confusing when I commenced to read Mr. Heaviside's work, but then I put this down to my own ignorance, and not to want of lucidity on Mr. Heaviside's part, and in time I came to see that that was the correct view. Having found Dr. Lodge and Mr. Heaviside sure and reliable guides in this difficult but interesting and most important field; having found that they understood and could explain problems which I see will soon be of the greatest practical and commercial importance, and they having found certain names and units desirable in order to explain and deal with these problems, it, to me, savors rather of ignorance and insufficient acquaintance with the subject than of anything else to say that such terms are not needed, and that the old ones are good enough.

As to the precise values which are to be taken as units, I am perfectly content to leave this to those who have made theory a special study, particularly as I think it probable that in another ten or fifteen years it will be found advisable to make a fresh start with a complete new set of electric and magnetic units, arranged on such a basis as Mr. Heaviside has indicated. Consequently I am not prepared to split hairs over the question of dimension, but there is no reason why the quantities themselves should not be defined in some definite and understandable unit as soon as possible, so that they can be thought, talked and written about with facility.

I trust, therefore, Dr. Lodge will not be discouraged at the cold reception he has met so far. It appears to me that his work is not only a good one, but has been exceedingly well done, and although I do not quite agree with him, especially on the 4π question, on which I side entirely with Mr. Heaviside, particularly from an educational point of view, yet I consider such matters of secondary importance as compared with the necessity of quickly and intelligibly defining magnetic relations and quantities. Apologizing for the length of this letter,

Yours, etc., G. L. ADDENBROOKE.

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*From the *Electrician* (London).

FRANKLIN LEONARD POPE.

Franklin Leonard Pope was born in Great Barrington, Mass., on December 21, 1840. His parents were Ebenezer and Electa Wainwright Pope. His father is described as one who did his own thinking, read the daily papers with avidity and could talk intelligently upon any of the questions of the day. He was distinctively a humorous man, and gave to his children a large inheritance of wit and humor. His mother was a strong-minded, though not a masculine woman, with strong individualities which, like the father's humor, were inherited by Frank. The paternal grandfather, Captain Ebenezer Pope, was in his day a very prominent citizen of Berkshire, and served several terms in the Legislature. On his mother's side his ancestors were equally worthy.

Frank's early education was that of the average New England youth of those days, with the addition of one term at Amherst Academy. His favorite studies were natural philosophy and geography, and at an early age he evinced a fondness for drawing and scientific and mechanical pursuits.

The first money he ever earned was the product of his pencil—it was 25 cents given to him by a railroad engineer for a sketch of his engine. This led to a somewhat lucrative business on a small scale in the same line, for his skill in drawing brought him orders for sketches of other engines on various roads centering in Great Barrington.

Next we find him editing and publishing, in connection with Merritt I. Seeley and Tom Maguire, a small local paper called the *Berkshire Rambler*. The youthful editors were their own compositors and newsboys. This paper, it seems, was dedicated to "Honesty and Justice," two watchwords which characterized Mr. Pope's after life so distinctively.

In 1857 a branch of the American Telegraph line was extended from Pittsfield to Great Barrington, and of this Mr. Pope was appointed operator. He had charge of the office until 1859, when he was appointed circuit manager of the Boston and Albany Railway wires at Springfield. At the close of the year there was a consolidation of rival telegraph companies, which threw many operators out of employment, but such was Mr. Pope's skill that he was retained and assigned to Westfield. He, however, soon after resigned in favor of one of the unfortunates who had a family on his hands and needed the position more than he did.

Going to New York, his skill with the pencil again availed him, and he secured a position as artist with the *Scientific American*. He also at this time imbibed much information in regard to the patent business which afterward was to become of much use to him.

At the breaking out of the war Mr. Pope re-entered the telegraph service and was assigned to Providence, R. I., where for a year he acted as operator for the American Telegraph Company. He was next transferred to New York, with instructions to prepare a complete series of maps of the company's system of telegraphs, which then embraced all the lines in the seaboard States from Maine to Virginia. This occupied him for two years, and resulted in a map including the smallest details of the whole system—a thing unique at that time in telegraphy. So valuable was his work in this line that he was next detailed to examine all of the different kinds of telegraphic apparatus then in use and to decide upon a standard. He was interrupted in this work by the New York riots. The lines were torn down and communication interrupted. Mr. Pope again was the man to fill the breach, and by appointment from Gen. Lefferts he undertook to re-establish the wires to Boston. Disguised as a farmer, and with a portable telegraph instrument and tools for repairing lines concealed in a sack of oats, he started from New Rochelle under cover of darkness and fog. He walked over the fifteen miles between that place and the Harlem River, and by daylight succeeded in connecting a single wire and restoring communication. During that night he had many hairbreadth adventures, but his indomitable pluck and perseverance brought him through all right.

In 1864 young Pope finding his health seriously impaired, in the hopes of regaining his strength, accepted an appointment as assistant to Col. C. S. Bulkley, engineer-in-chief of the Russo-American Telegraph Company, and in 1865 he went to San Francisco to investigate the practicability of connecting the United States with Europe by means of a telegraph line via Behring Strait. His preliminary investigation disclosed the fact that the country over which the proposed line was to pass, from Fort St. James, on the upper waters of the Frazer River, to Behring Strait, a distance of 1,500 to 2,000 miles, was an absolute *terra incognita*, rendering necessary a preliminary exploration and survey of this whole country. He recommended that the survey be undertaken by two parties, and this plan was adopted, Pope himself being placed in charge of one of them. The greater part of the winter of 1865 he passed on Lake Tatla, suffering many hardships, but nevertheless prosecuting his work.

Returning in the spring, he was next ordered to Kamchatka to prosecute further explorations there, but before he could start the successful completion of the 1866 Atlantic cable caused the abandonment of the scheme.

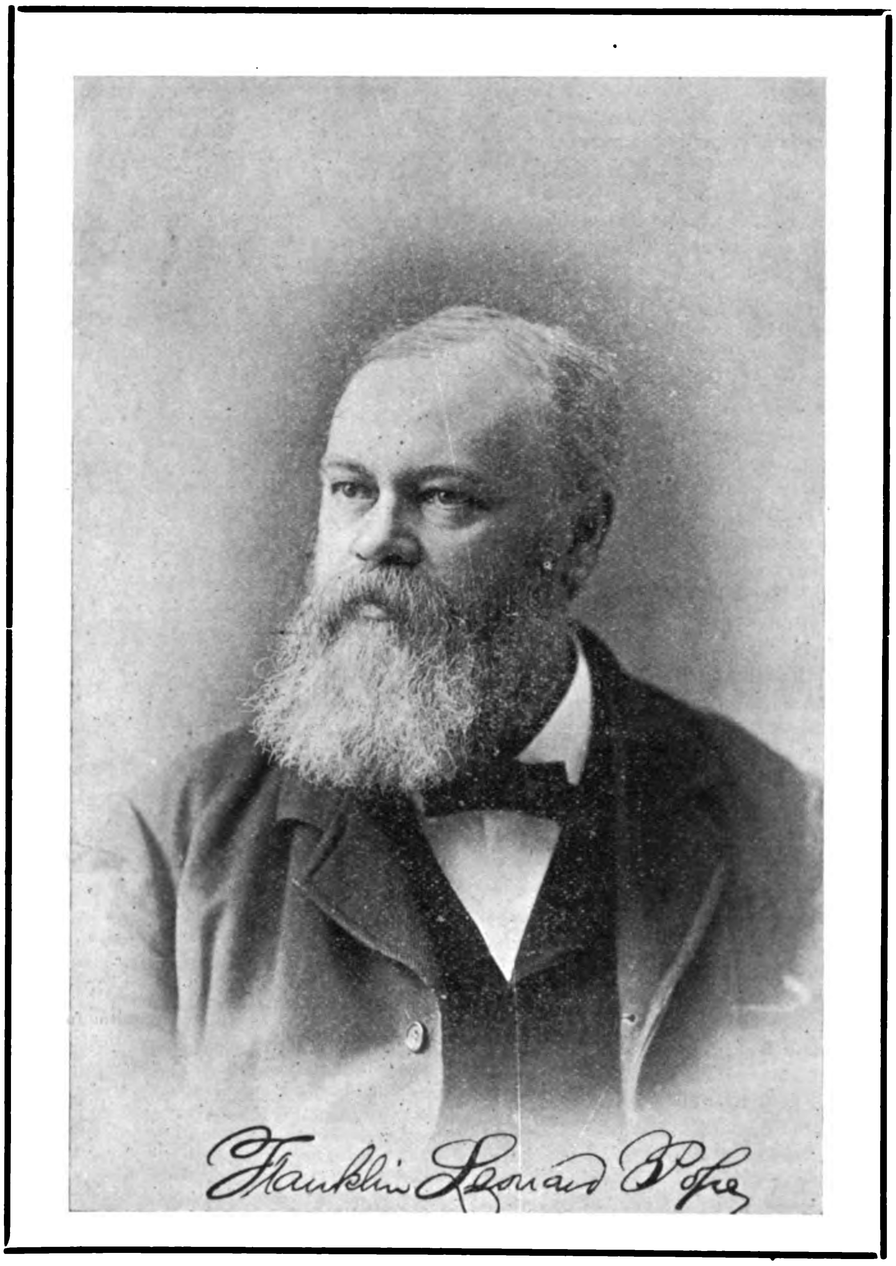
His work was not lost however, for when the surveys for the Canadian Trans-Continental Railway were made his notes proved of the utmost value in determining the best route to the Pacific in British territory.

After returning from Alaska, Mr. Pope was employed for some time as editor of *The Telegrapher*, a journal devoted to telegraphic interests. It was at this time that he wrote "The Modern Practice of the Electric Telegraph," a hand-book which at once became standard, and has passed through several editions, being used as a text-book in the United States Signal Service and in the military telegraphic service of the Government.

In 1867 S. S. Laws invented his stock-ticker. It was a failure as a system until Mr. Pope was called in to perfect it, since which time it has met every requirement, and two years afterward was sold to a company for $100,000 and a royalty of $10,000 per year in addition.

Soon after this business passed into other hands Mr. Pope invented a type-printing instrument, so simple that a child could work it after five minutes instruction. The inventor, with the assistance of his brother Henry, soon established quite a profitable business in constructing private telegraph lines equipped with these type-printing instruments. The business increased so rapidly that he was obliged, through want of capital, to form a company to carry it on. The Gold and Stock Telegraph Company of New York finally purchased a majority of the stock of this company, and consolidated it with its own, eventually developing an enormous business in private telegraph, extending to all the principal cities of the United States.

Electric railway signaling apparatus next attracted his attention, and in this line of work he was, from a technical point of view, almost equally successful,



but almost endless litigation has prevented satisfactory financial outcome. His systems have been employed on the Boston & Albany, Eastern, Old Colony, New York Central and other railroads.

In 1875 the late Wm. Orton, the president of the Western Union Telegraph Company, offered Mr. Pope a position in charge of the patent interests of his company, an office which he had previously occupied with the Gold and Stock Telegraph Company. This he accepted, and for years the whole patent system of this great company was in his exclusive care.

In 1881 he engaged in private practice as patent expert and solicitor, the firm at one time being Pope, Edgecomb & Terry.

In 1884 he assumed editorial charge of the monthly *Electrician*, the title of which was shortly afterwards changed to the *Electrician and Electrical Engineer*, which position he filled until the spring of 1890.

Latterly, and up to the time of his death, he was in charge of the electrical department of the *Engineering Magazine*, which through his discriminating judgment more than to any other one factor gave to that magazine an appreciated standing among the electrical fraternity.

While not a prolific writer, his style was terse and perspicuous, and everything that he wrote bore the impress of authority and mature judgment. His contributions have therefore been preserved with greater care than those of many other writers, and the clearer recollection of what he did write gave the impression of greater prolificness than was perhaps true.

He was a man of strong convictions, and he had the courage of his convictions. He did not believe that Edison was entitled to the credit of the invention of the incandescent lamp, nor that Morse deserved more credit than Vaile for the invention of the electromagnetic telegraph, and he said so. His mind was a judicial one of a high order, and while he may have been mistaken in his judgment at times, his conclusions were the result of logical deductions from the premises as they appeared to him.

It was this very judicial character of mind that made him at once a reliable, but in one sense an unsuccessful expert before the courts. When as an expert he swore to tell the truth, the whole truth and nothing but the truth, he proceeded to do it regardless of whether the whole truth injured his client's case or not. For this reason he was not always considered the best expert to employ.

It may be said with entire truth that he never prostituted the high office of expert to selfish or improper purposes, and therefore stood as a type of all that was good and honorable in professional ethics.

Mr. Pope was a charter member of the American Institute of Electrical Engineers, and during the year 1886-7 became its president, succeeding Dr. Norvin Green, the first president of the Institute, who held the office from 1884 to 1886.

He leaves a widow, two daughters and a son, all of whom have the sincerest sympathy of the entire electrical fraternity, who realize in Mr. Pope's almost tragic death a personal loss.

The funeral took place at Great Barrington, Mass., on Wednesday, October 16, the services being held at his late residence, the old family homestead, in which Mr. Pope was born and where he met his death.

The attendance was very large, and included a number of electricians from various parts of the country, some of whom came considerable distances to pay respect to the mortal remains of him whom in life they had admired so much.

The casket, a simple black draped one, with nickel trimmings, was placed in one of the parlors.

The floral offerings were few and simple, and consisted of a broken column at the head and a wreath of autumn oak leaves at the foot of the casket, with a few cut flowers.

The room in which the remains reposed was reserved for his professional friends who later acted as honorary pallbearers.

The service was the impressive one of the Episcopal Church. After the services at the house, the honorary pallbearers formed two lines between which the casket was carried to the hearse. They then preceded the hearse on foot to the cemetery, where they again formed two lines between which the body was carried to the grave.

A simple ceremony, and all that was mortal of Franklin Leonard Pope was consigned to the earth.

How the Accident Probably Occurred.

Mr. Ralph W. Pope, Secretary of the American Institute of Electrical Engineers and oldest surviving brother of the late Franklin Leonard Pope, who was killed by electricity at his Great Barrington home on Sunday last, returned to New York on Friday.

Mr. Pope, like his brother, has had a long and varied electrical experience, and from the time of his arrival at Great Barrington on Monday up to his departure on Thursday made a daily study of every condition existing at the spot where his brother died. He also carefully questioned every person who had any knowledge of the facts, as no official examination was made beyond the autopsy on Wednesday. Mr. Pope places great confidence in the careful examination of the converters, wires, etc., personally conducted by Edward Weston, Wm. Stanley and Geo. A. Hamilton, than whom he says no higher authority could be desired. These gentlemen have a report in preparation which will soon be published.

Mr. Pope's story of the occurrence shows that his brother was apparently the victim of an accident, solely due to the fact that in order to test the lines and observe the working of the plant he had permitted the location in his cellar of a converter, which necessitated the leading in of the primary wires of the system, carrying a normal voltage of 2,100. These wires were brought in at the north cellar window at a point distant about two feet from the transformer. There was a twisted joint in each wire about midway between the entrance of the primaries and the converter to which they were connected. One of the joints stuck up, and although both were supposed to be covered with so-called insulating tape, it is quite possible that one of the points of these joints was bare, owing to the difficulty of covering such a joint unless extreme care is used. The tape from these joints had been removed after the accident and the wire adjacent to the joints themselves broken on one side and cut with pliers on the other. The joints were taken out and were found on the floor behind the cold air box on Thursday. One of the facts which an early examination did not account for was that the main scar on the right hand gave evidence of a mechanical injury, being a deep ragged scratch, as well as a scar from the electrical burn. The point of either of these joints was well calculated to produce such an injury. Two other minor burns, one on the knuckle and one on the back tip of the forefinger, might have been made either before or after the more serious injury.

As he approached the transformer with the lighted lamp in his left hand to look at the wires, it is possible that he first encountered a strong draft from the open cellar window, the sash of which was suspended by hinges, but according to the statement of Mr. Bell, who was familiar with the cellar, had been unfastened for some time and would therefore swing more or less with the wind. It was necessary in order to secure it to push the window back and at the same time turn the button on the end of the sash with his right hand. Having thus closed the window, the withdrawal of the hand apparently brought it into contact with one of the twisted joints already described, by which his body was placed in the primary circuit, the current entering his hand, passing through his body and entering the concrete floor through the soles of his shoes. It is quite likely that the flame of the kerosene lamp may have been blown out before Mr. Pope had closed the window, in which case the liability to an accident of this kind was increased; or some trivial incident may have distracted his attention for a moment.

It was a rainy day and he had walked to and from church, a distance of about half a mile, and had also strolled about his yard, so that his shoes were doubtless damp. The wet branches of trees swayed by the wind had also caused grounds on the main line through the village, the consequent flashing having been quite generally noticed that evening. Had he stood closely enough to the window to close and fasten it, he must have stood on a portion of the concrete floor dampened by the dripping of water from the wires which had no "water-drip" outside.

Mr. Weston is of the opinion that the position of the hand after closing the window was at such an angle with the wire that the existing burn could not have been made by the point, although no other theory as to the raggedness of the injury has been advanced. It is evident that no attempt was made to handle the wires in any manner, all the burns being on the back of the hand.

Tribute of the Brooklyn Electrical Society.

At a meeting of the Brooklyn Electrical Society, held in the Edison Assembly Rooms, Brooklyn, on the 15th inst., the following preamble and resolutions were adopted:

THE POPE HOMESTEAD, GREAT BARRINGTON, MASS.

Whereas, The members of the Brooklyn Electrical Society have heard with profound regret of the removal from our midst of our worthy and esteemed co-laborer in the scientific field, Franklin Leonard Pope, and

Whereas, The intimate relations held by him with the science of electricity during his life makes it fitting that we record our appreciation of him; therefore be it

Resolved, That the wisdom and ability which he has exercised in aid of the advancement of the science of electricity by counsel, service and research, will be held in grateful remembrance.

Resolved, That the sudden removal of such a man from our profession leaves a vacancy and shadow that will be deeply realized by all members of the electrical fraternity, and his name will ever remain as that of a martyr to the science in which he met his death.

Resolved, That with deep sympathy with the afflicted relatives and friends of the deceased, we express an earnest hope that even so great a bereavement may be over-ruled for their highest good.

A copy of the resolutions was sent to Mrs. Pope.

Magnetism and Eggs.

Dr. Bertram Windle, a London experimentalist, has recently made investigations of the effect of magnetism on the hatching of eggs. He found that the eggs of silk-worms, when placed in the field of a strong magnet, were apparently unaffected by the lines of force penetrating them, but hens' eggs thus treated were found to produce an unusual number of abnormal chicks. Dr. Windle submitted the eggs of trout to an electrical current traversing the water, and found it to arrest their development.

New York Electrical Society.

The next meeting of the New York Electrical Society will be held at Columbia College on Monday evening, October 28th, when Mr. P. B. Delany will lecture on "High Speed Commercial Telegraphy."

THE MONTREAL MEETING.

FOURTEENTH ANNUAL CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The Proceedings in Detail—A Large Attendance—St. Louis the next Meeting Place.

The fourteenth annual meeting of the American Street Railway Association convened in the Windsor Concert Hall, Montreal, Canada, October 15, with President Joel Hurt, of Atlanta, in the chair.

The delegates were officially welcomed to the city in brief addresses by the Hon. J. A. Villeneuve, Mayor of the city, and by Col. A. A. Stevenson, of the Montreal Railway Company, to which President Hurt responded in well chosen words.

Next in order was the delivery of the annual address by President Hurt, as follows:

Gentlemen of the Association: You are for the first time assembled in convention beyond the confines of the States, and by this meeting on Canadian soil the lesson is taught that the Association is endeavoring to extend and receive the benefits of fraternal intercourse and broad educational work.

In this most beautiful city, situated in a profusion of nature's gifts to man, an examination and contemplation of all that may be interesting would render your limited stay most enjoyable indeed. We hope you will enjoy your visit to the city of Montreal, where you are now in convention in response to that noble fraternal spirit characteristic of the members of this Association throughout its entire field of operations, and which I am proud to say is so marked in our brethren in Montreal. Let us not forget, however, that we meet also for practical, useful work and that you are at this convention confronted with grave questions to be determined.

Before referring to matters which are in order, and which should engage your special attention, I feel constrained to speak in commemoration of the papers presented at the last annual meeting, and to invite your attention to them. I refer especially to the paper on "Uniform System of Railway Accounts" by Mr. H. I. Bettis; the paper on "City and Suburban Electric Railways" by Mr. E. C. Foster, and the paper on "Mail, Express and Freight Service on Street Railway Cars" by Mr. Richard McCulloch. While all the papers read bear evidence of much thought and merit, the three mentioned will be found especially useful.

The street railway problem of to-day is growing in importance more rapidly and is attracting to a study of its solution a greater number of educated men than any other branch of industrial work.

But a few years have sufficed to transform a business of dull drudgery and routine, in which animal power was resorted to chiefly, into a business in which the mysterious power electricity, but by a distinguished scientist denominated "God's vicegerent" (should not this be regent?) works a man's bidding on all sections of an immense system with instantaneous promptness. The usefulness of this subtle force is only equalled by the charm of its contemplation, and the ablest men of the day give homage to a business which invokes its application.

There are in operation to-day in the United States about 179,300 miles of steam roads and about 13,500 miles of street railways. The passenger receipts on the steam roads the past year were $276,031,000. The gross receipts of street railways in the United States were between $125,000,000 and $140,000,000. The street railway mileage is about 7½ per cent. of the steam railway mileage, and passenger receipts of street railways about 45 per cent. of the passenger receipts of steam roads. The total capitalization, bonds and stocks of steam roads in the United States is about $11,000,000,000, and of the street railways about $1,300,000,000. The latter is about 11 per cent. of the former, while the profits of the steam roads were $322,000,000, and of the street railways about $43,000,000, the latter being about 13½ per cent. of the former. From these figures an idea may be gathered of the magnitude of the business.

The Association having referred to the Executive Committee the question of the advisability of enlarging the scope of its work, the question will come back for your consideration with the committee's recommendations.

There are many questions which call for more extended and complete work. There are new branches of business to be cultivated by the companies, such as the handling of freight and mail, the delivery of small parcels from retail stores through a system of express, the handling of building material to suburban localities, the handling of milk on special cars for the purpose, and the operation of funeral cars from any portion of the system into cemeteries where special facilities are provided.

The companies will need to lend a mutual aid to each other through the National Association for the purpose of defeating hostile legislation in National, State and municipal governments, and to conduct a work all along the line which will tend to implant in the minds of the patrons of the roads the fundamental idea that the public interest demands friendly legislation for transportation companies, since this will tend to enable the companies to furnish the best and most rapid transportation, while harmful legislation will tend to bring about the opposite result.

The relation of street railroads to steam roads is growing more interesting, and in some localities even perplexing, until the question is now being asked, what will be the solution of the extension of electric lines which are cutting so rapidly into the business of the steam roads. A partial consideration of this question brings forth the inquiry—will not the interests of these two systems of transportation force an amalgamation of the systems, having thereby the main lines connecting distant points, which will be operated into sections at convenient points in municipalities from which passengers will be transported over various street railway lines to their destination?

The steam roads of the country are organized, the territory being subdivided into several sections for the purpose of promoting harmony and mutual protection. While it is true that street railroads do not now come into competition with each other, except to a limited extent, yet it is a question if their interests do not demand an organization with sufficient strength and facilities to keep a constant watch over the business throughout the country. It is believed that the time has come when a larger revenue must be raised, either upon the assessment plan or by increasing the membership dues.

The great and important question before you here is the one to enlarge the scope of the Association. The Executive Committee has held three long sessions, two in this city and one in New York, the time being devoted chiefly to a consideration of this question. Seven days and nights have been spent in these meetings, the results of which will appear in the committee's report, and to which your attention is invited.

I take this occasion to thank the members of the Association, especially those of the Executive Committee, for the support and co-operation extended to the officers of the Association.

After the minutes of the last meeting had been approved, the report of the Treasurer was read and showed the following result:

Receipts	$7,554.57
Expenses	7,240.55
Balance on hand	**$314.02**

After lunch the first business was the reading of a paper by Mr. E. J. Wessels on "Air Brakes," which was well discussed.

Following this a discussion on street paving was introduced by Mr. John A. Seely, who said:

I would like to inquire of the members of the Association their experience regarding street paving. I will state our case specifically: In building a railroad in a certain city the railroad company is compelled to pave its strip, 18 feet in width, with the same material that the city officials pave the remaining portion of the street, which happens in this case to be asphalt. In paving this street the paving contractor refused to do the paving unless we entirely suspended our service, taking all cars off. They paved one piece, and after that was done the railroad company decided it would not give up the street. The paving company has refused now to pave that portion of the street, claiming that it could not be done while the cars were in operation, and especially that the concrete would not set with the cars running over the rails. The railroad company has commenced to put in the concrete itself, keeping the cars moving at the same time. I am pleased to say that it is quite successful so far—the concrete being laid, headers and stretchers being put in, and cars moving right along. Of course it is expensive. The next problem is who will pave the top of the concrete with asphaltum. The railroad company is thinking seriously of constructing a plant of its own, and I would like to know if any of the gentlemen present have given up the street, given up their entire service, to the paving company to pave a street.

Mr. Johnston, of Richmond—In the work under my charge in Philadelphia I have done a great many miles of street paving, but we do it under contract. In that city they require you to pave the whole street, not your strip; if the street is 100 feet wide you have got to pave it. Our bills amount to a good many hundreds of thousands of dollars. In no case have we given up the street to the contractor. It is a piece of utter contrariness on the part of any contractor who says that he cannot lay the paving without stopping the cars. We put a concrete paving in and alongside the rail; we did $600,000 worth of this work. I did the paving in New Orleans, Philadelphia and Richmond. In Richmond we are going to put in a track laid on concrete, and do not propose to stop one minute for anything. It can be done.

Mr. Seely—Are you connected with the paving company?

Mr. Johnston—No, I am a railroad man. I will say further that some years ago I was assistant city engineer in Richmond and had charge of the paving. That was my work, and the contractors did it there for the railroad companies and the cars never stopped running a minute. There is no reason in the world why they should.

Mr. McCulloch—We pave between our rails and one foot outside, and between double tracks, with the same material with which the street is paved. We are now on one of our roads engaged in just the work the gentleman has referred to. We have two very busy streets, one of them originally paved with asphalt and the other paved with granite, both underlaid with concrete, and the men at this minute are working on both streets, and the asphalt men are paving, the concrete men are paving and the granite men are paving, and our cars are in constant operation without any hindrance or suggestion of interference, no contractor or paver ever having asked us to discontinue the running of the cars. It would not be tolerated by the Board of City Works in our city. It is not necessary, and is unreasonable on the part of a contractor, and in our city would not be tolerated. It is done with the cars in operation, and there never has been any suggestion of anything to the contrary.

WEDNESDAY MORNING.

The Convention was called to order by President Hurt at 10:45 A. M., and went into executive session.

The first topic on the programme for discussion, "The Labor Question," was taken up, the discussion being opened by Mr. Wyman, who was followed by Gen. Jackson.

The discussion was suspended to admit of the reading of a communication from Mr. Baumhoff, of St. Louis, enclosing a paper on Transfers. Both letter and paper were read, and on motion the paper was ordered to be spread on the minutes and printed.

The discussion on the subject of Transfers was opened by Mr. Sergeant, who was followed by Messrs. Charlton, McCulloch, Jackson and Hurt.

During the session an announcement was received that several gentlemen connected with the Dublin Tramways Company were without, having come upon the invitation of the President. They were invited to take seats in the hall and participate in the discussion if they so desired.

The discussion of the labor question was then resumed, Messrs. Sergeant, Wyman, McCulloch, McClary, Charlton, Hurt, McLain and Connette taking part.

WEDNESDAY AFTERNOON.

A letter was read inviting the members to attend the performance at the French Opera Theater on Thursday evening.

Mr. Hamilton then read the report of the Executive Committee, together with the amended Constitution and By-Laws proposed by the Executive Committee.

The vital points in the Executive Committee's report were as follows:

The committee found, to its surprise, that the Association was largely in debt, its liabilities exceeding its assets by nearly $5,000. These liabilities were found to be the accumulation of several years, in which the sum of the actual expenditures and the bills contracted but not settled had exceeded the receipts. It did not appear, however, that there was any extravagance in the conduct of the Association's affairs. The receipts have merely been insufficient to take care of all the work laid out by the Association at its annual meetings. The chief criticism that the committee has to make is that the situation had not long before been faced and a course of action determined upon which would prevent the annual increase of debt.

The records and property of the Association contained in the office of the Association in Brooklyn were examined by the committee and found to be well kept and in good condition, Mr. Richardson's assistant, Miss Strickland, being in charge.

The Treasurer's report had been made up for the eleven months and fifteen days from October 15, 1894, to September 30, 1895, showing in brief the following results:

Balance, Oct. 17, 1894	$94.07	
Receipts from all sources during the period named	7,263.25	$7,357.82
Total disbursements during the period named	7,040.61	
Balance in bank Sept. 30, 1895	316.71	$7,357.32

Assets and Liabilities.

Assets:		
Unpaid dues $900, charged to profit and loss by order of Executive Committee.		
Unpaid charges for space Atlanta Convention, $114, charged to profit and loss by order of Executive Committee.		
Unpaid subscriptions to Street Railway Decisions	$10.00	
Volumes Street Railway Decisions on hand, appraised valuation	200.00	
Office furniture, appraised valuation	125 00	
Cash in bank, Sept. 30	385.71	
Deficit	4,087.33	$4,808.04
Liabilities:		
Bills for printing, etc	$3,162.00	
Reports of special committees	150.00	
Loan, W. J. Richardson	300.00	
Expenses of Executive Committee	770 38	
Office rent	125.00	
Royalties	210.00	
Miscellaneous	90.00	$4,808.04

It will be seen that among the items included in "Assets," as stated above, appears one entitled "Unpaid Dues" amounting to $900. The committee regrets to say that the utmost efforts have so far failed to bring home to the members of the Association who are responsible for this item a realization of the fact that their debts to the Association are "debts of honor," which should be discharged with a promptitude certainly as great as would be the case with debts more easily collected by process of law. The committee recommends that the Association instruct the incoming Executive Committee to make a final effort to secure payment from the following companies, and if this effort shall not prove successful within sixty days, to drop the names of such companies as shall not have paid from the list and their membership shall thereupon cease.

Name of Company.	Years in arrears.	Amount due.
Sandusky Street Railroad Company	5	$125.00
Hoosac Valley Street Railway Company	6	150.00
Central Cross Town Railroad Company	4	100.00
Central Railway Company, Peoria	3	75.00
McKeesport & Reynoldtown Pass. Ry. Co	2	50.00
Syracuse Consolidated Street Railway Co	2	50.00
Paterson Central Electric Railway Company.	2	50 00
*Second Avenue Pass. Ry. Co., Pittsburg	2	50.00
Canton-Massilon Electric Railway Co	2	50 00
Metropolitan Railroad Co., Washington	1	25.00
Citizens' Electric Railway, Light and Power Company, Mansfield.	1	25.00
Allentown & Bethlehem R. T. Co.	1	25.00
Columbia (S. C.) Elec. St. Ry., Lt. & Power Co.	1	25.00
Atlanta Traction Company	1	25.00
Miami Valley Company, Piqua, O.	1	25.00
		$900 00

*During the meeting a telegram was received that the Second Avenue Passenger Railway Company of Pittsburg had paid the arrears of dues.

This committee in further explanation of the foregoing financial statement and as summary, reports as follows:

Deficit of previous years	$4,711.37
Surplus of 1895	289.04
Total deficit	$4,422.33
Assets on hand, books, furniture, etc	335 33
Net deficit	$4,087.33
Total liabilities, October 14, 1895	$4,804.04
Cash in bank, October 14, 1895	385.71
Deficit	$4,422.33
Assets deemed good	335 00
Deficit	$4,087.33

The report contained recommendations for enlarging the scope of the Association by establishing a permanent bureau of statistics and information, and by admitting supply men as associate members. A revised constitution and by-laws, providing for these changes were submitted to the Convention. Eight new companies had joined during the year and there were ten withdrawals.

Mr. Seely moved that the report of the Executive Committee be received and spread on the minutes.

On reassembling at 4.30 P. M., the Chair accorded to Mr. Harrison the opportunity of making an explanation which he desired to make respecting his non-concurrence with the report of the majority of the Executive Committee upon some items embraced in their report. This was followed by a discussion in which Messrs. Harrison, Hamilton, Jackson, McCulloch, Thompson, Hurt, Cunningham, Wyman and Fairchild took part. Finally, on motion of Mr. Wyman, it was agreed that the report as read by the Executive Committee be spread in full on the minutes, that it be printed, and a copy thereof sent to each member of the Association, and that action thereon be deferred until the next regular meeting of the Association.

A committee of seven was appointed by the Chair to make nominations of officers for the following year, and on motion of Mr. Harrison a committee of ten was also appointed to devise ways and means for raising the deficit.

THURSDAY MORNING.

The Chair announced the following committees:

On Ways and Means: R. B. Harrison, H. M. Littell, T. H. McLain, W. Y. Soper, H. M. Watson, Charles Odell, Charles Green, E. C. Goodrich, T. C. Penington and John N. Akarman.

On Nominations: C. D. Wyman, Milwaukee; Chas. S. Sergeant, Boston; John B. McClary, Birmingham; W. J. Thompson, Camden; Edward Lusher, Montreal; John A. Seely, New York; Henry Scullin, St. Louis.

The Secretary read a letter inviting the delegates of the Association to hold the next meeting at Saratoga Springs.

Mr. McCulloch, of St. Louis—We offer the Association the hospitalities of St. Louis for the next Convention. Ten years ago you were there, and we entertained you under such disadvantageous circumstances that we feel we would like to do it over again and do it properly. We were in the midst of the only strike we ever had, and at the time you were there there was not a car running in the city. We have a good many running now, and while we do not wish to boast we will say that we are not behind the times in anything, and when you come there you will find everything with us as modern and as varied as you will find it anywhere else. We have both cable and electric cars, and we have them in as good shape and condition as we know how to put them. We will try to entertain you as hospitably as we did ten years ago, and I believe you were all satisfied with everything except our operations of our roads at that time.

The Secretary read a letter from the Chicago City Railway Company, urging Chicago as the next meeting place.

A communication was read from Mr. W. J. Hammer requesting the co-operation of the Association in the establishment of standard miles for electric construction and operation. The new Executive Committee was authorized to appoint a delegate to cooperate with the N. E. L. A. and other bodies to accomplish this object.

The Chair stated that the next matter in order was discussion of municipal ordinances. The gentlemen who were requested to open the discussion on this question were not present and no discussion was offered.

At the conclusion of the executive session, the paper by Mr. N. W. L. Brown, of Atlanta, was submitted, and ordered to be printed in the minutes.

Messrs. F. R. Greene and J. W. McNamara, the committee appointed at the Atlanta Convention to submit a plan of organization whereby the Association might officially investigate all patented articles used in street railway practice, reported favorable to such an organization.

After referring to the great benefits accruing to the steam railroad companies from the Eastern and Western organizations of their members for the same purpose, and outlining the general scope of these organizations, the committee sums up the important advantages as follows:

1. Lessening total expenses in fighting patent suits, etc. as a suit affecting one road would affect all.
2. Uniformity of action.
3. Additional safety in putting on new devices.
4. Greater facility in defending suits, etc.
5. Decrease in number of suits and claims on account of the existence of such an association.
6. Advantage in settling suits.
7. Contesting and avoiding unfair and unjust royalties.
8. Reduction of prices on all patented articles.
9. By members refusing to buy articles where suits are brought against any of its members, thus shifting suits to the manufacturer.
10. The dissemination of valuable information to its members of all matters relative to any suit, etc., in which one or more members are the interested parties.
11. Advantage of employes of street railway companies in getting valuable information and assistance on their own inventions, whether patentable or infringement of other devices, without additional cost to said railway or employe.
12. The acquiring of a full and authentic report of all devices that are commonly found in use on all street railways, such as fare registers, brakes, rail bonds and numerous other articles, giving the expiration of all such patents, opinion on the validity of the same, etc., and to be followed up by like reports from time to time, giving list and opinion of new patents and list of expired patents.
13. The acquiring of models, devices, etc., for permanent exhibition.

In conclusion, your committee desires to express two plans of carrying into effect the above scheme, and recommends that the Association adopt one of the following methods:

1. Provided the members vote to increase the scope of the Association, we recommend that a bureau be established to handle all matters pertaining to patents as outlined in this report.

2. Provided it is not deemed best to enlarge the scope of the Association at this time, we recommend that the Association pass a resolution providing: That the annual dues be divided into two classes, Regular and Special (or if necessary the by-laws be amended to that effect); that all members be required to pay the regular dues as already provided in the by-laws, and that it be optional with members to pay the additional or special dues; that members paying special dues will be entitled to all the benefits to be derived through the agency of a Patent Bureau to be established under the direct control of the American Street Railway Association. That the special dues be based upon the gross earnings of the several roads; that the Association elect a Board of Control consisting of three members, whose terms shall expire in one, two and three years respectively, and hereafter electing one member each year; said Board of Control to establish and carry on a Patent Bureau as outlined in this paper, with the funds paid into the A. S. R. A. as "Special dues." Provided further, that no street railway company be entitled to the benefits and privileges of said Patent Bureau, except they are regular members of the A. S. R. A.

Respectfully submitted.

F. R. GREENE, } Committee.
J. W. MCNAMARA, }

Mr. Seely offered the following resolution:

Whereas, It is the purpose of the National Electric Light Association to hold in New York City next spring, at its annual convention, a comprehensive exhibit of modern electrical inventions and applications depending on the use of central station and power house current, with the object of increasing popular interest in electric lighting and allied arts, and

Whereas, It is the desire of the American Street Railway Association to promote on the part of the public, particularly in all large cities, a fuller and more intelligent appreciation of the great benefits that accrue from electric light, heat, locomotion and other modern triumphs of civilization,

Resolved, That this Association hereby expresses its cordial sympathy with and approval of this plan for the furtherance of electrical development, and for the enlargement of the sphere within which electricity is to perform its beneficent work.

Mr. Davis, Williamsport—I desire to say a few words in regard to the resolution just read. The National Electric Light Association intends to hold an exhibition in connection with its next annual meeting, to be held in New York City in May or June of next year. The exhibition will be held under the auspices of the National Electric Light Association, but is to be given in the name of a company formed specially for that purpose, with a sufficient capital to make the exhibit of far more than ordinary interest. I understand that the object is to include in that exposition electrical appliances applicable to street railways as well as appliances applicable to the electric lighting business. The resolution is simply intended to interest the members of this Association in that exhibition.

The resolution was then adopted.

THURSDAY AFTERNOON.

Vice-President Cunningham called the meeting to order at 2:20 P. M.

The report of the Committee on Ways and Means was presented by the chairman, Mr. Harrison, recommending the following changes:

CONSTITUTION.—*Members.*

Article III of the constitution shall be amended so as to read as follows:

Section 1.—There shall be two classes of members—active and associate.

Section 2.—Active members shall be American Street Railway Companies, or lessees, or individual owners of street railways, and each member shall be entitled to one vote by a delegate presenting credentials.

Section 3.—Associate members shall be individuals or firms, or companies, not embraced in Section 2, who have been recommended by an active member. Associate members shall not be entitled to vote.

BY-LAWS.—*Meetings.*

Article VII shall be amended by the substitution of the word "Tuesday" for "Wednesday," and by the addition of the following words to the first sentence, namely: "and shall continue four days."

Mr. Harrison stated further that voluntary subscriptions had been canvassed, and in the space of an hour and a half nearly $2,000 had been subscribed.

After an extended discussion, on motion of Mr. Goff, of Fall River, the report of the committee was *laid* on the table by a vote of 37 to 11.

Voluntary subscriptions to cancel all debts of the Association were then announced, as follows:

Mr. Robert McCulloch, St. Louis:	
Union Depot Railroad Co., St. Louis	$100
Lindell Railway Co., St. Louis	100
Missouri Railroad Co., St. Louis	100
St. Louis Railroad Co , St. Louis	100
Citizens' Railroad Co., St. Louis	100
Southern Railroad Co., St. Louis	100
Cass Avenue & Fair Grounds Railway Co., St. Louis.	100
Chicago City Railway Co	100
Covington & Cincinnati Street Railway Co	100
Camden, Gloucester & Woodbury Street Railway Co	100
Atlanta Consolidated Street Railroad Co	100
Lock Haven Street Railroad Co., Lock Haven, Conn	100
Williamsport Passenger Railway Co	100
West End Railroad Co., Boston	100
Twin City Railroad Co., St. Paul	100
Twin City Railroad Co., Minneapolis	100
Wilkes-Barre & Wyoming Valley Traction Co	100
Reading Traction Co	100
Cleveland City Railway Co	100
Louisville City Railroad Co	100
Lehigh Traction Co., Hazleton, Pa	100
North Chicago City Railway Co	100
Bridgeport Traction Co	50
Newark & South Orange Railroad Co	50
New Brunswick Traction Co	50
Winchester Avenue Railway Co., New Haven	50
Manchester Street Railway Co	50
Montreal Street Railway Co	50
Ottawa Electric Railway Co	50
Columbus Street Railway Co	50
Brooklyn City & Newtown Railroad Co	50
Consolidated Street Railway Co., Worcester	50
Citizens' Street Railroad Co., Indianapolis	50
Buffalo Railway Co	50
Hartford Street Railway Co	50
Union Railway Co., Providence	50
Terra Haute Electric Railway Co	50
Troy City Railway Co	50
Globe Street Railway Co., Fall River	50
Omaha Street Railway Co	50
Paterson Railway Co	50
Scranton Traction Co	50
Toronto Railway Co	50
Taunton Street Railway Co	25
New Haven Street Railway Co	25
St. Joseph & Benton Harbor Electric Railway and Light Co	25
Akron Street Railway Co	25
Wayne & Fifth Street Railway Co., Detroit	25
Consumers' Electric Light & Street Railway Co., Tampa, Fla	25
Des Moines City Railway Co	25
Total	$3,425

The following additional subscriptions were also made:

St. Louis railroad companies, first named	$100
Union Depot Railroad Co., St. Louis	100
Chicago City Railway Co	100
Twin City Railway Co., St. Paul	100
Twin City Railway Co., Minneapolis	100
Camden, Gloucester & Woodbury	50
Montreal Street Railway Co	50
Atlanta Consolidated Street Railroad Co	50
St. Louis Railroad Co	50
Milwaukee Street Railway Co	50
West Chicago Street Railroad Co	50
H. M. Littell	100
J. A. Bailey	100
J. Willard Morgan	25
New Bedford Street Railway Co	25
Total.	$1,050

Total subscriptions, $4,475.

Mr. Thompson moved that the Secretary be instructed to give every company an opportunity to add to this fund.

The Nominating Committee presented the following recommendations for officers for the ensuing year:

For President—H. M. Littell, Brooklyn, N. Y.

First Vice-President—Granville C. Cunningham, Montreal.

Second Vice-President—William H. Jackson, Nashville, Tenn.

Third Vice-President—J. Willard Morgan, Camden, N. J.

Secretary and Treasurer—T. C. Pennington, Chicago, Ill.

Executive Committee—Joel Hurt, Atlanta, Ga.; Prentiss Cummings, Boston, Mass.; C. G. Goodrich, St. Paul, Minn.; A. Markel, Hazleton, Pa.; W. P. Kelly, Columbus, O.

The above ticket was declared elected. and St. Louis chosen as the next meeting place.

The next business was the report of the Committee on the Use of Salt and Sand on Street Railway Tracks.

Votes of thanks were offered to the President, Vice-Presidents, and the members of the Executive Committee for the able manner in which they had discharged their official duties, and to Mr. E. E. Higgins, who had so efficiently acted as Secretary during the Convention; also to the citizens of Montreal.

FRIDAY MORNING.

The President called the meeting to order at 11 o'clock, and stated that the regular order of business called for an executive session.

Mr. Scullin, of St. Louis, moved that the session be declared an open one.

The President announced the subject of "Furnishing Free Music and other Entertainment by Street Railway Companies to the Public" to be in order.

The Chair appointed Messrs. Hamilton and Harrison a committee to escort the newly elected President and Secretary to the platform.

They were duly installed and acknowledged their election with thanks, pledging their best efforts in the development of the Association.

The meeting then adjourned, to meet in St. Louis the third Tuesday in October, 1896.

P. S.—Mr. H. C. Lewis has wired that he will remove the billiard tables from the spacious lobby of the Southern Hotel at the time of the St. Louis gathering, opening all available space to exhibitors free of charge.

The New President.

Harvey Mitchell Littell, the newly elected President of the American Street Railway Association, was born in Corydon, Harrison County, Indiana, in 1856.

Harvey Mitchell Littell.

In early life he moved to Louisville, Ky., attended the public schools in that city and embarked in the street railway business as a clerk in the office of the Louisville City Railway Company about 1874, the president at that time being C. G. Davidson, now of Brooklyn, N. Y., and H. H. Littell, his brother, superintendent. He filled various positions, as clerk in the office, starter, timekeeper, track foreman and almost every position known to the street railway business.

He afterwards entered the steam railroad business with the Louisville and Nashville Railroad Company. He worked himself up in the steam railroad business until he reached the position of general freight and passenger agent of what is now known as the Chicago, St. Paul and Kansas City Railroad Company. In the interim, however, he filled the position of general manager of the St. Paul City Railway Company for a period of three years, from 1883 to 1885, during which time he superintended the reconstruction and extension of the horse railroad system in that city, covering a territory of thirty miles of road. The road then changed hands and he accepted the position of general freight and passenger agent with the Chicago, St. Paul and Kansas City Railroad Company.

In 1888 he left the steam railroad business to take charge of the Cincinnati Incline Plane Railway, which road was changed from horse to electricity under his administration in the years 1888-1889. He remained here until January, 1893, when he was made president of the New Orleans City and Lake Railroad Company and Crescent City Railroad Company, and general manager of the New Orleans Traction Company, at New Orleans, La. These lines embraced about 120 miles of horse railroad, the changing of which to electric lines he superintended. completing the same in June, 1895.

On July 1, 1895, he was made the president and general manager of the Atlantic Avenue Railroad Company of Brooklyn, which position he now holds.

Upon his retirement from the control of the New Orleans roads he was presented by the directors of the company with a solid silver dinner service as a testimonial of their appreciation of his "character and ability as a railroad manager in the development of the property."

Mr. Littell married Miss Prawl, of Lexington, Ky., in 1882, and has two sons. He now resides with his family in Brooklyn.

SHORT STORIES OF THE CONVENTION.

Mr. W. J. Johnston, with his accustomed enterprise, published a daily bulletin which was highly appreciated by every one.

The feature of the entire week was the concert in the rooms of the J. G. Brill Company, conducted by Mr. Frank Randall. Admission was free, but exit was very expensive.

The Safety Insulated Wire & Cable Company had an active representative in Mr. H. T. Richards, whose newspaper experience has taught him the art of hustling to good advantage.

Among the exhibitors at the Victoria Rink were the following:

Consolidated Car Fender Co., Providence, R. I.
Keller Printing Co., New York.
Consolidated Car Heating Co., Albany.
Standard Underground Cable Co.
New York Car Wheel Works.
New Haven Car Register Co.
Canada Switch and Spring Co., Montreal.
Taunton Locomotive Works, Taunton, Mass.
Taylor Electric Truck Co., Troy.
Charles Scott Spring Co., Philadelphia, Pa.
Sterling Supply Manufacturing Co., New York.
Peckham Motor Truck and Wheel Co., New York.
Mica Insulator Co., New York.
Chapman Valve Co., Indian Orchard, Mass.
J. A. Roebling's Sons Co., Trenton, N. J.
Standard Paint Co., New York.
Akron Insulator and Marble Co., Akron, O.
Fiberite Co., Mechanicsville, N. Y.
Walker Manufacturing Co., Cleveland.
General Electric Co., New York.
Ohio Brass Co., Mansfield.
Hogan Boiler Co., Middletown, N. Y.
Fuel Economizer Co., Matteawan, N. Y.
Goubert Manufacturing Co., New York.
Babcock & Wilcox Co., New York.
Interior Conduit and Insulation Co., New York.
The Okonite Co., New York.

Messrs. W. B. Cleveland and J. W. Atkinson, of the Forest City Electrical Works, Cleveland, met with flattering success in their exhibition of roll-drop bars, etc., and carried away several good orders.

Messrs. Hathaway, Ackerman, Donohue and Carroll were the representatives of the American Electrical Works, and shouted the merits of a new rail bond just being introduced.

Messrs. J. W. Godfrey and Frank Harrington were industrious in looking after the interests of Habirshaw wire, the former exhibiting an interesting photograph of the company's new salesman in Japan.

Medbery insulating material was tastefully exhibited at the Rink, the booth being in charge of Messrs. H. J. Medbery and W. R. Mason.

Col. Meier, of the Heine Safety Boiler Company, was one of the busiest men at the Convention.

The Western delegation came in three hours ahead of time, under the personal supervision of Wabash Railway officials. The New York and Philadelphia delegations split up into two parties—one going over the New York Central route through the Adirondacks, the other going and returning via the D. & H. road. For the former party, Mr. M. C. Roach was the accomplished cicerone, and the arrangements for the latter were admirably carried out by Mr. William Heulings.

Mr. J. H. Rhotehamel, of the Columbia Lamp Company, improved his opportunities on the return trip by taking an order for lamps at Saranac.

The interests of Standard underground cable were carefully looked after by that Convention veteran, George L. Wiley.

The Sperry brake was the chief attraction in the General Electric Company's exhibit—if we except the punch-bowl.

Mr. Frank S. De Ronde, of the Standard Paint Company, had one of the most attractive exhibits, the samples of tape, etc., distributed by him and his friends being so popular that it was difficult to retain any on his tables.

Mr. P. M. McLaren, the rotund agent of the Abendroth & Root Company, may be expected to appear in Broadway very soon wearing an overwhelming sealskin cap, which he received at Montreal as the result of an election bet made seven years ago with a Canadian friend.

We violate no confidence in stating that no journal distributed at the meeting was the subject of so much favorable comment as ELECTRICITY.

The Duke of Gloucester was a prominent figure in the Windsor lobby, and appeared to take as much interest in the Convention proceedings as he used to when the "skates" were running at his race-track.

Mr. H. H. Harrison, of the firm of Corey & Harrison, found many appreciative listeners to his newest story.

The reception at McGill University should have been better attended, and would have been if the Association had not spent so much time in discussion of a subject which had really been settled in advance.

Mr. J. H. Carson, of the Sterling Supply Company, with his associates, had a good audience when explaining the merits of their goods at the Rink.

From the number of churches in evidence it was difficult to see how there could be any wickedness in Montreal.

Capt. Willard L. Candee talked okonite and Manson tape—as he always does—with the oratorical ability born of serene confidence in the goods he sells.

The hunt breakfast tendered by Mr. M. J. Forget was a thoroughly enjoyable affair, but few of the delegates availed themselves of the invitation. The horses used at fox hunts are not the harmless breed which street railway men are accustomed to.

From a gastronomic point of view, the banquet on Thursday evening was a thorough success. But it must be confessed that the best thing to be said of the toasts and responses is that they were not much worse than those at Atlanta. Even Joe Stedman and Charles Price were not in their usual good humor.

It was quite a common remark that the representatives of the General Electric Company were all good fellows.

The Westinghouse delegation was made up of the following gentlemen: Geo. H. Lewars, Albert Schmid, E. L. Sanderson, A. J. Craigin, B. F. Stewart, R. S. Brown, C. A. Bragg, J. A. Rutherford, E. H. Gordon, and E. H. Heinrichs.

ATTENDANTS.

Street Railway Companies Represented.

Akron, O.—W. D. Chapman, gen. supt. Akron St. RR. Co.
Atlanta, Ga.—Joel Hurt, pres. Atlanta Cons. St. RR Co.
Baltimore, Md.—S. B. Thompson, master mechanic City & Suburban Ry.
Birmingham, Ala.—J. B. McClary, supt. Birmingham Ry. & Elec. Co.
Boston, Mass.—D. F. Longstreet, ex-president A. S. R. A.; Chas. S. Sergeant, gen. man. West End St. Ry. Co.; Arthur E. Childs, Electric Storage Battery Co.
Bridgeport, Conn.—N. H. Heft, pres., Andrew Radel, gen. supt., C. J. Field, con. eng., and Henry Selzer, Jr., Bridgeport Traction Co.
Brockton, Mass.—Horace B. Rogers, gen. man., and John P. Morse, Brockton St. Ry. Co.
Brooklyn, N. Y.—H. M. Littell, pres. Atlantic Ave. RR. Co.; Duncan B. Cannon, sec. Brooklyn City & N. RR. Co.
Buffalo, N. Y.—H. M. Watson, pres., F. O. Rusling, supt., and H. P. Brown, con. eng. Buffalo Ry. Co.; Richard E. Danforth, supt. B., B. & L. RR. Co.
Butte, Mont.—J. S. Wathey, supt. Butte Cons. St. Ry. Co.
Braintree, Mass.—Benj. J. Weeks, Holbrook St. Ry. Co.
Brantford, Ont.—F. Nicholls, pres. Brantford St. Ry. Co.
Belleville, Ont.—T. C. Lazier, man. Belleville St. Ry. Co.
Bay City, Mich.—C. C. Rush, man. Bay City Cons. RR. Co.
Camden, N. J.—J. W. Morgan, pres., Wm. J. Thompson, treas., Thos. P. Curley, sec., Henry J. West, director, Horace M. Royal, supt. Camden, G. & W. Ry. Co.; Samuel J. Fenner, supt., W. E. Harrington, elec. eng., Camden Horse RR. Co.
Carbondale, Pa.—J. W. Aitken, gen. man., D. J. Duncan, gen. supt., Lackawanna Valley Traction Co.
Chicago, Ill.—E. D. Dubois, supt. Calumet Elec. St. Ry. Co.; T. C. Pennington, treas., Frank R. Greene, sec., and R. J. Hill, Chicago City Ry. Co.; B. J. Jones, supt. South Chicago City Ry. Co.; J. Millar, master mechanic North Chicago St. RR. Co.; F. L. Fuller, supt., F. T. C. Brydges, supt. car shops, and C. B. Fairchild, West Chicago St. RR. Co.
Cincinnati, O.—H. P. Bradford, gen. man. Cincinnati Incline Plane Ry. Co.
Cleveland, O.—George G. Mulhern, supt. Cleveland City Ry. Co.
Columbus, O.—W. J. Kelly, gen. supt. Columbus St. Ry. Co.
Concord, N. H.—D. Waldo White, Concord St. Ry. Co.
Cottage City, Mass.—John A. Duggan, Cottage City Ry. Co.
Council Bluffs, Ia.—W. S. Dimmock, Omaha & C. B. Ry. & Bridge Co.
Covington, Ky.—T. M. Jenkins, gen. man. South Covington & Cincinnati St. Ry. Co.
Danbury, Conn.—S. C. Holly, pres. Danbury & Bethel St. Ry. Co.
Dayton, O.—Ezra Bimm, v.-pres., Nelson Routzahn, supt., Wayne & Fifth St. RR. Co.
Decatur, Ill.—W. L. Ferguson, pres. City Electric Ry. Co.
Derby, Conn.—H. Holton Wood, pres., B. W. Porter, supt., Derby St. Ry. Co.
Des Moines, Ia.—G. B. Hippee, gen. man., W. G. Owens, supt., H. H. Polk, Des Moines City Ry. Co.
Detroit, Mich.—N. W. Goodwin, sec., and Edward Grace, Fort Wayne & Belle Isle Ry. Co.; Charles M. Swift, pres. Wyandotte & D. R. Ry. Co.
Fall River, Mass.—Robert S. Goff, treas. Globe St. Ry. Co.
Fishkill, N. Y.—John T. Smith, pres. Citizens' St. Ry. Co.
Fitchburg, Mass.—Robert N. Wallis, treas., G. H. R. Preble, supt., Fitchburg & Leominster Ry. Co.
Girardville, Pa.—E. W. Ash, gen. man. Schuylkill Traction Co.
Geneva, N. Y.—J. T. Ridgway, Geneva St. Ry. Co.
Gloucester, Mass.—Willard B. Ferguson, pres., Herbert D. Bosson, Gloucester St. Ry. Co.
Grand Rapids, Mich.—G. S. Johnson, gen. man. Consolidated St. Ry. Co.
Hamilton, Ont.—B. E. Charlton, pres. Hamilton St. Ry. Co.; John Patterson, Hamilton Radial Elec. Ry. Co.; W. W. Dean, elec. eng. Hamilton St. Ry. Co.
Harrisburg, Pa.—F. B. Musser, supt. East Harrisburg St. Ry. Co.
Hartford, Conn.—E. S. Goodrich, pres., and Wm. Granten, Hartford St. Ry. Co.
Hazleton, Pa.—A. Markle, gen. man., George W. Thompson, supt., Lehigh Traction Co.
Indianapolis, Ind.—Thomas H. McLean, gen. man. Citizens' St. RR. Co.
Johnstown, Pa.—E. B. Entwistle, Johnstown Pass. Ry. Co.
Joliet, Ill.—John Hulsizer, Joliet St. Ry. Co.
Kansas City, Mo.—Wm. A. Satterlee, C. F. Holmes, Metropolitan St. Ry. Co.
Kingston, Ont.—J. M. Campbell, Kingston St. Ry. Co.
Lancaster, Pa.—Wm. A. Armstrong, Jr., supt. Penna. Traction Co.
Lawrence, Mass.—Charles A. Clark, Charles A. Richardson, Lowell, L. & H. Ry. Co.
Lock Haven, Pa.—C. A. Bragg, John A. Seely, James P. McQuaide, Lock Haven Elec. Ry. Co.
London, Ont.—C. E. A. Carr, gen. man. London St. Ry. Co.
Long Island City, N. Y.—George Chambers, gen. man. Steinway Ry. Co.
Louisville, Ky.—T. J. Minary, gen. man., J. O. Haddock, supt., Louisville Ry. Co.
Lowell, Mass.—W. B. Ferguson, pres., Israel A. Kelsey, dir., Lowell & Sub. Ry. Co.
Lynn, Mass.—J. H. Cunningham, director Lynn & Boston RR. Co.; Washington G. Benedict, pres. Boston & Revere Elec. Ry.
Manchester, N. H.—Charles Williams, pres., N. H. Walker, man., Arthur H. Williams, director, and J. H. Gallinger, Manchester St. Ry. Co.
Milwaukee, Wis.—C. D. Wyman, gen. man., Milwaukee St. Ry. Co.
Minneapolis, Minn.—E. G. Goodrich, v.-pres., E. P. Burch, eng., Twin Cities Rapid Transit Co.
Mobile, Ala.—John S. Pugh, Mobile St. Ry. Co.
Montreal, Can.—Louis Beaubier, pres., Henry Holgate, man., Joseph R. Roy, chief eng., Albert J. Corriveau, Montreal Park & Island Ry. Co.; E. Lusher, sec. and treas., J. F. Hill, comptroller, D. McDonald, supt., K. W. Blackwell, director, Montreal St. Ry. Co.
Nashville, Tenn.—W. H. Jackson, pres., Edward G. Connette, gen. man. Nashville St. Ry. Co.
Newark, N. J.—Andrew Radel, supt., C. J. Field, con. eng., Newark & South Orange Ry. Co.
New Bedford, Mass.—E. E. Potter, supt., C. S. Mendell, elec. eng., A. C. Gardiner, Union St. Ry. Co.
New Britain, Ct.—E. S. Breed, eng. Central Ry. & Elec. Co
Newburg, N. Y.—W. F. Hogan, Newburg Elec. Ry. Co.
Newport, R. I.—Robert P. Lee, supt. Newport St. Ry. Co.
Newburyport, Mass.—James P. Shaw, H. F. Eldridge, Haverhill & Amesbury St. Ry. Co.; Charles Odell, pres., Warren Shaw, Wm. P. Clark, Newburyport & Amesbury Horse Ry. Co.
New Haven, Conn.—Alfred E. Pond, pres., Israel A. Kelsey, gen. man., Charles E. Graham, Winchester Avenue RR. Co.; G. A. W. Dodge, New Haven St. Ry. Co.
New York—E. T. Landon, sec. Dry Dock, E. R. & B. RR. Co.
Niagara, Ont.—F. R. MacKenzie, man., W. Phillips, elec. eng., Niagara Falls Park & River Ry. Co.
New Brunswick, N. J.—Wm. Silver, F. W. Parrott, Brunswick Traction Co.
Norwalk, Conn.—E. J. Hill, pres., W. F. Acton, sec., Norwalk St. Ry. Co.; W. S. Bushnell, Norwalk Traction Co.
Norwich, Conn.—W. G. Benedict, director, W. S. Silver, sec., Norwich St. Ry. Co.
New Orleans, La.—Frank R. Ford, man. Canal & Claiborne RR. Co.
North Staffordshire, Eng.—W. J. Carruthers-Wain, C. E. North Staffordshire Tramways Co.
Omaha, Neb.—W. A. Smith, gen. man. Omaha St. Ry. Co.
Ottawa, Ont.—J. W. McRae, pres., W. Y. Soper, vice-pres., T. Ahearn, man. dir., J. D. Fraser, sec. and treas., J. E. Hutcheson, supt., W. W. Wylie, supt., Ottawa El. Ry. Co.
Paterson, N. J.—M. R. McAdoo, gen. man. Paterson Central Elec. Ry. Co. and Paterson Ry. Co.
Philadelphia, Pa.—A. L. Johnston, elec. eng. Hestonville, M. & F. RR. Co.; George Lord, man., J. O. McLaughlin, E. M. Traction Co.; J. C. Lugan, gen. man., John A. Brill, director Manayunk & R. Incline Plane & Ry. Co.
Pittsburg—G. F. Greenwood, gen. man. Allegheny Trac. Co.; J. E. Rugg, gen. man. Citizens' Trac. Co.; G. F. Greenwood, gen. man. Pittsburg, A. & M. Trac. Co.; J. G. Traggardh, sec. and treas., Wm. L. Elkins, gen. man., Pittsburg Traction Co.
Port Huron, Mich.—Wm. Canham, pres., W. L. Jenks, treas., A. Dixon, man., City Electric Ry. Co.
Providence, R. I.—A. T. Potter, gen. man. Union RR. Co.
Portland, Me.—Wm. R. Wood, pres. Portland RR. Co.
Plymouth, Mass.—C. E. Barnes, Plymouth & Kingston St. Ry. Co.
Quincy, Mass.—Benj. J. Weeks, John A. Duggan, Quincy and Boston St. Ry. Co.
Quebec, Can.—Edward A. Evans, Quebec, M. and C. Ry. Co.
Reading, Pa.—John A. Rigg, pres., W. H. Heanburg, Jr., asst. to pres., Reading Traction Co.
Rochester, N. Y.—Chas. A. Williams, sec., Joseph W. Hicks, supt., J. H. Stedman, mgr. of transfers, Rochester Ry. Co.
Rockland, Me.—George E. Macomber, pres., S. M. Price, vice-pres., Thomas Hawkin, supt., H. C. Weston, elec., Rockland T. and C. St. Ry. Co.
Sandusky, O.—Frank J. J. Sloat, Sandusky St. Ry. Co.
Scranton, Pa.—Frank Silliman, Jr., gen. man. Scranton Traction Co.
Springfield, Mass.—George F. Reed, elec. supt. Springfield, St. Ry.
Springfield, O.—S. L. Nelson, gen. man., C. C. Rush, supt., Springfield St. Ry. Co.
Steelton, Pa.—Mason D. Pratt, eng., Middletown H. and S. St. Ry. Co.
St. Joseph, Mich.—W. Worth Bean, pres., H. C. Mason, supt., St. Joseph and B. H. Railway and Light Co.
St. Louis, Mo.—Robert McCulloch, gen. man. Cass Avenue and F. G. Ry. Co.; George D. Rosenthal, Lindell Ry. Co.; James F. Davidson, supt., A. C. Thompson, mech. eng., Missouri RR. Co.; Charles Green, pres. People's Ry. Co.; John C. Allen, supt., T. W. Shelton, eng., Southern Elec. Ry. Co.; D. G. Hamilton, pres. St. Louis RR. Co.; Henry Scullin, gen. man., H. C. Noe, Union Depot Ry. Co.; H. A. Rockwell, elec. supt. St. Louis Suburban Ry. Co.
St. John, N. B.—H. Brown, St. John Railway Co.
Tampa, Fla.—J. T. Douglass, Consumers' Elec. Ry. Co.
Taunton, Mass.—Geo. C. Morse, gen. man., Geo. F. Seibel, Taunton St. Ry. Co.
Terre Haute, Ind.—Russell B. Harrison, pres. Terre Haute St. Ry. Co.
Toledo, O.—Charles L. Wight, sec. Toledo Cons. St. Ry. Co.
Toronto, Ont.—James Gunn, supt., J. M. Smith, comp., C. E. L. Porteous, Toronto St. Ry. Co.; Charles Morton, Toronto Suburban Ry. Co.
Trenton, N. J.—Henry C. Moore, Trenton Pass. Ry. Co.
Troy, N. Y.—Charles H. Smith, supt., J. H. Jones, Troy City Ry. Co.
Victoria, B. C.—George H. Penty, Victoria Elec. Ry. Co.
Waterbury, Conn.—J. R. Smith, gen. man., A. M. Young, sec., Waterbury Traction Co.
Wilkes-Barre, Pa.—John Graham, gen. man., J. C. Meixell, supt., Wilkes-Barre and Wyoming Valley Traction Co.
Williamsport, Pa.—Ernest H. Davis, gen. man., J. W. Cochran, asst. gen. man., Williamsport Pass. Ry. Co.
Wilmington, Del.—C. F. Hutchings, Wilmington City Ry. Co.
Worcester, Mass.—John N. Akarman, supt., C. L. West, Worcester Consolidated St. Ry. Co
Washington, D. C.—A. N. Connette, Metropolitan Ry. Co.
Windsor, Ont.—M. Coventry, pres. Sandwich and Windsor St. Ry. Co.

Representatives of Supply Houses.

Allison, Giles G., St. Louis Register Co., St. Louis.
Atkinson, J. W., Forest City Elec. Co., Cleveland.
Ackerman, P. C., American Electrical Works, New York.
Auchinole, John, E. M. Traction Co., Philadelphia.
Robinson, Wm., Electric Truck Supply Co., Boston.
Allyn, Charles B., Brooklyn Supply Co., Brooklyn.
Adams, Jr., H. C., Phillips Insulated Wire Co.
Allen, W. B., Brownell Car Co., St. Louis.
Allen, Rodney D., Smethurst & Allen, Philadelphia.
Atkinson, F. W., Bell Telephone Co., Montreal.
Baylis, R. V., Walker Mfg. Co., Cleveland.
Bradley, Jno. S., New Haven Car Register Co., New Haven
Billings, Wm. R., Taunton Locomotive Mfg. Co., Taunton, Mass.
Brill, John A., J. G. Brill Co., Philadelphia.
Bushe, J. F., Keller Printing Co., New York.
Bruckman, S. E., St. Louis Elec. Eng. Co., St. Louis.
Bailey, Geo. C., John A. Roebling's Sons Co., Trenton, N. J
Brown, R. S., Westinghouse Elec. & Mfg. Co., Pittsburg
Barnard, J. H., Telephone Signal Co., New York.
Burnstine, Albert, Berlin Iron Bridge Co., East Berlin, Conn
Beard, W. W., Lombard Hydraulic Brake.
Boyd, F. C., New Haven Car Register Co., New Haven
Baumgartner, S., Mass. Car Co., Boston.
Beadle, Edw., Railway Register Mfg. Co., New York.
Burns, Chas. F., Chas. F. Burns Co., Rochester, N. Y.
Baker, Jr., C. O., National Elec. Light Assn., New York
Barrett, C. E., The Hale & Kilburn Mfg. Co., Philadelphia
Bonner, W. T., Babcock & Wilcox Co., New York.
Barber, A. G., Valentine & Co., New York.
Bigelow, H. T., Hale & Kilburn Co., Philadelphia.
Coleman, Chas. E., Mica Insulator Co., New York.
Christie, W. E., Ottawa Carbon Co., Ottawa, Ont.

Cooke, W. E., Peckham Motor Truck & Wheel Co., New York.
Cooke, W. J., McGuire Mfg. Co., Chicago.
Carter, G. M., Carter Brake Co., Chicago.
Carter, Clarence W., Carter Brake Co., Chicago.
Casper, W. P., Consolidated Car Heating Co., Albany.
Cass, J. H., Asbestos Mfg. Co.
Cicott, Frank X., Pettingill-Andrews Co., New York.
Condit, Jr., S. B., Chase & Co.
Chur, Walter, American Ry. Supply Co.
Conklin, Franklin, Flood & Conklin Co.
Collins, G. F., Valentine & Co., New York.
Cockey, M. R., John A. Roebling's Sons Co., New York.
Cleveland, W. B., Forest City Electric Co., Cleveland.
Crowley, H. J., General Electric Co, New York.
Cooke, H. C., Cooke & Co., New York.
Claflin, Jr., Geo. D., Am. Rail Joint & Mfg. Co.
Curwen, Samuel M., J. G. Brill Co., Philadelphia.
Conway, M. W., contractor, Brooklyn.
Cragin, H. A., Westinghouse Elec. & Mfg. Co., Pittsburg.
Collins, S. O., Stever Rail Joint Co., Cleveland.
Dean, W. F., Canadian General Elec. Co., Montreal.
Dinghan, Tandem Brake Co., Toronto.
Donohue, T. E., Chicago.
Daggett, Jr., H. M., Lombard Hydraulic Brake Co.
Dean, D. B., Terre Haute Car Mfg. Co., Terre Haute.
Dittrick, C., Dittrick Brake Co.
De Witte, E. F., De Witte Engineering Co., Lansingburgh.
Darling, Geo., Darling Brothers.
Dutton, W. A., Dorner & Dutton Mfg. Co., Cleveland.
Downs, Wm., Fuel Economizer Co., Matteawan, N. Y.
Dick, H. C., Flood & Conklin Co.
De Ronde, Frank S., Standard Paint Co., New York.
Donnville, A. E., St. Thos. Car Wheel Co., St. Thomas, Ont.
Doyle, W. L., John A. Roebling's Sons Co., New York.
Dolph, John C., Forest City Elec. Co., New York.
Daniels, A. L., H. B. Camp Co.
Estes, S. E., H. W. Johns Mfg. Co., New York.
Evans, H. C., The Johnson Co., New York.
Evans, E. O., The Johnson Co., New York.
Evans, O. C., The Johnson Co., New York.
Edwards, Albert, Edwards Car Fender Co., Brooklyn.
Estep, F. A., R. D. Nuttal Co., Allegheny, Pa.
Ellis, S. P. S., The Johnson Co., New York.
Fields, Arthur W., Peckham Motor Truck & Wheel Co., New York.
Feary, Thomas H., General Electric Co., Buffalo.
Flanders, Chas. Y., Morris, Tasker & Co., Philadelphia.
Fox, Thos., The Bushnell Co.
Gray, Louis A., Adams & Westlake Co., Chicago.
Green, Frank J., Bushnell Car Co.
Gillespie, H. F., Standard Paint Co., New York.
Gorham, Richard H., steel rails, Boston.
Gibson, R. B., Hunter Automatic Fender Co., Cincinnati.
Glasyone, A. W., J. Morrison Brass Mfg. Co., Toronto.
Graham, J. H., Graham Equipment Co.
Green, Stanley, Fuel Economizer Co., Matteawan, N. Y.
Gordon, J. R., Westinghouse Elec. & Mfg. Co.
Godfrey, J. W., India Rubber & Gutta Percha Insulating Co., New York.
Gomer, W. E., Fuel Economizer Co., Matteawan, N. Y.
Harrington, F. W., India Rubber & Gutta Percha Insulating Co., New York.
Heinrichs, Ernest H., Westinghouse Electric & Mfg. Co., Pittsburg.
Hogan, John J., Hogan Boiler Co., Middletown, N. Y.
Hensler, H., Electrical Engineering Co., St. Louis.
Henry, George W., Cleveland.
Hoffman, A. H., Falk Mfg. Co., Milwaukee.
Holt, Pliny E., Carter Brake Co., Chicago.
Hathaway, W. K., American Electrical Works, Providence.
Harrison, H. H., General Inc. Arc Lt. Co., New York.
Hewitt, E. A., Bushnell Co.
Harding, H. McL., Walker Mfg. Co., Cleveland.
Hilton, Arthur, Mass. Car Co, Boston.
Hart, J. F., McPherson Sand Box Co.
Hansell, Wm. H., Chas. Scott Spring Co., Philadelphia.
Hoadley, Geo. M., Bemis Car Box Co., Springfield, Mass.
Hyde, Lewis C., Wason Car Mfg. Co., Springfield, Mass.
Hurd, G. A., Crane Mfg. Co.
Haycox, W. G., Fulton Truck & Foundry Co., Mansfield, O.
Hurley, Thos. A., Holmes, Booth & Haydens.
Hedges, Percy, General Electric Co.
Hanna, J. A., McGuire Mfg. Co., Chicago.
Haskell, G. M., J. G. Brill Co., Philadelphia.
Hatch, E. B., The Johns-Pratt Co., Hartford
Hogan, W. F., H. W. Johns Mfg. Co., New York.
Huntress, Frank C., Laconia Car Co., Laconia, N. H.
Hueston, W. S., S. T. Baker & Co., New York.
Hammer, Wm. J., consulting engineer, New York.
Hogan, Wm. F., contractor, Brooklyn.

Issertel, Henry G., H. W. Johns Co., New York.
James, F. B., Adams & Westlake Co., Chicago.
Johnston, H. C., Charles Scott Spring Co, Philadelphia.
Jackson, E. C, Jackson & Sharpe Co., Wilmington, Del.
King, C. K., Ohio Brass Co., Mansfield, O.
Knickerbocker, C. K., Griffin Wheel Co., Chicago.
Kent, Chas. W., Walker Mfg. Co., Cleveland.
Kennedy, J. J., Sterling Supply Co., New York.
Keyes, Fred A., Washburne & Moen Mfg. Co., Worcester, Mass.
Kingston, Wm. W., The Johnson Co., Johnstown, Pa.
Kaufman, A. C., Street Car Fender, Charleston, S. C.
Kissam, Geo., Carleton & Kissam, New York.
Kimball, Fred M., General Electric Co, New York.
Kirkhouse, B. G., Montreal Electric Co., Montreal.
Lilley, L. G., Underwriters' Assns., Cincinnati.
Littlefield, N. S., The Johnson Co., Lorain, O.
Loper, A. N., New Haven Car Register Co., New Haven.
Liggett, Jno. C., J. R. Sterling & Co., Toledo Car Co., Detroit.
Lombard, N., Lombard Hydraulic Brake Co.
Leyden, H. R., Royal Elec. Co., Montreal.
Lex, P. A., A. Whitney & Son, Philadelphia.
Luther, H. R., Barbour-Stockwell Co., Stockbridge, Mass.
Long, E. G., Peckham Motor Truck & Wheel Co., New York.
Luscomb, H. H., Johns-Pratt Co.
Lawless, E. J., American Car Co., St. Louis.
Leach, P. F., Bass Foundry & Machine Co., Fort Wayne, Ind.
Lewars, Geo. H., Westinghouse Elec. & Mfg. Co.
Lyons, B. B., Brussels Tapestry Co.
McElroy, James F., Consolidated Car Heating Co., Albany, N. Y.
MacDuffie, R. L., Taunton Locomotive Mfg Co., Taunton, Mass.
Meaker, J. W., Meaker Register Mfg. Co., North Chicago.
Morris, Elmer P., General Electric Co.
Mason, W. R., Mason Electric Equipment Co., Chicago.
McCartney, J. L., Ohio Brass Co., Mansfield, O.
Meiklehan, T. W. R., Barnard Electric Signal and Telephone Co.
Millen, G. S, Sterling Supply and Mfg. Co, New York.
Macpherson, Alex., Alpha Rubber Co., Montreal.
Medbery, H. J., Fiberite Co., Mechanicsville, N. Y.
McPherson, Henry, McPherson Sand Box Co.
McDonnell, Alex., Babcock & Wilcox Co.
Milbank, L. A., Holmes, Booth & Haydens.
Magee, F. A., E. S. Greeley & Co., New York.
McQuade, Jas. P., National Conduit Mfg. Co., New York.
McLaren, P. M., Abendroth & Root Mfg. Co., New York.
Montgomery, H. M., Goubert Mfg. Co., New York.
Morrell, Frank A., New Haven Car Register Co., New Haven.
Meier, E. D, Heine Safety Boiler Co., St. Louis.
Mayer, Charles J., R. D. Nuttal Co., Philadelphia.
McGhie, John, General Electric Co., New York.
Morse, C. B., Jacobs Heater Co., Boston.
Mead, Frank S., E. F. Phillips Electric Works, Montreal.
Meneely, George R., Meneely Bearing Co.
McLaren, D. W., I. C. McLaren Belting Co., Montreal.
Macdonald, Jr., A. Roy, mica dealer.
Miller, J. D., Pierce & Miller Engineering Co., New York.
Mercur, R. J., New York Car Wheel Works, Buffalo.
Nethercut, E. F., Paige Iron Works, Chicago.
Newkirk, H. R., Hoefgan, Moxham & Co., New York.
Pugh, D. W., John Stephenson Co., New York.
Pugh, John S., John Stephenson Co., New York.
Paige, Alonzo W., Paige Iron Works, Chicago.
Piper, Edward S., Noah L. Piper & Son, Toronto.
Peavey, M. V., Adam Cook's Sons, New York.
Perry, Charles C., Theophile Euphrat, Darien, Conn.
Powell, G. A., Packard Electric Co., St. Catharines, Ont.
Pringle, H. E. T., Siemens & Halske Co., Chicago.
Price, C. B., Pettingill-Andrews Co., Boston.
Pratt, G. E., Jackson & Sharpe Co., Wilmington, Del.
Porter, George F., Sec. National Electric Light Assn., New York.
Perry, J. W., H. W. Johns Mfg. Co., New York.
Pratt, Mason D., Pennsylvania Steel Co., Philadelphia.
Partridge, Arthur S., Railway Specialties, St. Louis.
Potter, W. B., General Electric Co., Schenectady.
Ransom, Henry N., Consolidated Car Heating Co, Albany.
Rugg, E. L., Benedict & Burnham Mfg. Co., New York.
Ross, Edward L., Chapman Valve Mfg. Co., Indian Orchard, Mass.
Russell, Harry H., E. T. Burrowes Co., Portland, Me.
Russell, F. D., Rochester Car Wheel Works, Rochester.
Reynolds, A. T., Taylor Electric Truck Co., Troy, N. Y.
Randall, F. C., J. G. Brill Co., Philadelphia.
Robinson, John C., Wm. Wharton, Jr., & Co, Philadelphia.
Record, E. A., Vacuum Oil Co., Boston.
Robinson, E. P., Laclede Car Co., St. Louis.
Richards, H. T., Safety Insulated Wire and Cable Co., New York.
Rutherford, J. A., Westinghouse Elec. & Mfg. Co., Pittsburg.
Rosenthal, George D., General Electric Co., St. Louis.
Rose, R. M., New York Fare Register Co., New York.
Rhotehamel, J. H., Columbia Incandescent Lamp Co., St. Louis.
Roach, M. C, G. E. P. A., N. Y. C. & H. R. R.R. Co., New York.
Range, J. W., Consolidated Car Fender Co., Providence.
Starr, D. A., Dorner & Dutton Co., Cleveland.
Shainwald, J. C., Standard Paint Co., Chicago.
Sieber, Chas. J., Allentown.
Sylvester, John E., Somerville Spike Works Co.
Stewart, B. F., Westinghouse Electric & Mfg. Co.
Sclater, William, Keasby & Mattison Co.
Speer, J. S., Partridge Carbon Co., Sandusky, O.
Scott, Jr., Charles, Charles Scott Spring Co.
St. John, William, Safety Car Heating and Lighting Co., New York.
Schmid, Albert, Westinghouse Elec, & Mfg. Co., Pittsburg.
Saltonstall, Philip L., General Electric Co.
Shepardson, P. A. O., New England Engineering Co.
Sharp, Edward P., R. D. Nuttal Co.
Schieren, Jr., Chas. A., Chas. A. Schieren & Co., New York.
Scarritt, Sanford G., Scarritt Furniture Co., St. Louis.
Scheffler, Fred'k A., Stirling Co., New York.
Silver, Wm. S., Wm. S. Silver & Co., New York.
Sweet, D. C., Sweet Bronze Sand Box.
Swain, H. S., Hazleton Boiler Co., New York.
Sperry, Elmer A., Sperry Ry. Co., Cleveland.
Slack, W. G., Bell Telephone Co., Montreal.
Sanderson, E. A., Westinghouse Electric & Mfg. Co.
Stanley, E. A., Canadian General Electric Co.
Strieby, F. H., General Electric Co.
Traxler, Chas., Ohio Brass Co., Mansfield.
Tolles, C. L., Jewell Belting Co., Hartford, Conn.
Taylor, John, Taylor Electric Co., Troy, N. Y.
Taylor, John, U. S. Projectile Co., Brooklyn.
Trible, Walter P., R. D. Nuttal Co., Allegheny, Pa.
Turner, Wm. S., Woodbridge & Turner Co., New York.
Thomson, Fred., electrical engineer, Montreal.
Thayer, Frank A., Goubert Mfg. Co., New York.
Trawick, S. W., General Electric Co., Atlanta.
Van Dorn, W. S., Fitzgerald-Van Dorn Co., Lincoln, Neb.
Vosburgh, A. C., New Process Raw Hide Co, Syracuse, N. Y.
Vos, Wm., Barney & Smith Co., Dayton, O.
Vansant, H. C., Morris, Tasker & Co., Philadelphia.
Wyman, Edward B., Tandem Brake Co., Montreal.
Woodward, J. H., Benedict & Burnham Mfg. Co.
Wendell, Jr., Jacob, Taunton Locomotive Mfg. Co., Taunton, Mass.
Wurster, E. A., Falk Manufacturing Co., Milwaukee.
Wise, Clift, Chicago.
Weherns, George A., Railway Joint Mfg. Co., New York.
Walter, Franklin, F. Walter & Son.
Whyte, George S., Badger Mfg. Co. and Chicago Insulated Wire Co.
Winters, D. L., Winters Automatic Brake Co.
Wattles, James F., Rand Avery Supply Co., Boston.
Wightman, George H., The Cameyer Steel Co.
Watts, Edward T., Philadelphia Electric Equipment Co.
Whitmore, C. E., Whitmore-Dean Mfg. Co.
Washburne, Wm. A, Cambria Iron Co., Philadelphia.
Wightman, H. J, H. J. Wightman & Co., Scranton, Pa.
Webb, H. E., Solar Carbon & Mfg. Co., Pittsburg.
Wilkinson, E. T., Kensington Electric Co., Philadelphia.
Wessels, E. J., Standard Air Brake Co., New York.
Wood, Chas. N., R. D. Nuttal Co., Boston.
Woodbridge, J. Lester, Woodbridge & Turner Engineering Co.
Wiley, G. L., Standard Underground Cable Co.
Wheeler, Jr., Albert, Love Electric Traction Co, New York.
Wardwell, Fred. S., Wardwell Brothers.
Wood, W. C., Brooklyn, N. Y.
Wylie, W. W., Ottawa.
Yates, E. A., The Trendley Brake.
Yardley, John H., Philadelphia Car Wheel Co.

Press Representatives.

Edward Caldwell, Edward E. Higgins, C. B. Fairchild, W. H. Taylor, W. E. Partridge, *Street Railway Journal*, New York.
H. M. Davis, *Electric Power*, New York.
W. J. Johnston, Wm. Taylor, J. W. Dickerson, Cecil P. Poole, George T. Hanchett, *Electric Railway Gazette*, New York.
Fred De Land, *Electrical Engineering*, Chicago.
H. H. Windsor, H. I. Kenfield, F. S. Kenfield, James Boyd, *Street Railway Review*, Chicago.
John B. Bennett, *Street Railway Journal*, Chicago.
H. G. Tuckerman, Boston *Electrical Review*.
E. B. Biggar, *Canadian Engineer*. Montreal.
B. E. Greene, ELECTRICITY, New York.
T. E. Crossman, stenographer, New York.
W. C. Beard, *The Car*, New York.
W. T. Hunt, Thos. R. Taltavall, *Electrical Age*, New York.
T. C. Martin, A. C. Shaw, *Electrical Engineer*, New York.
W. Forman Collins, W. F. Osborne, *Western Electrician*, Chicago.
E. A. Simmons, *Railroad Gazette*, New York.
Charles W. Price, *Electrical Review*, New York.
R. W. Ryan, stenographer, New York.
E. W. Wood, *Electrical Industries*, Chicago,
E. Myerson, stenographer, New York.

THE THOMSON-HOUSTON REGULATOR PATENT.

A Statement of the Case.

The final decision of the United States Circuit Court of Appeals for the Seventh Circuit, in the suit of the Thomson-Houston Electric Company vs. the Western Electric Company and Enos M. Barton, concludes one of the most important patent causes relating to electrical inventions.

In 1879 Elihu Thomson and Edwin J. Houston applied for a patent upon an automatic adjuster for commutator brushes of magneto-electric machines. In this patent the applicants described and claimed a device for automatically adjusting the brushes upon the commutators of dynamo-electric machines, "whereby an automatic adaptation to variations of circuit resistance is secured." This device consisted of a relay adapted to bring into service a motor which shifted the brushes upon the commutator. The relay received its current from an accessory brush placed in advance of the main brush upon the commutator of the dynamo-electric machine.

The patentees of this "first" patent, which was issued as No. 223,659, July 20, 1880, both of them, testified that up to the time of the taking out of this patent they had not made the invention of current regulation and did not appreciate that the brushes upon the commutator of a dynamo-electric machine could be shifted so as to keep the current constant. Whether this is so or not, the fact remains that it was known to electrical engineers of that date that shifting the brushes upon the commutator of a dynamo-electric machine could be so performed as to keep the current flowing in the circuit constant, notwithstanding the variations of the resistance in the circuit. Weston testified that he had manually shifted the brushes for this purpose from 1876.

It was not long after the issue of this patent, No. 223,659, that Thomson and Houston discovered their failure to cover the device broadly for automatic current regulation. A second application upon substantially the same apparatus was therefore filed, and this patent, called generally the "second patent," had broad claims upon automatic brush-shifting current regulation. It was this second patent, No. 238,315, upon which suit was brought against the Citizens' Electric Light Company of Boston, users of Wood arc-lighting apparatus. A decision was secured in this suit in August, 1888, sustaining the validity of patent 238,315, and finding the defendants, users of the Wood regulator, to be infringers. Suit was subsequently begun against the Western Electric Company in the United States Circuit Court for the Northern District of Illinois, and after years had been spent in collecting evidence, the case came to hearing in June, 1894, before Judge Grosscup, who rendered an opinion adverse to the patent early in the present year. From this decision of Judge Grosscup the Thomson-Houston Electric Company appealed to the Circuit Court of Appeals. The case was elaborately argued in June of the present year. and the Circuit Court of Appeals has just handed down its opinion, affirming the decision of Judge Grosscup. The statement of facts occupies some forty large pages of the opinion of the Court of Appeals and comprises voluminous extracts from the testimony of Mr. Charles E. Scribner, the main witness for the Western Electric Company and one whom the Court of Appeals describes as an expert of conceded intelligence, skill and accuracy.

In addition to the defence which was most strongly urged, namely, that of the first Thomson-Houston patent, No. 223,659, which showed substantially the same device as that of the later patent, No. 238,315, upon which suit was brought, the invention of Maxim of an automatic current regulator for dynamo-electric machines which was applied to separately excited dynamos running incandescent lamps in multiple arc, was urged as an anticipation of the patent in suit, and it will be observed from the opinion of the court that this defence also was considered to be adequate to defeat the broad claim of Thomson and Houston for automatic brush-shifting current-regulation.

The Western Electric Company, who defended this case at the expenditure of much time and money, is to be commended for its pluck and intelligence. At the beginning of this litigation, after the decision by Judge Colt sustaining the patent, the outlook for a successful defence was fuliginous in the extreme. The competitors of the Thomson-Houston Electric Company, some of whom were courageous in undertaking patent litigation, almost unanimously preferred to surrender and sell out to the Thomson-Houston Electric Company, or to go out of the electric lighting business, rather than undertake the defence of this suit. The Western Electric Company in conducting this defence, therefore, had to contend not only with the prior decision in favor of the patent, but also with the almost universal acquiescence of the public in the claims of this patent, which claims have now been authoritatively found to be, as the Western Electric Company all along was convinced, unjust and inequitable.

American Institute of Electrical Engineers.

The 100th meeting of the Institute will be held on Wednesday, October 23, 8 P. M., at 12 West 31st street, New York City, having been postponed from October 16 by direction of the president.

A paper will be presented by Mr. Hermann Lemp, Jr., of Lynn, Mass., on the "Local Annealing of Hard Faced Armor Plates."

A paper will also be presented by Professor W. M. Stine, of Chicago, on "The Rating and Behavior of Fuse Wires."

A meeting of Western members will be held the same evening, Wednesday, October 23, 8 P. M., in the rooms of the Western Society of Engineers, 1737 Monadnock Building, Chicago.

Applications have been received from the following candidates for associate membership and will be acted upon by council at its meeting November 20, 1895: Ellicott Maccoun, Munhall, Pa.; Alfred K. Warren, New York City; Paul G. Burton, New York City; Eugene Friedlaender, Duquesne, Pa.; Chas. L. Brown, Chicago, Ill.; Erich Rathenau; Berlin, Germany; Eskill Berg, Schenectady, N. Y.; Henry Storrs Webb, South Bethlehem, Pa.; Clarence P. Gott, New York City; Fred'k Wm. Phisterer, Ithaca, N. Y.; Nevil Monroe Hopkins, Washington, D. C.; Wm. D. Ball, Chicago, Ill.; Clinton C. Burr, Pittsburg, Pa.

Should a member object to the election of any of the above candidates, he should notify the secretary to that effect prior to November 20.

The council will hold its regular monthly meeting in the rooms of the Institute, 26 Cortlandt street, Wednesday, October 23, 4 P. M.

The Welsbach Burner.

Some months ago ELECTRICITY took up the question of the Welsbach burners as competitors with electricity, and showed that for most purposes the much-vaunted burners had defects that would, in the long run, cause them to be laid aside. One of the most striking instances of this was shown in the case of the public schools at Vienna, where at first they were received with delight, but after trial were ordered out. That seems to be the general experience, and we notice place after place in San Francisco where one month you will see the sickly green rays of the Welsbach and a few months later they are gone. The *Electrical Engineer* in a recent number appears however to be somewhat muddled over the subject. It prints a lot of one-sided statements from *Progressive Age*, a gas organ, in which great claims are made for the Welsbach especially for use in stores. The *Engineer* then says: "What have electric light men to say to this? Our own comment on the situation appears on page 257."

All the *Engineer* says on page 257 is to the effect that the Welsbach burners will probably not prove suitable for *street lighting*. We would advise the *Engineer* either to investigate the matter a little, or to read up the back files of its contemporary, ELECTRICITY, before it throws up its hands in this style. —*Pacific Electrician*.

A NEW BATTERY ELEMENT.*

NOTE BY M. MORISOT, PRESENTED BY M. LIPPMAN.

I have the honor to introduce to the notice of the Academy a new battery element, which seems to me an important one on account of its electromotive force, which is greater than that of the usual couples, and also its current, which is practically constant.

This element is composed in the following manner:

1. The positive pole is a plate of retort carbon, immersed in the outer vessel in the depolarizing liquid. This is composed of one part of sulphuric acid, mixed with three parts of water, previously saturated when cold with bichromate of potash. Some crystals of this salt are held suspended in the upper part of the liquid in a short funnel.
2. A porous cell, immersed in the depolarized liquid, contains a weak solution of caustic soda (density = about 1.05).
3. The plate of amalgamated zinc, which is the negative pole, is immersed, within a second porous cell placed inside the first one in a concentrated solution of caustic soda (density = about 1.25). This latter solution, suggested by M. Reynier in 1880, for the Daniell battery, raises the electromotive force of the same from 1.1 volts to about 1.6 volts.

The electromotive force of this element is 2.5 volts at the beginning; it afterwards keeps above 2.4 volts during at least 10 hours of uninterrupted action.

The internal resistance is about .8 ohm; it varies, moreover, with the thickness and the structure of the porous cells.

In the experiments that I made, the quantities employed were:

For the depolarizing liquid, 600 cubic centimeters.

For the diluted solution of soda, 130 cubic centimeters.

For the concentrated solution, 110 cubic centimeters.

Under these conditions the current was maintained very near the following values:

For a resistance of 5 ohms interposed .423 ampere.
" " 10 " " .22 "

It therefore remained practically constant in both cases, notwithstanding the difference in the output. If the circuit is closed immediately after the setting up of the element, the resistance is at first greater, and consequently the current is less. The regular rate of working is established nearly an hour later, when the porous pots are sufficiently soaked. We obtain the definite rate of working at once if we do not close the circuit until after the soaking is complete.

It is the substitution of the alkaline solution for the acidulated water containing the zinc in the Poggendorff battery that raises the electromotive force from 2.1 to 2.5 volts. In fact the same substitution made in the Bunsen battery gives 2.25 volts instead of 1.85 volts, *i.e.*, the same increase, viz., .4 of a volt.

But if we confine ourselves to this change only, the advantage soon becomes deceptive, on account of the rapid increase of the resistance. The soda changes into neutral chromate, and we find on the zinc and round it an abundant deposit of hydrate of oxide of zinc. These actions, due to the modification of the liquids by one another through the pores of the porous pot, are considerably reduced, and their effect weakened by the interposition of the alkaline liquid contained between the two porous cells. This addition does not greatly increase the resistance, and it has the advantage of ensuring an almost absolute constancy, especially if we partly renew the weak solution of soda from time to time. This renewal is, moreover, necessary, as the level is soon seen to fall between the two porous cells. A good result is obtained by drawing off through a tube, about every three hours, a little of this intervening liquid which has become colored, and restoring the level by means of fresh weak soda; I used 40 cubic centimeters for each renewal.

The employment of potash instead of soda offers no advantage, any more than the employment of bichromate of soda instead of bichromate of potash in the depolarizing liquid.

I found that the zinc is much less attacked than in the Poggendorff element, and all those in which the metal is immersed in acidulated water. In this case the consumption of zinc is partly replaced by the consumption of soda. If there was an equal consumption of zinc, we should have an electromotive force of 3.1 volts; in fact, a normal couple, the zinc of which is replaced by a carbon, and in which the liquids act alone, gives 1 volt at the commencement.

After 10 hours of continuous action, we find the zinc covered with a gray crust. We can restore its polish and its original qualities by withdrawing it from the battery and immersing it, for a few moments only, in some acidulated water, which quickly dissolves this crust. The reconstituted element, even if the liquids are not changed or partially renewed' then resumes its action almost as at the commencement. We see that in this way the liquids could be used again for some time.

Lastly, I noticed that if the battery is to work for two or three hours only, for demonstration experiments, for instance, we can dispense with the amalgamation of the zinc.

PROF. PUPIN'S ASSOCIATION PAPERS.

The Most General Relation Between Electric and Magnetic Force and Their Respective Displacements.*

The author states the fundamental relations and hypotheses of Maxwell's Electromagnetic Theory. He points out the failure of the theory to explain dispersion and absorption of light and the rotation of the plane of polarization. He next points out that in all successful attempts so far to bring these phenomena within the scope of the electromagnetic theory, Maxwell's fundamental relation between electric and magnetic force and their respective displacements is abandoned, and in its place hypothetical relations are assumed, which are justified by the circumstance only that they lead to results which are in agreement with experiments. The author shows then that the relation between the electric and the magnetic force and their respective displacements, which Maxwell employed in his theory, is not the only permissible one.

In fact, the relation employed by Maxwell is a *statical* one, and is, therefore, a limited case of a more general one which may be called the kinetic relation, which the author obtains by considering the electromagnetic field in which the forces are varying in any continuous manner whatever.

This kinetic relation may be expressed as follows:

$$\int d\tau \int_0^t \left[\left(X\frac{df}{dt} - f\frac{dX}{dt}\right) + \left(Y\frac{dg}{dt} - g\frac{dY}{dt}\right) - \left(Z\frac{dh}{dt} - h\frac{dZ}{dt}\right)\right] dt \geqq 0.$$

In this formula X, Y, Z are components of the electric or of magnetic force at any point.

f, g, h are the components of the electric or of magnetic displacement at any point.

$d\tau$ is an infinitely small element of volume of the field.

dt is an infinitely small element of time.

The integration should extend over the whole electromagnetic field and from the moment of starting the field up to the time t when the field becomes constant.

The author shows that this kinetic relation contains Maxwell's relation as a special case and that it also contains those relations between the electric and the magnetic force and their respective displacements which were hypothetically assumed in all successful attempts to explain, by the electromagnetic theory the phenomena of dispersion and absorption of light, and the rotation of the plane of polarization.

Flow of Alternating Current in an Electrical Cable.*

The author discusses the problem in its most general aspect, showing how transmitting or receiving apparatus at any point of the cable should be taken account of by the theory. The application of Lagrange's generalized equations of motion to this problem is pointed out.

The theory of transmission of telephonic currents over long lines is then discussed as a special case, and it is shown that the initial value of the current at the sending end depends on the electromagnetic constants of the transmitter and is practically independent of the electromagnetic constants of the line. The wave length and the attenuation of the waves, on the other hand, depend entirely on the electromagnetic constants of the line.

Experiments with an artificial cable are then described and the experimental results compared with the theory showing the agreement between the two.

Several conclusions bearing on long-distance transmission of power, long-distance telephony and submarine telegraphy; the bearing of magnetic hysteresis on the attenuation of waves along cables containing iron wire is finally considered in the discussion of artificially loaded cables.

Married.

Mr. C. F. Scott, of the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., was married on Tuesday, 15th inst., to Miss Clarke, of Columbus, O. ELECTRICITY extends hearty congratulations to Mr. and Mrs. Scott, and wishes them a happy and prosperous career.

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* *L'Industrie Electrique.*

*Abstracts of papers read by M. I. Pupin, Adjunct Professor in Mechanics, Columbia College, New York, at the meeting of the American Association for the Advancement of Science, Springfield, Mass.

GENERAL NEWS.

What is Going on in the Electrical World.

Springfield, O.—The city clerk has been instructed to advertise for bids for 150 arc lights of 2,000 C. P. each, for city lighting.

Titusville, Pa.—Leading citizens of this city have petitioned the councils urging the building of an electric street railway.

Grand Rapids, Mich.—A movement has been started here for an electric line to connect this city with Rockford. It is regarded as a feasible scheme.

Fergus Falls, Minn.—Burns & Howard, of Minneapolis, have been awarded the contract for the new municipal electric light plant; price, $12,900.

San Francisco, Cal.—The Sutro Electric Railway, which is the third line running to the ocean beach, is completed and cars will begin running at once.

Kalamazoo, Mich.—H. C. Hoagland, of Elmira, N.Y., has been appointed superintendent of the municipal lighting plant and much is hoped from his management.

Morgantown, N. C.—The plant and franchises of the Morgantown Electric Light and Power Company have been sold to Geo. O. Baker and W. G. Baker of New York.

Pittston, Pa.—The charter of the Pittston, Jenkins and Avoca Street Railway Company has been filed and it is proposed to construct an electric road from Moosic to Pittston.

Riverside, Ill.—The trustees of this village have granted a franchise to the Suburban Electric Railway Company, of which D. B. Lyman, of La Grange, is president.

South Orange, N. J.—The South Orange and Maplewood electric railway is completed and in operation. On the trial trip a speed of thirty-nine miles an hour was attained.

Waverly, Ia.—J. N. Bowman, president of the First National Bank, is interested in the company to be incorporated to construct an electric road between Cedar Falls and Waverly.

Hempstead, N. Y.—The Hempstead Gas Light Company has been awarded the contract for lighting the village with seventy 800 C. P. arc lights, the contract to begin January 1 next.

New Haven, Conn.—Vice-president Hall of the Consolidated road has stated that the Stamford and New Canaan branch, about eight miles in length, will be equipped with electricity.

Bath, N. Y.—There is talk of an electric road from this village to connect with the Troy and Sand Lake road at Wynantskill. A direct route would make the distance less than five miles.

Madison, Ind.—The council has passed a resolution instructing the committee on light to advertise for lighting the city with electricity for a term of fifteen years at a specified price per lamp per year.

New Philadelphia, Ohio.—The commissioners of Tuscarawas County have advertised for proposals for the franchise for the construction of an electric railway between New Philadelphia and the twin cities.

North Tonawanda, N. Y.—Frank W. Hawley is here frequently nowadays looking over the work of constructing the lines for the canal trolley test, which he asserts will take place within the next two weeks.

Oswego, N. Y.—The directors and stockholders of the Oswego Street Railway have decided to increase their capital stock from $75,000 to $200,000. The object of the increase is to enable the road to issue $75,000 more bonds.

West Chester, Pa.—A meeting of the capitalists interested in the construction of an electric railway from West Chester to Quarryville, Lancaster County, will shortly be held and the company will be formally organized.

Meadville, Pa.—The electric street railway bill, making the franchise good for thirty-five years and requiring three per cent of gross receipts after ten years, has passed the councils. Two companies are after the franchise.

Norwalk, O.—H. K. Beck of Norwalk and J. W. Stoakes of Milan have been elected directors of the Sandusky, Milan and Norwalk Railway to fill the vacancies caused by the resignations of W. H. Price and C. H. Stewart.

Amsterdam, N. Y.—It is understood that the Amsterdam electric street railroad has been sold to the Amsterdam, Johnstown and Gloversville Railroad Company, but the purchasers will not take possession of the plant until spring.

Knoxville, Tenn.—Chairman Reps Jones of the board of public works has signed the contract with the Knoxville Electric Light Company for lighting the city. The company will put in $30,000 worth of improvements and begin work at once.

Homestead, Pa.—The Carnegie Steel Company has bought the electric light plant on Ninth avenue. The plant was owned by the Edison General Electric Company. The Carnegie company will operate it and furnish light to the borough.

Richfield Springs, N. Y.—At the recent corporation election held here, the candidates favoring the introduction of an electric railway were elected by an overwhelming majority. The old officials were opposed to the admission of an electric road into the town.

Summit, N. J.—The newly elected officers of the Mountain Electric Light Company are: President, John N. May; treasurer, William Halls, Jr.; secretary and general manager, C. P. Bassett; executive committee: Norman Schultz, John May and C. P. Bassett.

Hackensack, N. J.—The commissioners have been authorized by the council to advertise for bids for lighting the town with electricity or gas for terms of one and three years, the electric light bids to be for incandescent and arc lights. The present contract expires in November.

Weldon, N. C.—The citizens of Ringwood are making an effort to build a trolley line from that point to Littleton, via Brinkleyville, Medoc and Panacea Springs. The road would pass right through the tobacco belt, and the hauling of tobacco, cotton and wine from Medoc would give it a big business.

New Berlin, Conn.—The power house of the Electric Light Company was totally destroyed by fire on the 8th inst. The loss was estimated at about $15,000, as none of the dynamos or other machinery could be saved. The plant was a comparatively new one, having been in operation but two or three years.

Painesville, O.—The commissioners have granted a franchise to the Cleveland, Painesville & Eastern Street Railroad Company over county highways from the west line of Lake county to the west line of Painesville village. The road must be completed and operated by electricity within one year.

Little Falls, N. Y.—The council has granted a franchise to the Little Falls Electric Street Railroad Company to run an electric railroad through the principal streets of this city. President Tyler of the company intends to apply for a franchise to enter Richfield Springs, and if it is granted will extend the road to that village.

Corry, Pa.—The Corry Electric Street Railway has been organized with the following officers: President, R. N. Seaver; secretary, C. P. Rogers, Jr.; treasurer, D. L. Bracken; directors, R. N. Seaver, R. P. Dawson, D. L. Bracken, T. A. Edwards, H. L. Gordon, Frank Laurie and F. A. Beebe. The company is capitalized at $18,000.

Allegan, Mich.—F. A. Makin, the promoter and general manager of the Saugatuck, Holland and Southeastern Electric Railway, says the line will surely be built. The contract for the rails has already been let to the Illinois Steel Company of Chicago. E. J. Harrington is president of the road, but the capitalists who are to put their money into the scheme are not known.

Edgartown, Mass.—A committee of citizens has issued a circular stating that for an outlay of $45,000 the electric street railway can be extended from Cottage City to Edgartown. Stock subscriptions from permanent and summer residents to assist in securing the proposed extension are solicited. The committee consists of Edward W. Chadwick, Joseph W. Donaldson and Charles W. Marchant.

Easton, Pa.—The Easton Power Company has been granted a franchise by the South Easton council to establish an electric lighting plant in that town. It is the intention of the company to erect works for the manufacture of dynamos, motors, rheostats and all other kinds of electrical instruments. They propose to furnish light for the borough, stores, private residences, etc., in connection with the manufacturing plant. The company's superintendents are Lewis F. Johnson and Walter Slacke.

Paterson, N. J.—The stockholders of the New Jersey Electric Railway have elected the following directors: Thomas D. Jordan, James A. Morrisse, Francis C. Van Dyk, Charles Currie, John L. Heins, William H. McIntyre and George V. Turner. John L. Heins, who is also superintendent of the Brooklyn City and Newtown Railroad Company, has been elected president. Mr. Heins is regarded as one of the most capable railroad men in Brooklyn.

Hagerstown, Md.—The city council has granted a franchise to the Hagerstown and Potomac Electric Railway Company to build a street railway in Hagerstown and extensions to Williamsport, Funkstown, and Leitersburg, Md., and Waynesboro and Pen-Mar, Pa. The road will be built by Pennsylvania capitalists. John W. Bears, Harrisburg; Judge William Grier, New Bloomfield, and Frederick L. Snyder, Altoona, will be three of the seven incorporators.

Middletown, Conn.—The Schuyler Electric Factory was sold by public auction on the 15th inst. to the General Electric Company for $73,000, and all patents and patents applied for belonging to the Schuyler Company were sold to the General Electric for $40,000. They also bought the balance of the machinery not included in the first two lots for $8,250. President Boyd says he will try to lease the Schuyler plant from the General Electric Company.

Sioux City, Iowa.—The arrangements for the consolidation of the Sioux City Cable Railroad, the Sioux City and Leeds Electric Railway, the Sioux City Elevated Railway and the City and Suburban Railway companies and their sale to a New York syndicate have been completed. The roads will be merged into one system and connected with the South Sioux City Electric Railway, which will cross the new Pacific Short Line bridge and extend several miles into Nebraska.

East Pittsburg, Pa.—The Westinghouse Electric and Manufacturing Company have begun the erection of a foundry and machine shop as additions to their already immense plant here. The new departments, which will employ 300 additional workmen, are to be completed by January.—The entire board of directors of the Pennsylvania Railroad Company made a careful inspection of the Westinghouse Electric and Manufacturing Company's works and railway apparatus at East Pittsburg last week.

Langhorne, Pa.—A new company, to be known as the Langhorne, Bristol and Newtown Trolley Company, has recently been formed here and has obtained its charter. Work on the road will begin at once on that portion lying within this town and in the spring the line will be continued to Bristol. At the latter place the line will connect with the proposed Philadelphia and New York trolley line. In time the route will no doubt be extended in the other direction as far as Doylestown.

Boston, Mass.—The "Herald" says: "There is every prospect of great additions to the mileage of electric street railways around Salem and vicinity. The Lynn and Boston Company has fully determined to equip and run the Old Salem and Danvers road with electricity, and also to extend its electric power from Gloucester crossing in Beverly to Wenham. It is thought that this latter work will be begun at once and prosecuted so that electrics will be running this winter. This is believed to mean the extension from Wenham-Hamilton to Ipswich in the spring."

Philadelphia.—President J. Lowber Welsh has announced the names of the executive committee which is practically to have managerial control of the 400 miles or more comprising the consolidated street railway system in this city. The committee are George D. Widener and Thomas Dolan, of the Philadelphia Traction Company; J. J. Sullivan and Alfred Smith, of the Electric Traction, and Caleb F. Fox and W. H. Shelmerdine, of the People's Traction. President Welsh, as ex-officio member, will be the chairman of the committee. The latter will direct all the working movements of the system, will revise the service, suggesting improvements and economies.

St. Louis.—J. D. Houseman, the projector of the Houseman Air Line, otherwise known as the Baumhoff electric line, to Meramac Highlands, now announces that he will build another and longer road in St. Louis County. This will be a branch of the air line and will start from the power house at Brentwood. It will go westward over a private right of way between the Manchester and Clayton roads, past Mentor, Rock Hill, Des Peres, Manchester, Baldwin, Ellesville, Melrose and other important points to Pacific, Mo., a distance of nearly 40 miles. Mr. Houseman has decided to generate the necessary electricity from a water supply on the banks of the Meramac, just west of Pacific.

Kansas City, Kan.—The Argentine Water and Electric Light Works have been sold here under a decree of the United States Circuit Court, to satisfy a judgment in favor of the Farmers' Loan and Trust Company of New York. The property was bid in for the bondholders' committee, composed of Theodore C. Woodbury of Portland, Me., Julius Hammerslaugh of New York city, and Robert McLay, president of the Knickerbocker Trust Company of New York. The price paid was $40,000; the judgment was for $150,000 and interest. The operation of the works will continue under the direction of the reorganization committee.

Hartford, Conn.—President Clark of the New York, New Haven & Hartford Railroad, in his annual report, referring to the change from steam to electricity on the Nantasket Beach Railroad, says: "The experiment has demonstrated that power generated in a stationary plant and transmitted by electrical agency can be successfully used in the operation of a standard railroad. The current expenses for fuel indicate that this result is economically obtained. Power thus transmitted is capable of indefinite subdivision, and is therefore most available for frequent car service. The commercial result depends only on the durability of electrical equipment. It is probable that electricity will be promptly adopted by the company at other points."

Baltimore, Md.—It is stated that a franchise will be soon applied for to build an electric street railway over a number of streets which were included in the "Ram's Horn" franchise. The Central Railway Company, of which George Blakistone is president, is alleged to be an applicant for the franchise.—Mr. Clemens Hershel is examining the plans of the Susquehanna River Electric Company for the hydraulic work of the proposed generating plant at Conowingo on the Susquehanna River, and will pass upon them as soon as possible. It is fully expected that the construction of the plant will be commenced before the close of the present year. About 40,000 horse-power is the amount of power attainable, and it is proposed to transmit this by means of electricity to Baltimore and other places.

Asbury Park, N. J.—The Atlantic Coast Electric Railway Company has arranged to lease the Asbury Park and Belmar Street Railway Company. The former corporation owns the extensive Asbury Park system and also the new line from this place to Pleasure Bay. The Belmar road runs as far south as Shark River, and will soon be extended through Belmar, Como, North Spring Lake, Spring Lake, Sea Girt and Manasquan, where it will meet the electric road at Point Pleasant. The Atlantic Coast Company is controlled by the Metropolitan Traction Company of New York City, and expects to soon extend its lines from the seashore to Trenton. The trolley roads between Eatontown and Red Bank and Red Bank and Atlantic Highlands will soon be completed, when the entire shore from New York Bay to Barnegat Bay will be skirted by an electric road.

Columbus, O.—Another electric light company has been granted a franchise to establish a plant in this city, but the franchise must be ratified by a vote of the citizens.—A resolution has been adopted by the council to advertise for bids for lighting the streets of the city.—Attorney General Richards, in answering the question of the State Commissioner of Railroads and Telegraphs as to whether electric or trolley railroads operating outside of cities and towns and carrying freight as well as passengers are subject to the laws governing railroads generally and come under the commissioner's authority, says: "In my opinion you have authority to inspect the railroads you describe, notwithstanding the fact they are operated by electricity. Such railways cannot properly be classed as street railways, but, transporting passengers, freight and express between different parts of the State, they are railroads or railways within the proper acceptation of the term, although operated by electricity."

Pittsburg, Pa.—The stockholders of the Citizens' Traction Company have voted to lease the lines of the company to the Fort Pitt Traction Company for 950 years beginning November 1 next. The lease covers all the property and franchises of the Citizens' Passenger Railway Company, a part of the line of the Transverse Passenger Railway Company, the line of the Penn Street Railway Company, the line of the Aspinwall Street Railway Company and the charter of the Highlands and Butler Street Railway Company, no part of which is built. The Fort Pitt Company assumes the obligations of the Citizens' Company and pays an annual rental of $180,000. It is agreed that the Fort Pitt shall, prior to November 1, 1897, reconstruct so much of the Citizens' lines as is now operated by cable, and equip it with the most improved electric system. This applies also to the lines to be built.

Salt Lake City, Utah.—James A. Kelman, secretary of the Salt Lake and Ogden Gas and Electric Light Company, told a reporter of the "Tribune" a few days ago that his company was controlled by a wealthy London syndicate whose intention it was to make the Salt Lake plant the foremost in America. "By our co-operation with the Big Cottonwood Power Company," he said, "we have made it a certainty that cheap electrical current will be delivered into this city, and we have commenced to remodel our system of wires in the commercial district of the city in order to be ready to connect with the Big Cottonwood when it gets here. We will put in new dynamos here within a few weeks, and with our new system we will be able to run arc and incandescent lights and motors from the same wire. We will introduce the newest incandescent lamps, and these will be furnished free of cost to the present patrons of he company." The Citizens' Electric Company has ust entered the field as a competitor of Mr. Kelman's ompany.

Cleveland, O.—The county commissioners have granted he Wadsworth Electric Railway Company a franchise to onstruct and operate an electric railway from Brooklyn o the south line of Cuyahoga county. Under the terms f agreement the road will be completed within a year. The road, when completed, will extend from Brooklyn o Medina, the county seat of Medina county, and hence to Wooster, in Wayne county. The road has permission to transport light freight and United States mail. The franchise is for twenty-five years. James L. Mauldin and George D. Hile are the promoters of the enterprise.—C. Crosby Thompson, manager of the Cuyahoga Suburban Electric Railroad Company, says that it s the intention to have the new line to Chagrin Falls in operation before winter weather sets in. The company does not intend to stop at Chagrin Falls, but some time within the next year or two may extend its lines to Buron, Mesopotamia and other places which are greatly in need of good transportation facilities. The company's State charter allows mail and express matter, baggage nd farm produce in boxes and barrels to be carried.

PERSONAL.

Mr. E. E. Cary has resigned his position as superintendent of the Beacon Lamp Company, Boston.

Convention of Electrical Workers.

The next Convention of the National Brotherhood of Electrical Workers will be held in Washington, D. C., from November 11 to 17. The programme will include visits to the White House, the Capitol, Congressional Library and other places of interest in the city. One night will be devoted to an electric street parade of which a complete electric plant, including engine and dynamo, will form an interesting part. The session will be concluded by a banquet to be given by the members of Local Union No. 26, of Washington City, to the visiting members.

Engraved "Sunbeam" Lamps.

A novel feature in incandescent lamp manufacturing has been introduced by the Sunbeam Incandescent Lamp Company, of Chicago, who have recently perfected a process for engraving lamps and can now furnish lamps with any special design that is desired, such as a wreath of flowers, likenesses of individuals or cuts of buildings. This company has already fitted up several stores in Chicago with these ornamental lamps, which are being received with great favor.

James G. Biddle, Drexel Building, Philadelphia, sales agent of the Weston Electrical Instrument Company, has issued an elaborate catalogue and price list of the products of this well known firm. The book comprises thirty-two pages profusely illustrated and contains much information for those unskilled in the use of measuring instruments.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

OCTOBER, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	1.40 A. M.	1	5.10 A. M.
2	2.40 "	2	5.10 "
3	No light.	3	No light.
4	"	4	"
5	"	5	"
6	6.00 P. M.	6	7.30 P. M.
7	6.00 "	7	8.10 "
8	6.00 "	8	8.50 "
9	6.00 "	9	9.50 "
	6.00 "	10	10.50 "
	6.00 "	11	12.00 M.
12	6.00 "	13	1.00 A. M.
13	6.00 "	14	1.10 "
14	5.50 "	15	2.30 "
15	5.50 "	16	3.50 "
16	5.50 "	17	5.30 "
17	5.50 "	18	5.30 "
18	5.50 "	19	5.30 "
19	5.50 "	20	5.30 "
20	5.50 "	21	5.30 "
21	5.50 "	22	5.30 "
22	7.00 "	23	5.30 "
23	8.00 "	24	5.30 "
24	9.20 "	25	5.30 "
25	10.20 "	26	5.30 "
26	11.00 "	27	5.30 "
27	11.30 "	28	5.30 "
28	...... "	..	....
29	12.30 A. M.	29	5.30 "
30	1.30 "	30	5.30 "
31	2.30 "	31	5.30 "

INCORPORATIONS.

The Eastport Lighting Company, Eastport, Maine—to make and distribute gas and electricity for light, heat and power and mechanical purposes. Capital stock, $50,000. Promoters: W. A. Carey, Malden, Mass.; Walter Campbell, Henry H. Wardsworth, Eastport.

The Lafayette Machine Electric Light and Power Company, Lafayette, Col.—to furnish electricity for light and power both for mining and manufacturing. Capital stock, $100,000. Incorporators: J. S. Spencer, F. D. Taggart and J. H. Mayham. The company has been lighting Lafayette for about a year and now proposes to extend its operations.

The capital stock of the Laporte Electric Company, Laporte, Ind., has been increased from $25,000 to $40,000.

The Waterloo and Cedar Falls Rapid Transit Company, Waterloo, Iowa—to construct and operate electric street car lines in Waterloo and Cedar Falls, and between the two cities. Capital stock, $600,000. Incorporators: C. J. Fosselman and J.H. Bowman, of Waverly; L. S. Case, of Sumner, and J. H. Rafferty, of Waterloo.

The Lafayette Engineering and Electric Works, Lafayette, Ind.—to manufacture and sell electrical and steam machinery, engage in manufacture and sale of articles of all kinds manufactured from wood and metal. Capital stock, $60,000. Promoters: Chas. B. Robertson, Henry T. Meigs, John G. Flathers, Edgar V. Burt, Samuel Moore, Lafayette, Ind.

The Block Plant Electric Light Company, Boston, Mass.—to install, operate and maintain electric light plants. Capital stock, $15,000. Promoters: Thomas C. Fitzgerald, Henry Krey, David S. Boyder.

The Joliet Light, Heat and Power Company, Joliet, Ill.—to construct, maintain and operate gas and electric heat, light and power plants. Capital stock, $100,000. Promoters: J. E. Sutherland, L. J. Highland, John S. Ward.

The Automatic Battery Company, Louisville, Ky.—to manufacture, purchase and sell electrical batteries and other medical appliances and remedies. Capital stock, $5,000. Promoters: W. Neb. Webb, John Tierney, Warfield Webb, Louisville, Ky.

The Merchants' Electric Light Association, Lafayette, Ind.—to manufacture, supply and sell electric lights in Lafayette, Ind. Capital stock, $3,000. Promoters: P. A. Byers, F. B. Sheppard, Henry Rosenthal, C. H. Ankeny, Chas. E. Rugers' Sons Co., The Hogan-Johnson Co., Arthur A. Jeffries & Co.

The Garrett Water Company, Garrett, Ind.—to furnish Garrett with wholesome water and electric light for public use, etc. Capital stock, $20,000. Promoters: S. L. Fryer, J. A. Clevenger, Wilbert H. Hershberger.

The Suburban Electric Light and Power Company, East Orange, N. J.—to produce and furnish electric light and power, etc. Capital stock, $200,000. Promoters: Wm. H. Allen, S. Walton Freeman, Jerome D. Gedney, East Orange, N. J.

The Medway Electric Light and Power Company, Medway, Mass.—to manufacture and sell electricity for light, heat and power. Capital stock, $10,000. Promoters: E. Cutler Wilson, Henry E. Bullard, Clarke P. Harding, John D. Shippee, Daniel S. Woodman.

The Dayton, Springfield and Urbana Electric Railway Company, Springfield, Ohio—to construct and operate an electric railway from Dayton through Springfield to Urbana; manufacture and sell electricity for light, heat and power, etc. Capital stock, $10,000. Promoters: Fred. Colburn, John C. Webb, J. S. Harshman, Wm. H. Hanford, H. T. Mathers.

The Enclosed Carbon Lamp Company, Ironton, Ohio—to manufacture, buy and sell all kinds of electrical machinery, appliances and supplies. Capital stock, $50,000. Promoters: J. R. Cook, E. W. Bixby, C. H. Moore, J. W. Slater, Lester Keller.

The Owosso & Corunna Electric Street Railway Company, Owosso, Mich.—to construct, own and maintain a street railway, etc. Capital stock, $50,000. Promoters: James H. Edmunds, Cape May, N. J.; Irene D. K. Ralph, Lancaster, Pa.; Willis R. Armstrong, Philadelphia, Pa.

The Martin Underground Trolley Company (incorporated in W. Va.), Chicago, Ill.—to construct, own and operate the Martin underground trolley system, etc. Capital stock, $5,000,000. Promoters: James McDavitt, Gustav Schultz, Edw. O'Donnell, Samuel P. Marsha, Chicago, Ill.

The Mahanoy Valley Street Railway Company, which will operate a line between Ashland and Gordon, Schuylkill county, Pa., has been chartered. Capital stock, $1[illegible]

The Lexington Electric Company, Kansas City, Mo. Capital stock, $80,000. Incorporators: E. R. Kimball, E. G. Taylor, C. A. Burton, E. O. Marquis and D. M. Wolfe.

The Hagerstown & Potomac Electric Railway Company Hagerstown, Md. Capital stock, $200,000. Incorporators: Dr. E. A. Wareham, Samuel H. Long, Edward Hoffman Wyatt M. Keedy, Hagerstown; William Grier, John W. Beers and Frederick L. Snyder, of Pennsylvania.

The Holton Electric Company, Holton, Kan.—to deal in electrical supplies. Capital stock, $10,000. Incorporators: Clarence A. Ross and W. H. Blood, Jr., of Kansas City; L. P. Bonebrake, of Holton.

The Marietta Terminal Railway Company, Marietta, O. Capital stock, $125,000. Incorporators: Reuben L. Nye, Theodore B. Dale, Henry C. Vincent, Wm. H. Morse and Ossner R. Vincent.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCTOBER 15, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

547,783. Conduit System for Electric Railways. John Hartman, Philadelphia, Pa. Filed April 7, 1893.

547,784. Supply System for Electric Railways. John Hartman, Philadelphia, Pa. Filed Aug. 7, 1893.

547,847. Combined Electrical and Mechanical Brake. James R. Cravath, Chicago, Ill. Filed Aug. 10, 1895.

547,873. Switch or Cross-Over System for Electric Railways. Henry M. Brinkerhoff, Chicago, Ill., assignor to Carter H. Fitzhugh, same place. Filed June 13, 1895.

547,914. Series Electric Railway. Oliver B. Finn, Philadelphia, Pa. Filed March 29, 1894.

547,931. Insulator for Trolley-Wire Supports. John W. Meaker, Evanston, Ill. Filed Nov. 19, 1894.

548,011. Trolley-Wheel. Henry Schmidt, Moline, Ill. Filed Jan. 5, 1895.

548,032. Supply System for Electric Railways. Henry V. Brown, Brooklyn, N. Y. Filed Nov. 21, 1894.

548,070. Electric Railway System. John La Burt, Brooklyn, assignor, by mesne assignments, to the La Burt Electric Railway Company, New York, N. Y. Filed June 26, 1894.

548,074. Trolley Rope and Pole Controller. Charles A. Lord, San Francisco, Cal., assignor of one-half to T. A. Kirkpatrick, same place. Filed Jan. 9, 1893. Renewed Aug. 9, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

547,835. Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed Jan. 16, 1895.

548,028. Electric-Arc Lamp. Charles Beseler, Jersey City, N. J. Filed May 4, 1895.

548,036. Incandescent Electric Lamp. Samuel E. Cox, Cleveland, Ohio, assignor to the Adams-Bagnall Electric Company, same place. Filed July 18, 1895.

548,126. Electrical Illumination. Daniel McF. Moore, New York, N. Y. Filed Oct. 13, 1894.

548,127. Electric-Lighting System. Daniel McF. Moore, East Orange, N. J. Filed July 19, 1895.

548,128. Electric-Lighting System. Daniel McF. Moore, New York, N. Y. Filed April 10, 1895.

548,129. Method of Electric Illumination. Daniel McF. Moore, New York, N. Y. Filed Dec. 4, 1894.

548,130. Regulation of Electrical Phosphorescent Illumination by Magnetic Induction. Daniel McF. Moore, New York, N. Y. Filed Jan. 3, 1895.

548,131. Apparatus for Generating Phosphorescent Electric Light. Daniel McF. Moore, New York, N. Y. Filed Jan. 7, 1895.

548,132. Phosphorescent Electrical Illumination by Oscillation. Daniel McF. Moore, New York, N. Y. Filed Jan. 9, 1895.

548,133. Phosphorescent Electric Illumination by Intermittent and Permanent Interruption in Vacuum. Daniel McF. Moore, New York, N. Y. Filed Jan. 24, 1895.

548,134. Electrical Illumination by Phosphorescent Flame. Daniel McF. Moore, New York, N. Y. Filed Jan. 25, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

547,834. Electrical Transmission of Power. William D. Baldwin, Yonkers, N. Y. Filed July 3, 1894.

547,930. Coupling for Electromotors. Franz Marburg, Jr., Buffalo, N. Y. Filed May 14, 1895.

548,038. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed Jan. 31, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

547,960. Telephone System and Cable. Joseph W. Marsh, Pittsburg, Pa., assignor to the Standard Underground Cable Company of Pennsylvania. Filed May 6, 1895.

548,027. Telephone Attachment. Charles B. Bernhard, Cleveland, Ohio. Filed March 15, 1894.

SIGNALING APPARATUS.

547,897. Electrical Succession Signaling or Calling System. James G. Smith, New York, N. Y., assignor of one half to Robert G. Vassar, same place. Original application filed Jan. 14, 1895. Divided and this application filed Feb. 23, 1895.

547,942. Electrical Succession Signaling or Calling System. James G. Smith, New York, N. Y., assignor of one-half to Robert G. Vassar, same place. Filed Jan. 14, 1895.

MISCELLANEOUS.

547,820. Staff Apparatus for Working Single-Line Railways. Illius A. Timmis, London, England. Filed Dec. 1, 1893.

547,891. Apparatus for Placing Electric Cables. Edwin S. Reid, New York, N. Y., assignor to the Standard Underground Cable Company of Pennsylvania. Filed June 18, 1892.

547,979. Electric Heater. George H. Whittingham, Baltimore, Md., assignor to the Whittingham Electric Car Heating Company, same place. Filed July 15, 1895.

548,150. Electrical Gold and Silver Extractor. Alfred Williams and William R. Phillips, Seattle, Wash., assignors of one-third to Fred Everett, same place. Filed Jan. 21, 1895.

548,162. Combined Diaphragm and Electrode. James Hargreaves, Farnworth-in-Widnes, and Thomas Bird, Cressington, near Liverpool, England. Filed Dec. 31, 1894.

THE TELEPHONE WORLD.

Telephone Litigation.

The following is an abstract of the Answer of the National Telephone Manufacturing Company et al., in suit of the Bell Telephone Company for preliminary injunction:

* * * * * *

II. And further answering, these defendants upon information and belief deny that said Patent No. 463,569 in said bill declared upon is a good and valid patent ; and allege that the same is wholly invalid :

First—By reason of the delay in the Patent Office in and about the granting of the same, during which delay many rights accrued to the public in and about the invention alleged by said bill to be described and claimed in said letters patent and during which several patents involving the alleged invention issued to said Berliner, which delay, these defendants allege, being in no respect their fault, constitutes no reason why they should be prejudiced by said delayed letters patent issued on an invention alleged in said bill to have been made in 1877—eighteen years ago—rather than the complainant, who was a party to such delay, if not actively and intentionally, at any rate in fact ; that there is no reason why these defendants, or the public, should exclusively suffer for such delay, and the said applicant and his said assignees be in no degree prejudiced thereby ; that if, by reason of the fault of the law or of the Patent Office, or of the applicant or those in his interest, or of all combined, such delay occurs in the Patent Office as in the case of the patent in said bill declared upon, so that, in the meantime, applicant fully publishes the invention and other inventors perfect the invention, then, whether said delay amounts to laches upon the part of the applicant or those in his interest, or amounts to only non-compliance with the principles upon which the patent law is founded, or to failure to conform to its established conditions precedent, the patent is invalid ; and that the complainant has no equity to enjoin these defendants under said letters patent No. 463,569 ; but that the complainant is estopped to assert or enforce such patent.

Second—Because the patent No. 463,569 in said bill declared upon, and especially the alleged broad claims thereof, are for the same subject-matter, thing or invention as letters patent to said Berliner, No. 233,969, of November 2, 1880 ; and were, therefore, allowed and issued contrary to the statute in such case made and provided. These defendants allege that the structure of the apparatus is identically the same, and described to be the same, in both of said letters patent Nos. 463,569 and 233,969 ; and that the mode of operation of said apparatus is the same in each of said letters patent ; and that the said two patents are for the same invention, and for use in the same art ; and that the later of the two, viz., said patent No. 463,569, declared upon in said bill, is void.

Third—Because the thing, apparatus or mechanism described and claimed therein was not a patentable invention or discovery, but an inoperative and worthless device, wholly failing in point of utility ; and did not involve the exercise of invention, and was not novel at the time of its alleged invention, and has never been of any utility, or put to any use.

Fourth—Because the application made June 4, 1877, was not according to the statutes of the United States, and did not become in accordance therewith by the amendments up to and including July 27, 1877, and up to and including October 27, 1877, as an application for the constant-contact variable-pressure transmitter or microphone, or for an art, method or process for the transmission of speech ; and no application for such transmitter or such art or method was made until after the same had been in public use, by the complainant and others more than two years ; whereby said Berliner abandoned said alleged invention, if the same were ever made by him.

Fifth—Because the invention alleged in said bill to be described and claimed, in said patent, is substantially other than and different from any indicated, suggested or described in the alleged application therefor of June 4, 1877, or in the attempted amendments up to July 27, 1877, or up to August 8, 1877, or up to and including October 27, 1877 ; and if any application made after said June 4, 1877, was for such alleged invention, the same dates from the filing thereof and not, as an allowable amendment, from said June 4, 1877, and is subject to all usual defences thereby arising.

Sixth—Because said patent No. 463,569, so far as the same describes or broadly claims the constant-contact variable-pressure transmitter, or microphone so-called, was unjustly obtained by the said Berliner, or his assigns, for that which was, in fact, the invention of Alexander G. Bell, then of Salem, Mass., who was then using reasonable diligence in adapting and perfecting the same.

Seventh—Because said patent No. 463,569, so far as the same describes or broadly claims the constant-contact variable-pressure transmitter, or microphone so-called, was unjustly obtained by the said Berliner, or his assigns, for that which was, in fact, the invention of Thomas A. Edison, then of Menlo Park, N. J., now of Llewellyn Park, who was then using reasonable diligence in adapting and perfecting the same.

Eighth—Because said patent No. 463,569, so far as the same describes or broadly claims the constant-contact variable-pressure transmitter, or microphone so-called, was unjustly obtained by the said Berliner, or his assigns, for that which was, in fact, the invention of Elisha Gray, of Chicago, Ill., who was then using reasonable diligence in adapting and perfecting the same.

Ninth—Because said patent No. 463,569 was unjustly obtained by the said Berliner, or his assigns, for that which was, in fact, the invention of James W. McDonough, of Chicago, Ill., who was then using reasonable diligence in adapting and perfecting the same.

Tenth—Because said patent No. 463,569 was unjustly obtained by the said Berliner, or his assigns, for that which was, in fact, the invention of William L. Voelker, of Springfield Township, Delaware County, Pa., who was then using reasonable diligence in adapting and perfecting the same.

Eleventh—Because the alleged invention, the constant-contact variable-pressure transmitter, or microphone, or substantial and material parts thereof, had been patented in the United States prior to said Berliner's invention or discovery thereof, in letters patent, to

Thomas A. Edison, of August 12, 1873, No. 141,777.

Thomas A. Edison, of April 30, 1878, No. 203,016.

Thomas A. Edison, of April 30, 1878, No. 203,014.

Alexander Graham Bell, of March 7, 1876, No. 174,465.

Alexander Graham Bell, of January 30, 1877, No. 186,787; and in letters patent of Great Britain, to

Thomas A. Edison, No. 2,909, dated July 30, 1877.

Henry Hunnings, No. ——, dated September 16, 1878; and in letters patent of Canada, to

Thomas A. Edison, No. 8,026, dated October 20, 1877; and in letters patent of France, to

Thomas A. Edison, No. 121,687, of December 19, 1877; and in letters patent of Belgium, to

Thomas A. Edison, No. 43,984, of January 11, 1878; and in letters patent of Italy, to

Thomas A. Edison, No. 9,791, of January 19, 1878; and in letters patent of Spain, to

Thomas A. Edison, dated May 6, 1878; and in other letters patent the dates and numbers whereof are not now known to defendants, but which when learned they pray for leave to insert in this their answer.

Twelfth—Because the alleged invention, the variable-pressure constant-contact transmitter, or microphone, or material and substantial parts thereof, had been described prior to said Berliner's invention or discovery thereof, in the following printed publications, viz.:

(Then follows a long list of publications.)

Thirteenth—Because, before any invention by said Berliner of the alleged variable-pressure constant-contact transmitter, or microphone, the same, or substantial and material parts thereof, has been invented, and were known to and used by the following persons in this country, residents of the following places at the following places :

A. G. Bell, of and at Salem, and at Boston and Washington.

Thomas A. Edison, formerly of and at Menlo Park, New Jersey, now of Llewellyn Park, New Jersey.

Elisha Gray, of and at Chicago, Ill.;

William L. Voelker, of Springfield Township, Pa.;

Daniel Drawbaugh, of and at Eberley's Mills, Pa., and other persons whose names and residences are now unknown to these defendants, but which, when found, they ask leave to insert in this their answer.

Fourteenth—Because for more than two years prior to any application under and according to the laws of the United States, by the said Berliner, or his assigns, for letters patent for the invention alleged in said bill to be described and claimed in said letters patent No. 463,569, the same, or material and substantial parts thereof, had been in public use in this country both by this complainant and their predecessors and assignors, and by said Berliner, at said Boston and elsewhere, and by Alexander Graham Bell, of Salem, at Salem and Boston and Washington, D. C., and by Thomas A. Edison, formerly of Menlo Park, now of Llewellyn Park, New Jersey, at said Menlo Park, and by Elisha Gray, of Chicago, at said Chicago, and elsewhere; and by various other persons whose names and residences are now unknown to these defendants, but which, when found, they ask leave to insert in this their answer.

III. And further answering, defendants allege on information and belief, that before the application of June 4, 1877, alleged in said bill to have been filed by said Berliner for said letters patent No. 463,569, the invention, machine or apparatus set forth in said application, had been published in the printed publications hereinbefore in paragraph eleventh set forth; and had been also in public use in Germany by Philip Reis, aforesaid ; G. Quinke, of Heidelberg, Giesen; C. Bohm, of Aschafenberg ; Dr. R. Bottger, president of the Physical Society; Albert & Son, mechanics ; Johann Ehren, and Segismund Theodore Stein, of and at Frankfort-on-the-Main ; Leon Garnier, Ernst Hockheimer, Rudolph Meissel, Heinrich Hold and Heinrich F. Peteur, at Freidrichsdorf and in England by William Ladd, of London ; and at Dublin, Ireland, by Thomas Ballad, of Bristol, England; Stephen M. Yates and A. M. Voreker, of said Dublin; which said use had shown that the apparatus known and described, as aforesaid, as the Reis telephone, transmitted not only musical sounds, but to an extent articulate sounds and speech, which transmission defendants allege to have been in part and at times accomplished by varying the resistance in the circuit by varying the pressure of the electrodes, thereby weakening the current without breaking the circuit.

And further answering, defendants show unto your Honors that the said Berliner, at the time of the alleged invention set forth in said bill, appears to have been an uninformed and tentative experimenter upon various theories, including those enunciated by the said Bell in his said patent of 1876, but not then fully or generally understood, admitted or current even among scientific students, and does not appear by his said application, or by his acts and writings to have appreciated the alleged necessity of constant contact between the electrodes, in order to embody Bell's method of transmitting articulate speech, until long after practical forms of constant-contact variable-pressure transmitters had been produced; that he naturally failed in his application of June 4, 1877, and in his attempted amendments up to and including October, 1877, to set forth or claim an invention which he does not appear to have then arrived at, to wit, a constant-contact variable-resistance transmitter; that he had therefore, by his own admission, sought to protect himself by filing caveats for what are now considered opposite and inconsistent inventions, and after his caveat of April 14th, alleged in said bill to be for a transmitter operating by weakening the current, but which he appears to have regarded as operating by make-and-break of circuit, he filed April 30, 1877, a caveat for an air-discharge instrument, and on May 9, 1877, a caveat for a distinctly make-and-break transmitter; that his application of June 4, 1877, was never made to state the necessity of constant variable contact in conformity with the requirements of the patent law, and particularly U. S. R. S., Section 4,863, until after other inventors had produced commercial forms of constant-contact variable-resistance transmitters, or even until the same had been in public use for more than two years, as hereinbefore set forth, and that none of the apparatus produced by him has ever been of any practical use in telephony, nor the public his debtor for any advance in the art. The Blake form of carbon microphone was introduced commercially in the fall of 1878; the Edison carbon transmitters were in extensive public use in the summer of 1878, and were invented as early as April, 1877, and improved in July, 1877, as shown in applications for said Edison patents, Nos. 474,230 and 474,231. And long before that, substantially the same structure as that described in said Berliner letters patent, No. 463,569—a simple structure, as defendants believe—had been made and operated as a musical telephone and for other electrical uses, by various persons hereinbefore named.

In view of these facts and circumstances and of the history and state of the art, these defendants upon information and belief further say that the said Emile Berliner was not the inventor of any practically useful or commercial microphone, or constant-pressure variable-contact transmitter, as alleged in said bill, or as described or claimed in said letters patent No. 463,569 ; but that the same was the product of the state of the art in 1876, the invention of A. G. Bell, set forth in his letters patent of 1876 and as herein before mentioned, the invention of Elisha Gray, and others as hereinbefore set forth, supplemented by the inventions of Thomas A. Edison, upon some of which he applied for patents in April and July, 1877, as shown in United States letters patent to said Edison, Nos. 474,230 and 474,231, and hereinbefore set forth; and so far as improved by other and later inventors than said Bell and said Edison and others aforesaid, the valuable features of such variable-contact transmitter were largely devised by Blake, Hunnings, and others mentioned in complainant's bill, and are described in various patents and publications now constituting the exposition of the art of electrically transmitting speech as practised at the present time.

That in view of the history and state of the art, and of said references, the letters patent No. 463,569, declared on in said bill are not valid as a patent for an art, method or process; nor as a broad patent for the machine known as a constant-contact variable-pressure transmitter; but if valid at all, only as a patent for precise forms or details of structure merely, of narrow and limited scope.

IV. And further answering, defendants say on information and belief that the invention and improvements, alleged in said bill to be described and claimed in said letters patent No. 463,569, were patented to the said Emile Berliner, or to those in his interest, in foreign countries before the same were patented in the United States, and that patents therefor so granted in such foreign countries have expired, and that by force of the statutes of the United States in such case made and provided, the said letters patent No. 463,569 have expired and become void and of no effect, and that complainant is not entitled to any relief in equity thereon, that said foreign patents to said Berliner are:

Letters patent of France, No. 134,481, of January 8, 1880.

Letters patent of Canada, No. 11,734, to said Berliner and one Williams, of September 8, 1880, and others, the countries, dates and numbers whereof are not now known to defendants but which, when found, they crave leave to insert in this their answer.

The Watson Switch Patent Not Valid.

Commenting upon the statements recently made in the columns of ELECTRICITY in reference to the validity of the Watson telephone switch patent, the *Pacific Electrician*, of San Francisco, says:

"The patent, which has been considered one of the most valuable of the patents controlled by the American Bell Telephone Company, is not worth the paper it is written on. The device in its broadest and most complete form was invented by Mr. Paul Seiler of this city over two years before Mr. Watson applied for a patent.

"It was used commercially as early as 1878, and in the following years over 2,500 telephones were manufactured here using this switch. Telephones are in use to-day in the interior of this State that were put in in 1878. In most cases where the validity of patents has been attacked on the ground of prior use, it has been a question whether the use was not rather a laboratory experiment. In the present case this question cannot arise, for the Seiler switch, which is identical with the Watson switch, was manufactured and used on hundreds of telephones. The Bell Telephone people may as well throw up their hands so far as the Watson patent is concerned.

"It is worthy of note that Californians were the first to recognize the possibilities of the telephone, and that here in the early days of the telephone industry it reached a degree of development far in advance of any place else in the world, and this was due almost entirely to the business ability of George S. Ladd and the mechanical genius of Paul Seiler.".

Western Union's Business.

The report of the Western Union Telegraph Company for the year ending June 30 contains the following figures: Gross earnings, $22,218,019; operating expenses, $16,076,629; net earnings, $6,141,389; balance, $5,207,577; dividends, $4,767,737, and surplus, $439,844. The balance sheet stands: Accounts payable, $1,230,382; cash, $1,488,434; accounts receivable, $2,560,609; supplies, $243,483; real estate, $4,979,533; stocks and bonds owned, $8,397,520. Miles of wire, 802,651; offices, 21,360; messages sent, 58,307,715.

There was constructed during the year 817 miles of new pole line at a cost of $574,639, which, with $16,000 paid for patents, was charged to surplus account. The American Rapid Telegraph Company was absorbed through an increase of $550,000 in capital stock. There was a marked falling off in press messages, and an increase in full-rate messages.

Want the Appeal Dismissed.

When the appeal in the Berliner telephone transmitter patent case comes up before the United States Supreme Court at the present session, the attorneys for the Bell Telephone Company will move to dismiss the appeal, their contention being that by the Evarts law establishing the Circuit Courts of Appeals their decisions in cases arising under the patent laws are made final. The Government will oppose the motion on the ground that the case did not arise under the patent laws, but is a case presenting the question whether or not the United States can initiate proceedings to annul patent.

The Largest Branch Telegraph Office.

The Chicago Board of Trade is said to have the largest branch telegraph office in the world. The Western Union and Postal companies have 170 operators on the floor every day, and one company alone has been known to handle 12,000 messages in the few working hours of the Board of Trade day. This enormous telegraphic business is now being supplemented by a telephone service. Twelve instruments have been already installed, 24 are to be added shortly, and it is not unlikely that before long 100 instruments will be in use. The telephones are all on private lines, not connected in any way with the telephone exchange, but merely serving for direct communication between members on the floor and their offices.

Will Boycott Telephone Monopoly Candidates.

At the last meeting of the New York City Board of Trade and Transportation, the Committee on Telephone reported progress, and asked that all candidates in New York State be canvassed before election and sounded on their views regarding the telephone monopoly, and that only those Assemblymen and State Senators be supported or voted for who pledge themselves in favor of a measure crippling the monopoly.

The City Council of Saginaw, Mich., and the Bell Telephone Company have locked horns over the payment of a bill for the inspection of the poles of that company. Recently an ordinance was passed which provides that once each year the city shall cause all telegraph, telephone, electric light, trolley support and other poles in the city to be inspected to see that they are properly erected, painted and that the wires are properly strung on them, the fee for the inspection to be 50 cents per pole, to be paid by the company owning the pole. A bill of $550 was presented to the Bell Company. Payment was refused and the city will sue to collect it.

Morgan T. James of Youngstown, O., is organizing a company, to be composed of Youngstown and Cleveland capitalists, for the purpose of operating an independent telephone exchange in the former city. At least 400 subscribers have already been obtained on three and five year contracts at $20 and $30 per year, and an application for a franchise has been made.

The Red Hook Telephone Company, Red Hook, N. Y., has completed its lines, which will give telephone facilities to the villages of Barrytown, Barrytown Corners, Annandale, St. Stephen's College and Red Hook. The company is now constructing lines to Upper Red Hook, Madalin and Tivoli.

On the application of stockholders the office of the Indiana Telephone Construction Company, with headquarters at Frankfort, Ind., has been placed in the hands of Charles W. Fish, of Elkhart, as receiver.

The New York and New Jersey Telephone Company has applied for a franchise to lay underground conduits in Orange, N. J., agreeing to put all its wires underground if the franchise is granted.

A movement is on foot looking to the building of an independent telephone line connecting Americus, Ga., with the Plains and other towns along the Georgia and Alabama Railway.

J. T. Foley and William T. Slaughter, proprietors of the telephone system at Martinsville, Ind., have secured a franchise for a telephone exchange at Spencer, Ind.

The Saginaw Valley Mutual Telephone Company has applied for a franchise at Flint, Mich., agreeing to furnish service for $24 and $18 per year.

The Central District and Printing Telegraph Company of Pittsburg will extend its telephone service from Wheeling to Parkersburg, W. Va.

The Colorado Telephone Company will establish a new line of communication between Greeley and Denver via Brighton, Platteville and Fort Lupton.

The new telephone company organized at Chippewa Falls, Wis., has been granted a franchise in that place.

Storm Lake, Ia., is to have a new telephone company.

New Companies Incorporated.

The Eastern Ohio Telephone Company, Richmond, Ohio, has been incorporated with a capital of $5,000.

The Cairo Telephone Company, Cairo, Ill. Capital stock, $5,000. Incorporators: Thomas W. Gannon, Angus Leek and Francis J. Fitzgerald.

The Oak Telephone Company, South Haven, Mich. Capital stock, $20,000. Officers: C. J. Monroe, president; B. F. Harmon, treasurer; A. T. Dewer, secretary and manager.

A New Idea in Tape.

The Okonite Company, Ltd., always progressive and leaders in all that pertains to their special line of goods, took a new idea in tape to the Montreal Street Railway Convention, which created a genuine sensation and caused any amount of favorable comment. The novelty consists of a new form in which the company is putting out the celebrated Manson Tape, and was shown by Capt. Willard L. Candee, who was to be found here, there and everywhere surrounded by an interested group of the electrical fraternity eager to get points on the "good thing."

The usual manner of supplying the trade with tape has been for the manufacturers to put it up in half pound packages or rolls, incased in tin foil or other wrapping. It is the general experience of most companies that the linemen in using tape so put up, after taking what was needed for the work in hand from the roll, would throw what was left away, or if they did put it back into their kit, the wrapping would soon become loose, the tape gather dust and dirt and in a short time become almost unfit for further use.

Captain Candee showed the Manson Tape packed in round tin boxes of two colors—red and white—both very attractive and neat in appearance, and containing one ounce of the tape. This nine times out of ten is a sufficient quantity for any ordinary repair, and if there be any left over it may be put back into the box, which is conveniently small (about the size of a silver dollar) where it will be kept fresh and clean and ready for use at any time. The new form of packing meets an evident want and will unquestionably mean a considerable saving to the companies and prove a great convenience to linemen. The Manson Tape is furnished in two colors; the black tape will be put up in red boxes lettered in black, the white tape in white boxes also lettered in black.

Captain Candee returned from the Convention with a large number of valuable souvenirs in the shape of substantial orders for the novelty. As a large number of our readers are probably devotees of the "wheel," it is of interest to state that the tape put up in this way adapts itself perfectly to the needs of cyclists as well, and will doubtless prove as popular in that quarter as for purely electrical uses.

The "A.-B." Incandescent Lamp.

Last week there was presented to our readers cuts and description of the new arc lamp manufactured by the Adams-Bagnall Electric Company of Cleveland. This week there is presented a cut of the Incandescent Lamp manufactured by the same company. The incandescent lamp catalogue issued by this company has for its opening sentence, "Something new in incandescent lamps." This has a refreshing sound to it, but the "newness" does not consist simply in a newly figured or an odd shaped bulb, but there are really some important changes embodied in the new lamp.

The "A.-B." Lamp is constructed without the glass tip on the large end. This may seem a small matter on first thought, but further consideration will enable one to realize the important changes made. The glass tip is caused by welding a tube to the large end of the bulb and then sealing off close to the bulb when the air has been exhausted from the same. To get rid of this tip it is necessary to seal off at the other end. In order to do this it is necessary to abandon the usual glass mount. This therefore changes the entire interior construction of the bulb and the "A.-B." Lamp presents an entirely new appearance. The side of the bulb is drawn inwardly in the shape of sharp pointed projections which take the place of the usual glass mount.

The platinum wires are conducted through the walls of the bulb at diametrically opposite points, as far apart as it is possible to place them, and all trouble from short circuiting at this point is therefore avoided. A new feature in the manufacture of this lamp is the application of a small brass ferrule to the lamp during the process of construction. When the leading-in wires have been attached to the platinum they are laid along the neck of the bulb in small grooves provided for that purpose. Over these wires and the neck of the bulb is then placed the ferrule (shown in Fig. 2) which seats on the glass. The plaster or cementing substance is then placed in the open end of the ferrule, filling the grooves and depressions in the glass made for its reception. After this the bulb is exhausted and sealed off at the neck end. The lamps are placed in stock in this shape. It can be readily understood that with an open end ferrule the plaster can be better applied to the glass than with a blind end base. The plaster being applied during the process of construction has ample time to dry and harden before the lamps are shipped to market. This avoids all trouble arising from green lamps or lamps which will loosen at the base. This loosening at the base has been one of the greatest difficulties lamp manufacturers have had to contend with.

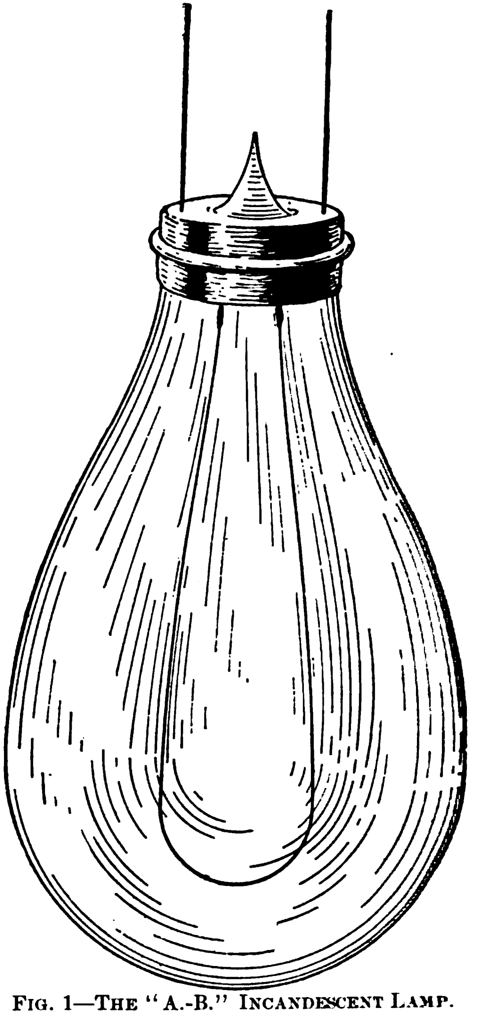
FIG. 1—THE "A.-B." INCANDESCENT LAMP.

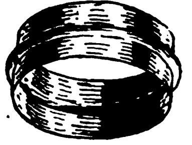
FIG. 2.

An ordinary lamp base is not constructed with a view to its being attached properly by plaster to the neck of a glass bulb. This additional brass ferrule used on the "A.-B." Lamp seems to perform an important function in the surmounting a serious difficulty in the manufacture of incandescent lamps. The fastening of the lamp base to the ferrule is accomplished by mechanical means and without loss of time in waiting for the plaster or cement to dry. Care has been taken by this company to select a very handsome shaped bulb. Besides being tasty in appearance the lamp is novel in every respect.

Patents have been awarded this month to the Adams-Bagnall Electric Company covering this lamp and its method of construction.

ELECTRICITY.

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EDITORIAL NOTES.

The Standard Telephone Company.

In the issue of ELECTRICITY for October 16 there was printed a photographic fac-simile of a circular bearing the copyrighted imprint of the Standard Telephone Company of New York, a corporation made up of men of high standing and wide reputation. The circular was one of the most remarkable documents ever issued by a business concern and included the following paragraph :

So that the promoters of a local telephone company, under a Standard Telephone Company's license, have $20 in cash net profit on each 'phone to play with a d a stock interest in every telephone of $34 TO GREASE COMMON COUNCILS, TO SELL TO LOCAL THIRD FLOOR SUBCELLAR INVESTORS, ETC. YET THE BOYS WHO ARE IN THE REAL POT, IF THEY PLAY THEIR CARDS RIGHT, will have this control of every local telephone company's plant on the above basis, annually 51 per cent. and $20 in cash. . . .

The publication of this circular has naturally created a sensation in the telephone world, and has been particularly interesting to the various gentlemen who invested money in State and local rights of the Standard Telephone Company, believing it to be a legitimate enterprise. Some of these people have been thrown into such a fright that they have rushed into print with very rash statements, which they will have great difficulty in substantiating.

At Richmond, Va., the local Standard Company is fighting for a franchise. After the publication of the circular referred to, in ELECTRICITY, the directors, Messrs. R. H. Smith, J. F. Bradley, Thos. R. Marshall, A. B. Guigon, Geo. W. Cross and John C. Robertson, made a long statement to the Common Council, the gist of which is published on our telephone page. Among other things they say :

> . . . The Standard Telephone Company has never issued any such circular as that quoted by our opponents from ELECTRICITY, a journal of unsavory reputation, which is not recognized in the electrical profession; nor has it made any suggestion of corrupt dealings with councils.
>
> The Standard Telephone Company has its own factory now in active operation in New York, and is establishing several now in the North.

It is rather difficult to see how these Richmond gentlemen can be so certain that an office in New York over which they have no control has ever issued this circular, or any other circular.

The unqualified statement that the Standard Telephone Company has a factory in operation in New York shows that these gentlemen have been imposed upon, as have many other State and local companies. After a diligent search for several months, no one, so far as we know, has found any trace of such a factory in this city or anywhere else. On the contrary, it is known that the Standard Telephone Company has had a few telephones made under contract by other companies, and only last Saturday their New York office was in the custody of the sheriff on an attachment issued for a claim of about $1,500 for such telephones sold to the Standard Company. The matter was finally adjusted.

ELECTRICITY publishes no bogus news, makes no misstatement of fact. We have never yet felt called upon to defend our reputation. We advise our Richmond friends to go slow. They talk too much on subjects of which they have no knowledge.

Gen. James S. Clarkson, whose name has been prominently connected with the Standard Company, is quoted as follows in an interview concerning this circular in the *New York Herald:*

> We never issued it and know nothing about it. We have gone into a big fight and expect a hard struggle, and this is part of it.

As soon as our attention was called to this we sent the following letter to Gen. Clarkson :

[COPY].

"ELECTRICITY,"
6 Park Place, New York. October 25, 1895.

HON. J. S CLARKSON,
Fifth Ave. Hotel, New York.

DEAR SIR: I notice in a recent interview attributed to you, in the *New York Herald*, a denial of the authenticity of a Standard Telephone circular recently published in this paper, and would esteem it a favor if you will make such denial over your own signature, and forward to me.

Yours very truly,
(Dictated.) (Signed) B. E. GREENE, Publisher.

As we go to press (October 29) no reply has been received.

A letter was also sent to Thurlow Weed Barnes, the president of the company. To this no reply has been received.

[COPY].

"ELECTRICITY,"
6 Park Place, New York. October 25, 1895.

THURLOW WEED BARNES, ESQ.,
President Standard Telephone Co., New York.

DEAR SIR: I notice that in interviews with various people connected with your company, the authenticity of one of your telephone circulars, recently published in this paper, is denied, and I beg to advise you that you are at liberty to use whatever space in our columns is necessary to deny that the circular in question was prepared and issued by the Standard Telephone Company of New York.

Yours very truly,
(Dictated.) (Signed) B. E. GREENE, Publisher.

There have been several developments in the affairs of this concern during the past week other than the sheriff taking temporary possession of their office. The following despatch was printed in the Boston *News Bureau:*

> The Wisconsin stockholders of the Standard Telephone Company, which was to revolutionize the telephone business, have demanded an accounting of the money subscribed by them. Several letters have been written to the officers, and if an accounting is not soon forthcoming suit for the recovery of the money is to be brought.

In regard to this. Mr. C. C. Rogers of Milwaukee, one of the Wisconsin stockholders, said a week earlier :

It is true, we have felt somewhat disappointed at the delays and postponement of active operations, for we had reason to expect that the new telephone would be in use much earlier, but there is no reason to fear that we have been cheated. *Should the undertaking be abandoned, we feel assured that all the money paid in by subscribers will be returned.*

The Milwaukee parties interested in the undertaking are C. C. Rogers, N. S. Murphey, Gustav G. Pabst, E. H. Bottum and H. D. Smith, the Appleton banker. Each one of these, it is said paid in $1,000 cash when the Wisconsin district was organized.

Mr. Rogers has expressed a hope which we believe is very general among the investors in the company's State rights. Will Mr. Barnes or any other responsible party tell the public that it is their intention to return this money if the undertaking is abandoned? We think not.

One of the Chicago dailies reports that "there was consternation in telephone circles all over the country as the result of the exposure of the stock-jobbing methods of the Standard Telephone Company. Locally there was considerable comment on the character of the deal, which embraced so many prominent men as backers and promoters, and which has been pronounced a bare-faced swindle."

It is also said "that a suit will be immediately brought against the parent Standard Company by the New Jersey State Company. The New Jersey corporation is capitalized at $3,000,000 and has a board of twenty directors. Each director paid $1,000 cash for $50,000 stock in the State company, making $1,000,000 in stock that they now nominally hold. The other $2,000,000 in stock went to the original syndicate of four promoters.

"A committee of three directors," it is said, "has been appointed to bring suit against the syndicate, and if necessary to prefer criminal charges against Allen T. Nye, the chief promoter and organizer. It is considered likely that other State companies will follow the lead of the New Jersey corporation, and that the affairs of the Standard Company will soon be involved in a mass of litigation."

The gentlemen whose names have been connected with this enterprise are certainly in an unenviable position. They will soon have to speak or stand convicted of selling their names for the promotion of a very questionable scheme. The entire career of the company has been marked by methods which would have been called criminal if applied by men of no repute. It will be remembered that the original syndicate behind the Standard Telephone Company was made up of Allen T. Nye, Thurlow Weed Barnes, Charles T. Strauss and J. O'Neill. The parent company was capitalized at $10,000,000.

Twenty-one separate district companies were then organized under the laws of Arizona. In exchange for the transfer of patent rights the syndicate took the whole of the capital stock of these twenty-one district companies, ranging from $3,000,000 to $6,000,000 each. They then sold back to themselves and the additional directors in each district company one-third of the capital stock at the rate of $50,000 stock for $1,000 cash. Each person putting in $1,000 cash was promised a directorship. Some prominent men are said to have received $30,000 stock as a bonus for the use of their names. The syndicate pocketed the cash received, and is said to have divided $300,000 in money, besides owning two-thirds of the capital stock in all their district companies.

The principal district companies are:

	Capital.
New York State	$6,000,000
Eastern (New England States)	6,000,000
New Jersey	3,000,000
Pennsylvania	5,000,000
Columbian (District of Columbia, Maryland, Virginia and West Virginia)	4,000,000
Southern (Tennessee, Kentucky, North and South Carolina)	4,000,000
Ohio and Indiana	4,000,000
Michigan	4,000,000
Northwestern (Illinois, Iowa and Wisconsin)	6,000,000
Northern (Minnesota, North and South Dakota)	4,000,000
Central (Missouri, Kansas, Arkansas and Nebraska)	5,000,000
Gulf States (Georgia, Florida, Alabama, Louisiana and Mississippi)	5,000,000
Pacific (Washington, Oregon, Montana, Idaho, Wyoming and Alaska)	5,000,000

This is an imposing showing on paper, and yet, so far as we can learn, after all these months of stock-jobbing not a single Standard telephone exchange is in operation. If there is one we would like to know of it. If there are any patents worth $100 apiece, we would like to know of them. If there was any honest basis whatever for the company's operations, we would like to know of it. If there is any equivalent which they can give honest investors, we would like to know what it consists of; and we defy any one of the promoters to justify the sale of any State or local rights whatever.

The whole structure is already tottering, and if many a heretofore honored man is not discredited and disgraced beyond redemption by its collapse, the best men in the telephone world will be greatly surprised.

ELECTRICITY has not been able to find one of this class who has any confidence whatever in the concern.

It is evident that the insiders are very much disturbed over the turn affairs have recently taken—the exposures of ELECTRICITY, the intended suits for recovery by different State organizations.

In the New York *World* of Sunday, October 27, there was a paid reading notice of over five columns, written in a style which reminds one of Allen T. Nye, booming the company. The whole thing was a conspicuous though ill-timed effort to stem the tide which has set in against the principals.

We quote a few sentences:

In three years from to-day, in place of the 15,000 telephones in use in New York City, and in place of the 4,571 in use in Brooklyn, and of the 4,500 in use in Philadelphia, there will be at least 150,000 in New York City and 100,000 each in Brooklyn and Philadelphia.

The general public has very little conception of the fact that the combined capitalization of the companies comprising what is known as the Bell Telephone system is in the neighborhood of $400,000,000, and that this vast ocean of stock is paying dividends.

The Bell Company in New York City showed total profits in six years of 474 per cent.

The Standard switchboard is a novel departure in exchange work, and marks an epoch in switchboard construction. It is exceedingly cheap to install as well as to maintain. For an exchange of 10,000 subscribers, according to the Standard Company's claim, a switchboard costs, instead of $350,000, only about $20,000. Instead of $80,000 a year for connections, its cost would only be about $60,000; and interest, depreciation and maintenance, instead of being $50,000, would be only $3,000. Each section of the switchboard has, instead of 10,000 jacks, or switching terminals, only about thirty to fifty. The limit of the multiple switchboard now in use all over the United States is at the top notch 10,000 subscribers. The limit of the Standard switchboard is, as above stated, not reached even at 50,000.

No official statement has ever been given out by any authorized agent or officer of the new company, and inquirers at the headquarters of the company, in the Postal Telegraph Building, are politely requested to allow results to speak for themselves.

The Standard Telephone Company's beginning was entirely wrong if its objects were legitimate.

We have no doubt that, despite the refusal of the officers to give out official statements, results will soon speak for themselves.

* * *

Get Together. What ELECTRICITY predicted in the incandescent lamp business is gradually coming true, though not as rapidly as we hoped it would. We refer to the enforced retirement of the makers of inferior and cheap lamps by the working out of natural commercial laws. There have been several suspensions, none of them large enough to create any particular comment. The cutting of prices has gone far enough, however, to convince the public itself that other things than cheapness should be considered in an incandescent lamp. There never were so many poor lamps on the market, nor such a universal protest from users against them. And while the leading manufacturers are turning out better lamps than ever before, they are yet suffering from the evil effects of the competition in "cheapness." The situation, though apparently better than it was a few months ago, is critical. Some of the makers of the best lamps, exasperated at the loss of orders by the underbidding of one cent a lamp on lamps known to be worth less than half as much as their own, are seriously considering cutting the market wide open with a reduction of 50 per cent. in order to drive the trade disturbers out, trusting to an ultimate re-establishment of fair prices. We doubt the wisdom of this plan, though there appears some justification for it.

The most sensible thing would be for the lamp makers to come together in some sort of a combination in which each company would preserve its individuality and work as hard to sell its own product as ever. This could be accomplished by the establishment of a central agency, from which all lamps should be billed at uniform prices for different candle powers and voltages. The selling argument would then be quality alone, and the company refusing to go into the combination would practically confess in advance its lack of confidence in its own product.

There should be in some way a general stiffening of prices, and a constant struggle to turn out the BEST LAMP POSSIBLE. In no other way can the incandescent lighting business hold its own against the competition of small arc lamps (constantly being improved), and against the Welsbach light, which has already made serious inroads on the income of many a central station. And it is the central station men who ought to be more interested than any one else in improving the quality of the lamps. They do not aid in this by buying the cheapest lamp offered. The loss of a few customers by reason of poor, yellowish and offensive looking lamps will more than overbalance the saving of a few cents on initial cost.

The strongest argument the central station man can offer against the Welsbach burner is the superior QUALITY of the incandescent electric light. This quality is only obtainable by the use of the best lamps.

The average production of lamps for this year will be about 50,000 per day. An increase in price of two cents per lamp would thus mean an added profit of $1,000 per day to divide among the various manufacturers.

Lamp makers who are in the business to stay should get together on the basis of better prices and better product.

* * *

Municipal Lighting in Boston. The special committee of the Common Council of the City of Boston appointed to consider the expediency of exercising the authority provided by legislative acts of 1891 concerning the manufacture and distribution of gas and electricity by cities and towns, has made its report.

The committee investigated the lighting systems in the cities of Philadelphia, Marietta, O., Springfield, Ill., Bloomington, Ill., St. Joseph, Mo., Aurora, Ill., Chicago, Michigan City, Ypsilanti and Detroit. As the result of its labors the committee concludes "that Boston was paying too much for electric lighting, and that a great saving could be made and at the same time the citizens could be furnished with an electric light service fully equal to the present, and that it is expedient for the city to establish and maintain a plant for the manufacturing and distributing of electricity for municipal purposes."

Other discoveries made by the committee are stated as follows:

The committee has given sufficient time to the question of the cost of an electric light plant, fortified with the experience of other cities, to be able to state that an overhead line of construction, with 35 to 40 foot cedar poles, shaved and painted, with triple braid No. 6 weather-proof line wire, including everything requisite for such service as the city of Boston would require, can be constructed for less than $300 per mile. In fact your committee are prepared to venture the statement that it can be constructed for $250 per mile.

The plant in Detroit of the finest possible make cost $300 per arc. This includes the cost of expensive real estate, both in land and building. The actual cost of construction will not exceed $168 per arc for an overhead system of 3,000 arcs in Boston, and your committee are positive that they are not in error in making this statement. The additional cost of real estate will of course depend upon the location, but your committee believe that such location can be secured as to bring total cost of plant, including land and buildings, not over $250 per arc. Assuming that an estimate of $250 per arc is correct, the cost to the city of a 3,000-arc plant would be $750,000. The interest on the investment, a fair charge for depreciation and well-paid labor would, in the opinion of your committee, make the total cost not over $75 per arc, and there would be a net saving to the city of at least $125,000 per year.

That electric lighting is to supersede gas is only a question of a short time, and your committee are thoroughly convinced that the best and most economical light for a large city is the electric light It is no longer a question of experiment, and the cost of operating is no longer the exclusive property of the electric light companies. The manufacture by cities of electricity for municipal purposes has demonstrated the fact that the generating of electricity for lighting purposes is an open commercial question, entirely devoid of mechanical difficulties, and proves that the fancy prices charged by the electric light companies, not only in this but in all other cities, are unwarrantable, and it certainly must be a surprise to the City Council and the citizens of Boston that a commercial company receiving such valuable franchises from this city for a merely nominal consideration should take such an advantage of the taxpayers as to charge 100 per cent. more for electric light than it costs to manufacture.

Notwithstanding the suggestive discoveries made by this committee, it is evident to it "that the consummation of a municipal plant, however desirable, is very remote" until certain modifications are made in the act of the Legislature.

* * *

The investigations made by the committee reveal nothing new, nor do they confirm anything, except possibly the inaccuracy and unfairness of the statistics on municipal lighting that have already been compiled. In no case thus far brought to public notice have all the elements entering into the cost of the production of electricity for lighting purposes been taken into account in the estimates made by the advocates of municipal control. Failure or refusal to do so has vitiated all statistics previously prepared. The report of the Boston committee exhibits all the characteristic defects, while it adds nothing but volume to the literature of the subject.

Under the Searchlight.

Views and Opinions on Timely Topics.

MR. AL T. SHOCH has qualified as receiver for the Ottawa (Ill.) Electric Street Railway Company. This is the road, it will be remembered, built by Mr. T. P. Bailey, of Chicago, with General Electric money, to show the citizens of his native town what a great man he had grown to be.

* * *

Still Scheming.

H. M. Byllesby is Trying to Work Another Bond Deal.

A few weeks ago Mr. H. M. Byllesby spent considerable time in Missoula, Mont., endeavoring to carry through a great water-power-electric-light-stock-and-bond scheme, with a bonus from the town of land and subscriptions for $15,000 of the bonds. The effort failed.

Now we understand Mr. Byllesby has returned to to Missoula to try it again.

ELECTRICITY warns the business men of the town that any scheme which Byllesby may propose will be against the best interests of the community.

If there is any water power in the Hell Gate river worth getting, local capital and local people alone should engage in the enterprise. Any company which Byllesby may organize will be on the straight road to bankruptcy as soon as it is incorporated.

The Missoula General Electric Company is one of the characteristic Northwest schemes, and we do not wonder that Byllesby and Coffin desire to get out of it in some way. The population of the town in 1890 was 3,426. The plant was started in that year by Abe Heyman and H. M. Ogden. The first city contract was for ten arc lights. A big debt was piled up with the Northwest General Electric Company. Then Byllesby took hold with a strong hand to apply his regular treatment. He got an option on it, and tried to raise money in St. Paul to buy it, representing that the new company would have *only* $100,000 stock and $100,000 bonds. He told the boys in the St. Paul office that he had made up a syndicate of Messrs. Willins, Weed and Lockey (Northwest General Electric stockholders) to buy it, and every one was invited to come in on the ground floor. "There is large money in it," said Byllesby. But Mr. Lockey sent for Mr. B. F. Meek to ask a few questions, and found that $200,000 of bonds, instead of $100,000, had already been printed before the plant was bought. Mr. Lockey thought that this was a little too much for a town of 3,426 people, and kept his money.

Where the securities are now we do not know, but they appear to have been sold.

At the time Mr. Byllesby took the plant, the following was the extent of the tangible property. Little has been added since :

INVENTORY OF MISSOULA ELECTRIC LIGHT COMPANY'S PROPERTY.

Three lots, as shown on abstract.
One brick station 40 x 65 feet.
One 2-story building on lots used for office supply room and workshop.
Three boilers of 80 horse power each.
Two 35 H. P. Westinghouse engines.
One 65 H. P. Westinghouse engine.
One 80 H. P. compound Westinghouse condensing engine.
Two 50-light arc machines.
One 35-light arc machine.
Two 650-light Thomson-Houston incandescent machines.
One 400-light Edison dynamo.
One 300-light Edison dynamo.
About 36 miles of wire.

We advise Mr. Byllesby to remain in obscurity. The millions of worthless bonds manufactured and sent East by him during his career as president of the Northwest Thomson-Houston and General Electric companies are conclusive proof that there is no further opportunity for him in this business.

And before many months Mr. C. A. Coffin will join him in retirement.

* * *

MR. EDISON, in a recent interview, has announced that he will return to active work in his laboratory as soon as he can secure a competent manager for his mining plant at Ogden. He has offered the place to Prof. W. D. Marks, of Philadelphia, who may accept.

* * *

THE daily paper reports of the sale of the Schuyler Electric Company's factory at Middletown are slightly inaccurate. The General Electric Company paid for the entire property $77,825. This is somewhat less than our estimate of its value in our analysis of General Electric reports.

* * *

THE case of the Adams Electric Railway Company vs. the Lindell Railway Company came up before the United States Circuit Court of Appeals at St. Paul last week. Dr. Adams is confident of a judgment in his favor this time.

* * *

ARGUMENT was heard at Philadelphia last week by Judges Pennypacker and Sulzberger on the question of Councilman Andrew J. De Camp's right to a seat in Common Council as a representative from the Twenty-ninth Ward while holding a stockholder's and manager's interest in the Brush Electric Light Company, which has lighting contracts with the city. Mr. De Camp was elected last spring.

* * *

False Prophecy.

(From the Boston Commercial Bulletin, October 19, 1895.)

> General Electric attracts attention by its comparative strength. Advices from New York, not through news agency channels, have been to pick up this stock on weak spots, as plans were being quietly laid which would make it sell very much higher.

General Electric shares have since sold at 33¾, a drop of 3¾ points in one week.

* * *

The Solid Truth.

People who are contented seldom give the world any of its forward movement.

The Brooklyn Bridge.

The Executive Committee of the Brooklyn Bridge Trustees, which was authorized some time ago to inquire into the advisability of using electric power to do the car switching at the bridge terminals and to heat the cars, and which has visited a number of cities to see how this work was being done elsewhere, has decided to permit the electrical companies to put in experimental plants at the Brooklyn terminal with a view of adopting some one of these systems if it prove to be satisfactory. Chief Engineer Martin was authorized to advertise for proposals.

"High Speed Commercial Telegraphy."

The above was the subject of a lecture delivered by Mr. Patrick B. Delaney before the New York Electrical Society at Columbia College on the 28th inst. Mr. Delaney has devoted his life to the development of multiplex, synchronous and machine telegraphy. The expressed purpose of his lecture was to explain the construction and to illustrate the methods of operation of his most recently perfected devices, by means of which it is possible to transmit upwards of 2,000 words per minute. The apparatus consists of a perforator, upon which the message is prepared by perforating a ribbon of paper ; a transmitter, through which the ribbon is passed, and the receiver, which reproduces by electrolytic action upon a prepared ribbon the impulses imparted at the transmitting end.

It is not claimed by the inventor that his new system will replace the present duplex, quadruplex or multiplex systems for commercial work, but that it has a peculiar field of its own. By an elaborate array of statistics he demonstrated that a line of two wires between New York and Chicago, costing complete $850,000, and transmitting messages at the rate of 400 words per minute, would be able to take care of as many messages as there are now letters transmitted between those points, and at a cost not exceeding 15 cents per message. Thus the telegraph would become the auxiliary of the postal service, and at a tariff within the reach of all.

LEGAL NOTES.

Conduit Railway Litigation.

Charles Bidwell of Toledo, O., has commenced suit in the United States Court at Toledo against the Toledo Consolidated Street Railway Company, now the Toledo Traction Company, to determine the question of infringement of patents Nos. 373,046 and 504,549. These patents are for an electric conduit railway and were granted to Benson Bidwell, father of the complainant.

Elias E. Ries, of Baltimore, and Albert H. Henderson, of Philadelphia, have instituted suit against the Metropolitan Railway Company of Washington, D. C., for infringement of certain patents on conduit railways.

In the suit of the Edison Electric Light Company et al., against James Pass and Albert P. Seymour, of Syracuse, N. Y., a preliminary injunction has been granted restraining the defendants from manufacturing incandescent lamp sockets.

The Siemens & Halske Company of America has instituted suits in the United States Circuit Court at Chicago against the General Incandescent Arc Light Company of New York and E. Baggot of Chicago, for alleged infringement of the Hefner-Alteneck chain-feed arc lamp and the Hoffman cut-out patents.

Lawyer Wainwright, of Manasquan, N. J., has been appointed receiver of the South Jersey Street Railway Company of Point Pleasant, N. J.

The Florida Supreme Court has affirmed the judgment of the lower court, which recognized the right of the City of Jacksonville to furnish lights for commercial purposes.

GENERAL ELECTRIC'S FINANCING POLICY.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

HOW BONDS ARE MANUFACTURED FOR NEW ENGLAND INVESTORS.

The Austin Electric Company.

The condition and history of the Austin Electric Company possesses more than usual interest from the fact that after many vicissitudes the plant finally became the personal property of Mr. Charles A. Coffin, who still owns it. Mr. Coffin's fortune is variously estimated now from —$250,000 to +$3,000,000. Whatever it may be, we cannot help but wonder how many securities like those of the Faribault and Austin companies go to make up his pile. The fact, however, that the Austin stock was not unloaded on some outsider does not detract in the least from the justice of our arguments against the swindling methods of Coffin and Byllesby, but rather strengthens it. The stock has been offered to dozens of people in the past three years, and would have been sold if possible. The reasons why it has not been unloaded are the same reasons which account for the slump of General Electric stock from 119 to 25⅞, the winding up of the Northwest Company's campaign, and all the humiliating history of the General Electric enterprise since the summer of 1893, to wit: the loss of public confidence, brought about by the exposures of ELECTRICITY.

The lighting plant in the town of Austin, Minn., was first started in the fall of 1888, by the same gentlemen who put in the plant at Owatonna, and it was put in in much the same way. Pierce Bros. were honest country boys who had read of the fabulous sums to be made in electric lighting. They wanted to try the business, yet had shrewdness enough to keep their money and place the chief burden from the start upon the company whose agents sold them the apparatus and who made such glowing misrepresentations. They had no desire to humbug any one, but they did not propose to be humbugged. And it is on record that when they retired from the electric lighting field the field owed them nothing.

Acting under advice from the Northwest Company's agents, they procured a franchise in the town of Austin, a copy of which we offer in evidence:

[*Certified Copy.*]

ORDINANCE No. 115.

An ordinance granting Pierce Bros. the right to use and occupy the streets, alleys and public grounds in the City of Austin, to erect and maintain poles and wires thereon for electric light and power purposes.

The Common Council of the City of Austin do ordain:

Section 1. That the right, permission and authority is hereby granted to Pierce Brothers (S. H. Pierce & W. S. Pierce), their heirs and assigns, for the term of *twenty-five* years from the date of the passage of this ordinance to erect and maintain in any and all of the streets, alleys and public grounds of the City of Austin, Mower County, Minnesota, poles for electrical purposes, and to place wires and fixtures thereon, also to repair or remove said poles and wires at any time as may be necessary or expedient, provided, however, that the rights hereby granted are subject to the following conditions:

1st. The franchise hereby granted shall not be exclusive.

2d. The right of the City of Austin to use the tops of said poles for *fire alarm purposes* free of charge.

3d. The right to regulate the manner and places in said streets where the same shall be placed, not exceeding *one hundred and twenty-five* (125) *feet apart*, is hereby reserved to the Common Council of the City of Austin, by resolution or ordinance, or by its committees and the right to provide by ordinance or resolution *prohibiting excessive charges* for light to the citizens and inhabitants of said City of Austin.

Amendment to Section one (1) offered by Alderman West, by adding thereto the following:

And provided further, that in the event of said electrical plant not being operated for the space of *sixty days* the City Council may require the poles herein authorized to be removed by said Pierce Bros., or their successors or assigns; and provided further that the franchise hereby granted shall terminate and be null and void upon a failure of said Pierce Brothers, or their successors or assigns, to keep said electrical plant in active operation for the space of three months; and provided further that the City of Austin reserve the right to terminate the franchise hereby granted at any time after ten years by purchasing said electrical and power plant at the actual cost thereof and the actual cost of the poles, wires, lamps and other fixtures.

Section 2. This ordinance shall not be valid as a franchise unless said Pierce Brothers shall, within thirty days from the passage of this ordinance, file with the City Recorder their acceptance of this ordinance and consent to comply with all reasonable ordinances or regulations that may be passed, regulating the maintenance of said poles, and conducting the business of maintaining an electrical plant under this ordinance, and shall have said plant in operation within seven months from the date of the passage of this ordinance.

Section 3. This ordinance shall effect and be in force from and after its passage and approval.

Passed this 8th day of November, 1888.
Approved this 12th day of November, 1888.
Published this 22d day of November, 1888.

Attest: Approved November 12, 1888.
JOHAN WOLD, City Recorder.
O. W. GIBSON, Mayor.

The plant lost money steadily and piled up a large indebtedness with the Northwest Company at St. Paul. At length, in the spring of 1892, Mr. H. M. Byllesby, having taken charge of Mr. Coffin's exploiting and financing work in the Northwest, directed his attention to the Austin plant. It answered all the requirements for the application of the Coffinesque plan. It was losing money, was in an out-of-the-way place, and had never been stocked or bonded. It was ripe for capitalization. Accordingly the Austin Electric Company was incorporated, with $50,000 stock and $50,000 bonds planned to be issued. A copy of the original incorporation papers follows:

[COPY.]

ARTICLES OF INCORPORATION OF THE AUSTIN ELECTRIC COMPANY.

We, the undersigned, for the purpose of organizing and becoming a body corporate under and by virtue of the laws of the State of Minnesota, in such cases made and provided, have adopted and executed the following Articles of Incorporation.

ARTICLE FIRST.

I. The name of this corporation shall be the "Austin Electric Company."

II. The general nature of its business shall be (a) to construct, maintain and operate a plant or plants for manufacturing and generating electricity.

(b) To manufacture, sell and supply electricity for light, heat and power.

III The principal place of business of said corporation shall be in the city of Austin, county of Mower and State of Minnesota.

ARTICLE SECOND.

The time of the commencement of this corporation shall be April 4, 1892, and the period of continuance of said corporation shall be thirty years from said date.

ARTICLE THIRD.

The amount of the capital stock of this corporation shall be fifty thousand ($50,000) dollars, and the same shall be paid in at such times and in such manner as the Board of Directors of this corporation may designate.

ARTICLE FOURTH.

The largest amount of indebtedness or liability to which this corporation shall at any time be subject shall be the sum of fifty thousand ($50,000) dollars.

ARTICLE FIFTH.

The names and places of residence of the persons forming this association for incorporation are as follows: Henry M. Byllesby, St. Paul, Minn.; Howard C. Levis, St. Paul, Minn.; Benjamin F. Meek, Jr., St. Paul, Minn.; Wentworth P. Johnson, St. Paul, Minn.; Winfield S. Pierce, Austin, Minn.

ARTICLE SIXTH.

I. The government of this corporation and the management of its affairs shall be vested in a Board of five Directors, each of whom shall be a stockholder, and in the following officers, viz., a President, Vice-President, Secretary and Treasurer, and such other officers and agents as the Board of Directors may from time to time appoint.

II. The Directors shall be elected at the annual meeting of the corporation on the first Monday in April in each year.

III. The officers of this corporation shall be elected annually by the Board of Directors at their first meeting each year immediately after the annual meeting of the stockholders.

IV. The President, Vice-President, Secretary and Treasurer shall each be Directors, and their terms of office and the term of office of Directors shall be one year and until their successors are duly elected and qualified.

V. The names of the first Board of Directors of this corporation are: Henry M. Byllesby, Howard C. Levis, Benjamin F. Meek, Jr., Wentworth P. Johnson, Winfield S. Pierce, and they shall hold office until the first annual meeting in April, 1893.

ARTICLE SEVENTH.

The capital stock of this corporation shall be divided into five hundred shares of the par value of one hundred ($100) dollars each.

In witness whereof we have hereunto set our hands and seals this 14th day of March, 1892.

H. M. BYLLESBY.
HOWARD C. LEVIS.
BENJAMIN F. MEEK, JR
W. P. JOHNSON.
WINFIELD S. PIERCE.

Signed and sealed in the presence of
J. F. BISHOP.
A. A. BARRY.

State of Minnesota, County of Ramsey, ss.

On this fourteenth day of March, A. D., 1892, before me personally appeared Henry M. Byllesby, Howard C. Levis, Benjamin F. Meek, Jr., Wentworth P. Johnson and Winfield S. Pierce, to me well known to be the same persons who executed the foregoing instrument, and each for himself acknowledged that he executed the same as his free act and deed for the uses and purposes therein expressed.

[Notarial seal] J. F. BISHOP.
Notary Public, Ramsey County, Minnesota.

Office of Register of Deeds, Mower County, State of Minnesota.

I hereby certify that the within instrument was filed for record in this office on the fifteenth day of March, A. D. 1892, at 4 o'clock P. M., and duly recorded in Book "E" of Miscl., page 95.

E. WOOD, Register of Deeds.

Filed for record in this office March 23, 1892, at 9 o'clock A. M. F. P. BROWN, Secretary of State.

It will be noted that, as in the case of all the other local companies organized by Mr. Coffin's exploiters. no local people were interested. We find again the names of Byllesby, Levis, Meek, Johnson, all employés of the Northwest General Electric Company, and W. S. Pierce, who was soon to become an employé of that company.

At this time there was no legitimate reason for any disposition of the plant other than closing it down and getting rid of the apparatus on the best terms possible. It had lost money every month, and the length of pole lines was such as to preclude any profit from the amount of lighting possible to be done in the town. Austin had in 1890 a population of 3,901 people—an ordinary country village. It had no large manufacturing establishments or other enterprises likely to use much light. It had three banks, with an aggregate capital of $150,000.

But the General Electric Company was at the high tide of prosperity, and Mr. Coffin had advised Byllesby that he could take an unlimited number of bonds, provided they did not cost over 60. Of course Mr. Byllesby's only desire was to "boom the business." He had no reason, from his point of view, to trouble himself about the ultimate gain or loss of the people who took the securities. It was no part of his duty to prevent his superior officer from swindling Eastern investors.

The records which we will present are perfect justification of our charge that there was no honest motive behind the capitalization scheme. The size of the town did not warrant it; the plant as it stood was thrown together for a speculation and was unfit for even the small amount of business done The manager wrote to the home office in 1893 as follows:

"This whole steam plant is an abortion from start to finish, and simply places on the company's shoulders the effects of the plans and work of a combination of a pack of fools."

Now let us see the actual results after Mr. Byllesby had taken hold and issued $50,000 of securities, as shown by the record of the first twelve months under his control:

[COPY.]

AUSTIN ELECTRIC COMPANY.

STATEMENT OF EARNINGS AND EXPENSES FOR TWELVE MONTHS ENDING MARCH 31, 1893.

Earnings.

	Inc.	Arc.	
April	$336 88	$154.50	
May	335.24	153.25	
June	333.77	147.50	
July	340.12	176.00	
August	359.76	154.10	
September	375.06	155.00	
October	381.27	156 00	
November	406.11	157.25	
December	418.90	149.50	
January	336.59	174.35	
February	278.52	148.20	
March	239.84	141.50	
	$4,142.06	$1,867.15	$6.009.2

Expenses.

Salaries of officers and clerks	$503.80	
Salaries of engineer and fireman	1,129.10	
General expense	296.69	
Traveling expenses	25.35	
Fuel	1,154 46	
Oil and waste	74.02	
Water	39.22	
Repairs to electric plant	271.99	
Repairs to steam plant	68.68	
Discount	273.81	
Taxes	87.36	
Insurance	272 50	
Carbons	113.35	
Lamps	411.15	
Legal expense	70.20	
Boiler compound	8.25	$4,799 9
Surplus for one year		$1,209.

Here we have a surplus of receipts over disbursements of $1,209.28.

The trial balance, taken off at about the same time, showed a plant account of $49,040.50 and *debts* of only $401.30. The plant account in all these statements is the amount at which these companies were carried on the books of the Northwest General Electric Company—the amount which they had cost. The trial balance follows:

[COPY.]

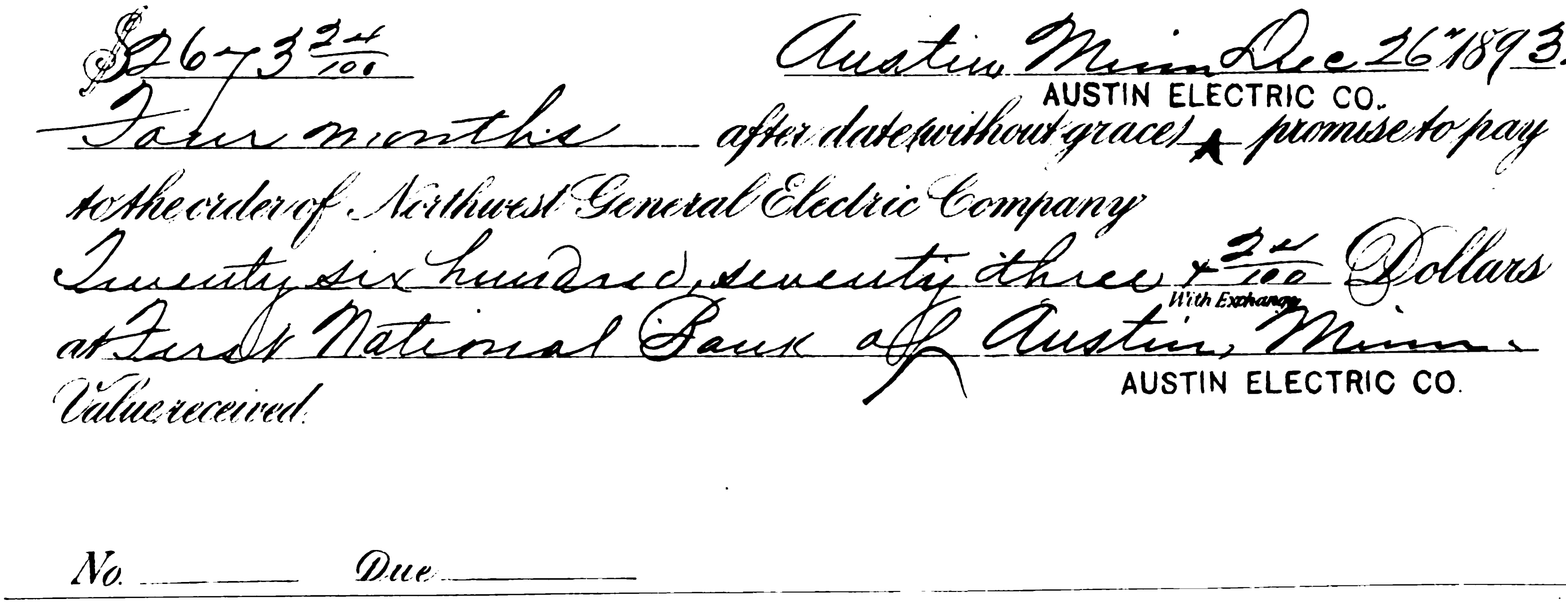
AUSTIN ELECTRIC COMPANY.

TRIAL BALANCE FOR FOUR MONTHS ENDING MARCH 31, 1893.

Plant account	$49,040.50	
Steam plant	242.50	
Electric plant	132 00	
Street lines and wire	103.47	
Transformers	147.70	
Wiring	99.13	
Tools and fixtures	18.00	
Buildings	23.10	
Office fixtures	38.73	
Cash	50.02	
Organization expense	500.00	
Accounts receivable	416.72	
Cooley & Vater	25.11	
Officers and clerks	201.90	
Engineer and fireman	350.00	
Fuel	120.87	
Discount	110.27	
Insurance	242.73	
Lamps	112.25	
Taxes	87.36	
General expense	49.66	
Carbons	50.00	
Water	36 72	
Repairs to electric plant	40.30	
" " steam plant	12.42	
Oil and waste	14.82	
Traveling expenses	22.40	
		$52,288.70

Credits.

Capital stock	$50,000.00	
Northwest General Electric Co.	401.30	
Earnings	1,887.40	
		$52,288.70



$2673 24/100 Austin Minn Dec 26th 1893.

AUSTIN ELECTRIC CO.

Four months after date (without grace) promise to pay

to the order of Northwest General Electric Company

Twenty six hundred, seventy three & 24/100 Dollars

With Exchange

at First National Bank of Austin, Minn.

Value received

AUSTIN ELECTRIC CO.

No. ______ Due ______

AN OBJECT LESSON IN NORTHWEST G. E. EXPLOITING WORK.—(Fac-simile.)

The shortage of the first year's operations may be reckoned thus:

6 per cent. depreciation on $49,040.50	$2,942.43
6 per cent. interest on $50,000 stock	3,000.00
	$5,942.43
Deduct net earnings	1,209.28
Total deficit	$4,733.15

But the longer the plant was run the worse its condition became.

The proportion of earnings to operating expenses, given above, could not be maintained, and was at various dates as follows:

	Earnings.	Exps.	Surplus.
4 mos. ending March 31, 1893	$1,887.40	$1,451.70	$435.70
5 " " April 30, "	2,277.34	2,123 86	153.48
6 " " May 31, "	2,642.14	2,506.93	135.21
7 " " June 30, "	2,993.16	2,775.45	217.71
8 " " July 31, "	3,305.22	3,138.16	167.02
13 " " Dec. 31, "	5,921.84	5,342.17	579.67

At the same time the debts were increasing constantly, and it is evident that the only way a "surplus" could have been counted at all was by deceptive manipulation of accounts. The money owed was chiefly for supplies bought of the Northwest Company, as the Austin Company had no credit elsewhere, and frequently had to borrow coal from the city. The debts grew as follows:

March 31, 1893	$401.30
April 30, "	942.18
May 31, "	729.91
June 30, "	729.91
July 31, "	888.34
Dec. 31, "	3,904.32
March 31, 1894	7,586.16

At the latter date, while the company's insolvency was becoming more and more conspicuous, all the time the Northwest Company had gradually *raised* the amount at which the Austin Company was carried as an asset, as shown by the plant account in the following:

[COPY.]

AUSTIN ELECTRIC COMPANY.

TRIAL BALANCE MARCH 31, 1894.

Plant account	$53,767.11	
General office expense	210.00	
Salary superintendent	650 00	
Wages engineers and firemen	568.06	
General expense	19.89	
Fuel	754.75	
Accounts receivable	473.45	
Water	41.78	
Repairs to electric plants	3.00	
Repairs to steam plant	59.62	
Discount	42.24	
Interest	3.00	
Taxes	145.51	
Insurance	257.50	
Street lines and wire	8 90	
Carbons	50.45	
		$57,055.76

Credits.

Capital stock	$50,000.00	
Notes payable	3,476.87	
Earnings	1,987.74	
General Electric Company	562.95	
Accounts payable	469 62	
Profit and loss	558.58	
		$57,055.76

We will leave to Mr. Coffin and Mr. Byllesby the task of explaining how any company could have a surplus of earnings over expenses from month to month, while its debts were constantly growing, and with no increase in real assets.

As before stated, the Austin plant is one of Mr. Coffin's gems. It is all his. In May of this year he offered it for sale very cheap, and in his letter to a prospective customer enclosed the following statement:

[COPY.]

AUSTIN ELECTRIC COMPANY, AUSTIN, MINN.

COMPARATIVE FINANCIAL AND INCOME STATEMENTS.

Assets.

	May 31, 1894.	Dec. 31, 1894.
Cost of plant	$53,595.58	$53,854.69
Supplies on hand	65.00	
Accounts receivable	646.10	1,095.28
Cash		32.36
Profit and loss (deficit)	1,279.48	231.02
	$55,586.16	$55.213.35

Liabilities.

Capital stock	$50,000,00	$50,000.00
Bills payable	5,476.87	
Accounts payable	2,030.49	5,213.35
Cash (per draft)	78.80	
	$55,586.16	$55,213.35

COMPARATIVE INCOME STATEMENT.

	Gross Earnings.		Gross Expenses.		Net Earnings.	
	1893.	1894.	1893.	1894.	1893.	1894.
January	$482.75	$667.57	$421.24	$621.84	$61.51	$45.73
February	399.49	640.58	394.34	587.64	5.15	52.94
March	377.86	679 69	395.19	592.65	17.33	87.04
April	374.17	623.26	359.80	615.14	14.37	8.12
May	389.73	640.80	346.60	626.64	43.13	14.16
June	339.85	648.55	340.43	555.72	.58	92.83
July	304.63	651.69	257.73	498.44	46.90	153.25
August	474.70	644.65	293.93	558.71	180.77	85.94
September	466.80	712.96	419.62	559.57	47.18	153.39
October	487.88	792.57	456.44	673.32	31.44	119.25
November	612.13	876.87	549.67	675.42	62.46	201.45
December	698.71	878.66	573.20	733.80	125.51	144.86
	$5,408.70	$8,457.85	$4,808.19	$7,298.89	$600.51	$1,158.96

1895.	Gross Earnings.	Gross Expenses.	Net.
January	$837.89	$679.73	$153.16
February	780.96	640.80	140.16
March	783.23	602.37	180 86

It will be noted that the plant had apparently improved its condition between March and December of last year. The debt had decreased to $5,213.35 and cash in bank had been raised to the magnificent sum of $32.36.

We will leave for the concluding chapter a consideration of the amount of the actual investment in the Austin plant as shown by the official inventory.

FRANKLIN L. POPE.

Resolutions of the American Institute of Electrical Engineers.

At the regular monthly meeting of the Institute of Electrical Engineers on October 23d the following resolutions were adopted:

Whereas, The American Institute of Electrical Engineers has heard with heartfelt sorrow the sudden death by a lamentable accident of its past President, Franklin Leonard Pope; and

Whereas, We the Members, Council and Officers of the Institute desire to express our profound realization of the bereavement we have sustained, and the sincere grief we experience, and to record in fitting terms our keen appreciation of the great worth and high qualities of our late fellow member, his eminent services to our organization, and his able, unwearying and successful work in applying electrical energy to many useful purposes. It is therefore

Resolved, That by the death of Mr. Pope, called away in the full fruition of manhood and the meridian vigor of intellect, the profession at large has suffered an incalculable loss, and the Institute has been deprived of a most distinguished and valuable member and a wise and sagacious counsellor, endeared to many members by long, pleasant and affectionate intercourse, and esteemed and respected by all, no less for his kindly and warm-hearted nature and dignified simplicity of character, than for his universally acknowledged genius and great ability.

Resolved, That we hereby express the poignant grief wherewith we contemplate the sad event which has taken from us one who, whether in the earliest days of our Association, co-operating in its successful establishment, urbanely and efficiently presiding as our chief executive officer at business and social meetings, discreetly and judiciously performing the unassuming duties of a member of the Committee on Editing, or in the capacity of an individual member conserving the interests of harmony and stability, has uniformly had the dignity of the Institute at heart, and has assiduously, cheerfully and faithfully labored for its welfare.

And while we sincerely mourn the loss of an associate so eminent and useful, thus suddenly withdrawn from the activities of this present life, we most earnestly grieve for the parting from a friend so sincere, faithful and true.

Resolved, That we extend to his stricken family our tenderest sympathy in this the hour of their affliction, and that in testimony thereof a copy of these resolutions be forwarded to them.

Resolved, That these resolutions be appended to the minutes of the Council, and be published in the Transactions of the Institute.

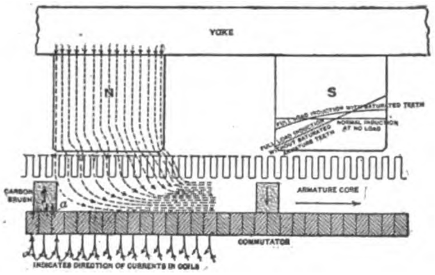
THE BEHAVIOR OF THE CARBON BRUSH ON THE COMMUTATORS OF DIRECT CURRENT POWER GENERATORS.*

BY HARRIS J. RYAN.

The experience of electrical engineers during 1880 to 1890 with dynamo electric machinery of magnitude was almost without exception in connection with generators for supplying incandescent lighting currents. Such generators were generally of the two-pole type with smooth-bodied armature cores, on the surface of which the conductors were mounted and secured in place by means of binding wire. Self-induction of the sections of such armatures was a minimum. The air gaps were large and the M. M. F.'s used for the establishment of the armature induction were in the sizes of generators then in use easily maintained ahead of the maximum M. M. F. of the armature when delivering its full load current. Under these circumstances it was easy to maintain a suitable set of conditions for the successful commutation of the currents by means of metallic brushes, which at that time were universally used. Being used for electric lighting, these generators had a load output that fluctuated slowly, and the attendant from time to time, as the load shifted, would adjust the brushes to that neighborhood of the magnetic fringe under the leading pole tips where the E. M. F. generated by the mechanical motion of the conductors, connected to the commutator segment passing under the brush, would be sufficient to oppose the E. M. F. of self-induction and reverse the current.

When electricity was applied to the propulsion of street cars at Richmond in 1888, for the first time with commercial success, it was found that the method of current commutation that had been an entire success for incandescent lighting was utterly unsuited for the purposes of power supply for such street railway service. At this time Mr. Van Depoele, later connected with the Thomson-Houston Electric Company, thought of the use of carbon in the place of metal for taking the current from the commutators of power generators engaged on this class of work. The idea was tried and found to be a great success, and it is altogether likely that a far greater part than people have thought of the success of the electric street railway has been due to the use of the carbon brush on the street railway generators and motors. In connection with the motors, as well as with the generators, it was found that so long as metallic brushes had to be used the commutators suffered serious disintegration due to the sparking that ensued with the use of metallic brushes, because an attendant could not keep up the changing of the commutation point with every change of the load, for these changes of load both in the motors and generators were found to take place so suddenly, and to vary constantly, that it would be impossible for the attendant, giving his entire time to a set of brushes, to keep them at the non-sparking point of the commutators in those cases where the time of such an attendant could be afforded. It is interesting to note, therefore, just in what manner the carbon brush takes the current off the commutator so that it is unnecessary to have the brushes moved from point to point with every variation of load in order to avoid sparking.

In the Figure, the carbon brush to which we will direct our attention is on the left. On the left side of this brush the current in the armature is traveling from left to right; the opposite of this is the case on the right side, as indicated by the arrow heads below the commutator bars. As the bar, therefore, passes under this brush, as the armature rotates from left to right, the current in the armature coil that is connected to this bar at one end and to its neighbor at the other must be completely reversed. This coil is located in a groove in the armature and is therefore nearly surrounded by laminated iron so that its self-induction is comparatively high. The self-induction E. M. F. formed on the sudden reversal of the current in such a coil is, therefore, correspondingly high. Some sort of E. M. F. then must be available to oppose such self-induction E. M. F. with a balance sufficient to reverse the current against the ohmic resistance. The current delivered by the brush is taken from the commutator bars under it, as indicated by the arrow heads. For the sake of clearness let us number the bars under the brush by calling the left 1, the middle 2, and the right 3. Now remember that carbon has a high specific resistance, and study what happens to the coil when between bars in the position of 1 and 2, and then 2 and 3. Remember also that our purpose in this study is to see how it is that a carbon brush assists in the reversal of the current in the sections under commutation without the aid of E. M. F.'s generated in the fringe of the leading pole tips. To do this it is convenient then to assume that the brushes are in the normal diameter of commutation and that such fringe E. M. F.'s are absent. The armature winding to the left is active in delivering current to the brush through bar No. 1 over the restricted area of contact. This restraint area of contact presents considerable resistance to the passage of the total current from the left which gives rise to much local fall of potential. That diverts a considerable portion of the current through the coil between bars 1 and 2 to the brush through bar No. 2. The entire surface of this bar is under the brush, to which it connects with less contact resistance therefore than at No. 1. Thus far there is observed no tendency to reverse the current in the coil between the bars 1 and 2. A moment later this coil will occupy the same position as that between 2 and 3. What occurs in the position 2–3? The armature current from the right is being delivered to the brush as indicated by the arrow heads at *a*. Here again is a restricted area of contact constantly diminishing with increasing resistance, so that just before No. 3 moves from under the brush a high local fall of potential occurs that causes some of the total armature pressure to divert the current by way of the coil 2–3 against the current already in that coil, causing it to reverse quickly in opposition to the E. M. F. self-induction. It is in this way that the high specific resistance of the carbon brush is used advantageously for effecting the commutation of current without the aid of pole fringe E. M. F.'s. This property of the brush cannot be depended upon for the complete commutation of the full current without sparking, though in most generators with armatures of the iron-clad type where self-induction of the coils is highest, fully half of the current may thus be commutated. In street railway generator practice, therefore, it is usual to adjust the brush at no load into that neighborhood of the magnetic fringe of the leading pole tip where the E. M. F.'s mechanically generated are sufficient to reverse one-half of the normal current. These E. M. F.'s are not large enough to cause serious short circuiting of the coils under commutation at no load and assist the carbon brush to reverse the current at the full normal load. It is in this way that generators are now made to operate without disruptive effects of the commutator under the most trying conditions of load variation.


YOKE
N
S
FULL LOAD INDUCTION WITH SATURATED TEETH
NORMAL INDUCTION AT NO LOAD
FULL LOAD INDUCTION WITHOUT SATURATED ARMATURE TEETH
CARBON BRUSH
a
ARMATURE CORE
COMMUTATOR
INDICATES DIRECTION OF CURRENTS IN COILS

LOCAL ANNEALING OF HARD-FACED ARMOR PLATES.*

BY HERMANN LEMP, JR.

Every one is now more or less familiar with the Thomson electric welding process, which in the past year has been introduced in almost every metal industry in one shape or another. This process created a new field in the technical application of currents of large volume and small E. M. F., a field which, while it was primarily intended for welding, naturally suggested a number of other applications to so fertile an inventor as Prof. Thomson; and so it happened that early in its fundamental inception the use of large currents was contemplated to be utilized for heating plain metal bars or parts of sheet billets, etc., for forging purposes, to rivet, upset, to temper or withdraw the temper, or to be worked upon in any well-known manner while being kept heated by the current.

It has been the good fortune of the writer to lately work out one of these novel applications, and since the literature concerning this branch of electrotechnics is somewhat limited, he has thought it advisable to bring an account of the same before the Institute.

One of the latest advances in the making of protective armor for battle-ships, or even forts, has been the introduction of what is known as the Harvey process. For those not conversant with the latter, I will briefly state that it consists in taking an ordinary low carbon steel plate and introducing an additional percentage of carbon into the surface metal, thus changing the crust to the depth of about an inch into a steel resembling tool steel. A plate thus treated is lastly water-hardened, similarly to an ordinary tool, and by experience has shown to offer, under equal conditions, more resistance to the impact of a projectile than any other armor known. And therefore we will take this as an illustration of hard-faced armor. The extreme hardness of the surface of a Harvey plate, while exceedingly valuable in preventing projectiles from piercing it, has a disadvantage when it is required to be pierced by a drill and tap. Such holes may be required either for fastening ladders, swivels or other appliances to the hull of the vessel, or to fasten T flanges supporting the deck to barbettes or turrets.

The methods heretofore used to produce these holes were principally two:

1. To protect the surface of the plate in patches or strips, to prevent carburation, wherever holes were expected to be drilled.

2. To make accurate drawings and patterns of each plate beforehand, to which all holes are drilled before plate is hardened.

Plan No. 1 was practised in the United States until it had to be abandoned. In practice it was found that numerous alterations in construction, errors in either draughting-room or mills, made it necessary to pierce holes where no provisions for annealing were made. It also happened quite frequently that the method for prevention of carburation did not always work satisfactorily, and while white paint indicated well enough where soft metal was expected, very often hard metal was actually found. Hence it was patent from the first that some process was needed to rectify errors of this kind. Experiments were made with the oxy-hydrogen blowpipe, or the electric arc, to anneal such spots as were required to be drilled, and numerous mechanical devices for drilling, with drills of every design and method of tempering, were tried, until it seemed that the case was without a remedy.

It was at this stage that the problem was referred to the Thomson Electric Welding Company of Lynn, and experiments were immediately undertaken to solve it. The process and apparatus necessary to carry it out, all resulting from the experiments undertaken, will be described presently.

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* *The Sibley Journal of Engineering.*

* A paper presented at the 100th Meeting of the American Institute of Electrical Engineers, New York and Chicago, October 23, 1895.

The second method, which is used in England, has the advantage over the first that there is no difficulty in carrying it out provided there are no alterations made and no errors committed. The present method of construction seems to be to make, beforehand, a complete *model* of the vessel to be built; then make accurate drawings and full-size patterns of every plate, giving the exact location of every hole. These are then bored, tapped and countersunk to a depth of approximately ⅜'' and of a much larger diameter, filled with clay, and then the plate as a whole is heated and hardened with water. (See Fig. 1.)

This method works apparently all right, although in spite of drawings and models errors are made. There is no doubt, however, that it is a slow and very costly method of working, and would hardly ever be resorted to in the United States.

From the above it seems clear that there has existed a need for a process by means of which isolated spots, regardless of location, might be annealed so as to permit drilling and tapping.

If by sending a current of large volume through any spot thus to be treated the spot is brought to a temperature of approximately 1000° F., there can be no doubt that the temper has been withdrawn. Experiments carried out to that effect at once showed, however, that upon taking off the heating current the heat was so rapidly conducted away by the surrounding metal masses as to cause the heated spot to become chilled just as effectually as if it had been plunged into cold water. No method of outside protection of the heated spot would prevent this, and the *gradual* cooling of the spot had to be attained by different means, namely, a gradual and slow withdrawing of the heating current. The method of introducing the annealing current is best shown in Fig. 2.

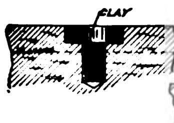


FIG. 1.

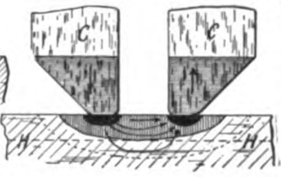


FIG. 2.

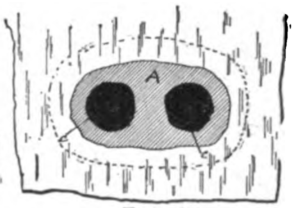


FIG. 3.

C C are two copper contacts cooled by water circulating inside. The current enters the plate by one end and leaves it by the other. Right under the contact, the metal comes to a bright cherry heat (shown in black), while the portion intervening and partly surrounding the contacts acquires a temperature of just a visible red. Line H H indicates where the influence of the Harvey treatment stops.

The shaded portion in Figs. 2 and 3 shows the zone softened and ready to be machined, while the dotted line shows how far the heat radiation would cause the metal to turn blue. When cooled, the annealed portion shows a chocolate color, while the place where the contacts have been resting is scaled and hard, and cannot be touched by a tool to a depth of about ¼''. These places can again be annealed later on, if required.

The apparatus necessary to carry out this process consists of the generator, the annealer proper (transformer) and the regulating apparatus.

The generator is commonly a separately excited alternator of variable potential, of a maximum of 300 volts and 100 amperes. The frequency, preferably, should be low, 50 cycles per second being used. When more than one annealer is to be run simultaneously from one generator, constant E. M. F. of the latter should be used, and each annealer regulated separately by a reactive coil. The annealer proper is a transformer similar to the well-known welding transformers. As the apparatus is to be operated outdoors, on board of vessels during construction, it is important that the same may be handled with immunity from electric shocks, even when operated in mist and rain.

To meet these conditions a copper-clad type of transformer is used, one in which the secondary is composed of two copper castings each having a rectangular groove, which two halves, when bolted together, form a closed rectangular frame in which the primary is held enclosed. The hollow space intervening between primary and secondary is moreover filled with a heavy oil, which acts both as the insulator and conductor of heat from primary to secondary. The secondary, by completely surrounding the primary, affords an excellent mechanical protection, and prevents electric as well as magnetic leakage. The primary is a copper ribbon insulated with asbestos, and the ratio of conversion is 100 to 1. The transformer has two trunnions fastened to its sides, in a line a little above the center of gravity, which trunnions swing in bearings, part of a yoke which straddles the whole. The yoke in its turn has a hook which may be secured to the latter at any place of the arch, thus allowing the transformer to be suspended, like a compass in gimbals, in any position desired.

It goes without saying that the copper castings which compose the secondary are cut through at one place in the circuit. On either side of the cut, two short platforms form the base for copper contacts of various shapes and sizes, by means of which the currents are made to enter and leave the plate to be annealed. These copper contacts are of forged copper, hollowed out to receive water circulation for cooling purposes, and terminate in narrow tips rounded at the end.

The weight of the whole annealer, being approximately 1,000 pounds, is sufficient to give proper contact pressure for all work on a horizontal plate. When inclined surfaces, vertical or otherwise, are to be worked upon, the transformer is suspended so that its weight shall not interfere with the contact pressure, which is obtained for work by bracing the contacts directly with wooden wedges against any object near by. On the outside of a hull, it is proposed to use a pair of electro-magnets, which are made to hold themselves against the iron hull, and form a support for the annealer.

The remarkable thing is the great amount of current that is being carried by the copper contacts into the plate. The contact surface is seldom more than about ½'' square, and yet 10,000 amperes are made to flow through it continually. This is equivalent to 40,000 amperes per square inch, a density which is only possible on account of the thorough cooling by the water circulation.

The regulating apparatus is in most cases simply a rheostat in series with the field of the generator. When more annealers than one are run simultaneously from one generator, as mentioned before, a reactive coil is interposed between the two, and this latter has been made automatic; that is to say, provided with a dash-pot, which permits the current to be reduced uniformly and at any given rate it is set for.

This reactive coil, Fig. 4, is composed of a solenoid coil of cable, well insulated, having a movable laminated iron core which is raised out of the coil by means of a leather strap and winch. The core is composed of thin iron strips placed side by side around a circle and projecting radially from the same, and being held on top and bottom by a slate disk, in a manner similar to the securing of the copper segments of a commutator. No insulation of the core is necessary, and good ventilation is obtained. The core once raised out of the coil tends to return by gravity and the attraction of the solenoid, but is checked in its descent by a pair of dash-pots, one on each side of coil. These latter communicate with each other, top and bottom, and have one of the pistons provided with a valve which opens when the core is raised, and closes when the core descends. The dash-pot cylinders are filled with a light mineral oil, which does not freeze nor clog under any ordinary conditions of temperature. An adjustable by-pass valve allows the oil to flow from the tube to the top side opposite. By opening or closing this valve more or less, any rate of descent, and consequently diminution of current, can be uniformly obtained, without requiring any skill on the part of the operator.

The annealing operation is carried out as follows: The transformer is placed in position the contacts touching the plate either side of the place marked to be annealed, and the primary current brought up by means of a rheostat to from 75 amperes to 90 amperes for about two minutes, according to the size of spot to be annealed, which will bring the metal to a dull red heat, a temperature at which a pine stick catches fire when held in contact with the plate. If no reactive coil is used, the current is now diminished by turning the rheostat one point every minute. If the reactive coil is used, the core is now raised by winch, the coil put in circuit by opening a short-circuiting switch, and then is allowed to descend on its own account. The operation generally takes *seven minutes*, all told. No difficulty has been experienced from the beginning. The annealing of individual spots was, however, only the stepping-stone to a more important work of a similar nature, work which was about to be given up, owing to what was considered insurmountable difficulties.

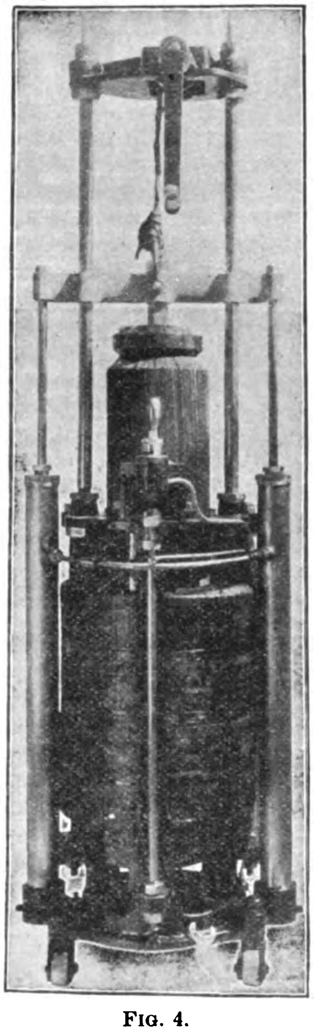


FIG. 4.

In the construction of a modern man-of-war, there are many armor plates which act as shields to the guns, and have to be perforated to allow the gun muzzle to pass through and to be either raised or lowered. Some of these shields are circular or oval with narrow edges around the ports. In the case of

Harveyed plate, to perforate these shields after carburation and before being water-hardened was the only possible way, since previous experiments had shown that prevention of carburation could not be relied on, and no process was known to anneal the plate locally after hardening. The hardening of a plate once perforated showed itself to be, however, almost impossible; in fact, a matter of chance. In most cases the plate cracked in two, as shown in Fig. 9, or the whole plate became distorted in such a way that it could not be used. As individual spots for holes could be annealed, there could be no doubt that a series of annealed spots could be likewise obtained by the electric process, following a line along which a cutting tool was expected to be run. The first attempt, therefore, and made in England, was to anneal a number of spots in proximity to each other in such a way that the annealed zones should overlap each other.

As described above, it is very important that the temperature of any individual part should be gradually and slowly withdrawn; and while for individual spots the only possible way was to do this by gradually diminishing the current, it was obvious that when a line was to be annealed, instead of annealing a number of spots side by side, the same effect of withdrawing the heat gradually from one portion could be obtained by moving the apparatus itself relatively to the plate to be treated. The rate of this movement, of course, depended upon the rate at which the temperature should be allowed to fall in any particular spot to prevent chilling. The apparatus was therefore arranged to be moved along a line to be annealed, the motion being obtained by an ordinary screw and nut held in a bracket, the nut being turned at a predetermined rate controlled by a watch. It was found that a speed of about ¼″ per minute was sufficiently slow to ensure thorough annealing.

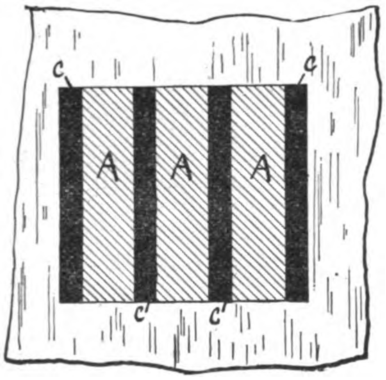


FIG. 5.

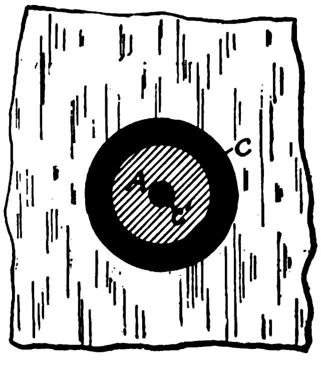


FIG. 6.

The copper contacts were of the simplest kind, as described above, bedding themselves partially in the surface, and when being dragged along by the screw and nut raised in front of themselves a burr or chip similar to a planing tool. After a whole day's continuous use the copper contacts were found intact, while a number of chips from the steel surface were lying about. We thus had the peculiar phenomenon of a hard steel chip cut with a copper tool.

Upon the completion of the work, it was found that a strip about 2¼″ wide throughout the length over which the machine had been moved could be operated upon by drills or a shaper, in a manner as easily as if it had never been hardened before.

In the work just described, the apparatus was moved about, but in regular practice it would be better to construct a machine consisting of a large bed, on which the plate to be treated may be fastened and moved in any direction automatically at a predetermined speed, while the annealer proper is suspended in a given position above plate, as shown in Fig. 10. The annealing operation occupies but a small percentage of the time required for the cutting.

It is unnecessary to state that when the apparatus is used for continuous annealing, the primary current is kept at a nearly constant value, the diminishing of heat at any individual spot being obtained solely by the moving of the apparatus from it. As mentioned before, the places where the contacts are passing over the plate, being brought to a higher temperature than any other, remain hard. Experience has demonstrated, however, that they may be re-annealed later on by treating the spots in the same way as any other hard spot on the plate. By this means we are therefore able to anneal any shaped portions, not merely lines. This is best seen in Fig. 5, in which a series of strips are annealed side by side (shown in shaded lines A). The hard-faced surface is then removed on such places by a planer and drill; the machine is then run a second time over the annealed strips, resting it this time on the bottom of the groove and on the softer metal, thus annealing the ridges C left between the annealed strips, on which ridges the contacts were running previously. When all these strips are annealed they may be removed by machine tools without any further difficulty. In a similar manner a large round place may be annealed, as shown by Fig. 6. The transformer is set on the plate, one contact resting on C′, the other at any other place in circle C; the apparatus is then slowly revolved around contact C′ as a center, until the second contact has completed the circle C. The shaded portion A represents now the annealed surface, which is removed by a cutting tool. The contacts are then made to rest on either side of the center C′, and the latter is annealed and removed in its turn.

The apparatus may also be used for the reversal of the annealing process; that is to say, for creating isolated hard spots in soft tool steel by sending a current through the spot to be hardened until it reaches a bright cherry heat, and then suddenly removing the current or machine.

Various other applications will suggest themselves in the operation of this process, already adopted by the United States Government. It may be used in the construction of burglar-proof safes, for dies and punches, for projectiles, and other articles of a similar nature.

Y. M. C. A. Business Institute.—Popular Lectures.

The Twenty-third Street Branch of the Young Men's Christian Association of this city is very fortunate in securing as Instructor of Electrical Engineering in their Educational Department Frederick M. Pedersen, E.E., Assistant Engineer of the Crocker-Wheeler Electric Company. A course of fifty lectures will be given on Wednesday and Saturday evenings throughout the winter. The lectures will be grouped under four general divisions as follows:

1. Introduction. Fundamental Units.
2. Sources of Electricity.
3. Electrical Measurements.
4. Chief Commercial Applications of Electricity.

All young men interested in such a course may obtain full information by applying in person or by letter to the Educational Director, No. 52 East 23d street, New York City.

Three electric freight engines are in the course of construction at the Baldwin Locomotive Works, under the direction of engineers of the Westinghouse Electric and Manufacturing Company. Two will be used for switching purposes, and the other is to be placed on exhibition.

The Microphone Question.

We are in receipt of the following two communications from "Hello," which although almost too long for publication we give in full, requesting, however, that our correspondent, from whom we are always glad to hear, will endeavor to be more brief.

To the Editor of ELECTRICITY.

Sir: Begging pardon for my seeming positiveness in my last communication, October 9, and showing such lamentable ignorance (any ignorance short of infinite wisdom is lamentable) of the subject of acoustics, I will try to be more moderate.

I enter this discussion realizing full well the superior advantage an editor has in an argument of this nature. However, I feel that the editor of ELECTRICITY will not take advantage of his position to extinguish his opponent. Further, I desire more light upon this subject, and I presume there are others in the same boat. If I am wrong no one will be more willing to accept the truth as it may be shown. Though I have studied these subjects for years, yet the more I study the less I think I know.

You ask: "On what does 'Hello' base his statements that improvements in the microphone have been in the line of Reis not the Berliner (method)?" All the difference I can see between the Reis and Berliner inventions is in the "opposing" electrodes (I use Berliner's expression), that is, the electrode held against the vibrating plate (1). In the Berliner the opposing electrode is "rigidly-held" while that of Reis is flexible. Not one of the many microphones of the present day has a rigidly held opposing electrode, so far as I have been able to discover. Even the Hunnings type has in reality flexible opposing electrodes.

To prove that I am not in the wrong in stating that tones cannot be produced by making and breaking the circuit would take up too much of your space for me to have the face to ask. I reiterate here that tones cannot be produced by a make and break circuit, that is, by a Reis microphone. In my former communication I did not so qualify my statement, supposing since we were discussing microphones that it would be taken for granted that I meant that tones cannot be produced by a Reis microphone by making and breaking the circuit. (2). Let me state right here that Reis's theory of how tones were produced by his microphone is not correct.

I am not way off when I say that experience has proven that in no other way can sound waves be transmitted by the agency of a battery 'phone other than that of varying the pressure between the electrodes. I was discussing what the Supreme Court said about battery 'phones transmitting sound waves by impinging sound waves against a diaphragm. Any fool knows that a vibrator or buzzer is made by a make and break contact. Reis's telephone was not either of these (3).

"Bell specified several methods, one of which was by varying the depth of immersion of one of the electrodes in the liquid." Is not this one method by which the electrodes are in constant contact? Bell did not mention constant contact in his claim. In this you are right, but the constant contact is there all the same and goes with the patent which is now public property. Bell had a constant contact method prior to Berliner, and to Bell, if either, belonged the broad claim of constant contact. Gradually increasing and diminishing the resistance is one and the same thing as constant contact, because if the contact be not constant the contact is a make and break and consequently the increase and decrease is instantaneous, not gradual, as required by Bell's 4th claim. Bell's sinusoidal curves cannot be made by a make and break contact, for during the interval of open contact the line ceases to be a curve and becomes a right line. "Berliner claims to have discovered that this method (constant contact) was effective and patented it." He may have discovered the theory, but he certainly was not the first to produce the art. The discovery of a theory is not patentable, but a discovery of an art is. Art is not theory, nor is theory art.

I might rest my argument right here, but let us look at this from another standpoint. If to Berliner belongs the broad claim of a constant contact, and had Bell attempted to use his liquid electrode method as he described and claimed in his '76 patent, Berliner could have stopped him from using it upon the plea that Bell's electrodes were in constant contact. Right here a decision of the Supreme Court is apropos. "A broad claim so expansive as to exclude all previous or future inventions for the same purpose is invalid," 1 Wall, 531.

To show that Bell's knowledge and foresight were such as to forestall any such claim as made by Berliner, I copy from his '76 patent, page 1, beginning at line 26: "The advantages I claim to derive from the use of an undulatory current in the place of a merely intermittent one are . . . second, that a closed circuit and single main battery may be used . . . . fifth, and that as the circuit is never broken a spark-arrester becomes unnecessary." (A spark arrester becomes necessary when an intermittent current is used.) Bell expressly states that a make and break circuit produces an intermittent current. Bell's whole invention is based on an undulatory current whose continuity is never broken be it an induced current or a battery current—whether it be a magneto 'phone or a battery 'phone. The circuit being never broken, the electrodes are always in constant contact. HELLO.

Chicago, October 17.

To the Editor of ELECTRICITY.

Sir: I notice in your remarks in reply to a correspondent of yours, October 16th issue, under the caption of "The Telephone Situation," in which you assume that the intention of the inventor limits the scope of his invention; that the theory of the inventor limits his invention to his idea. Neither the law nor the courts will bear you out. The United States Court in speaking of a certain claim says: "The claim is not as broad as the invention." Applying the same to Reis's, his idea, his intention, his theory was not as broad as his invention. (4) Reis's invention belongs to the public no matter what his theory or idea was. It is laid down by the courts that "there can be no patent for a mere principle. The discoverer of a natural force or scientific fact cannot have a patent for that." According to your article, Berliner discovered a scientific fact, a theory, a principle, and is entitled to a patent thereon. The above quoted decision does not sustain you in this assertion. You say, "his (Reis's) instrument probably did, at times, transmit electrical undulations similar to those necessary for articulate speech." This is all the admission I want. The public owns his invention in all its entirety, no matter what was in his mind. His was not a lost art. All that he would have been entitled to had he taken out letters patent for his invention belongs to the public. It makes no difference what his views were, or what his intentions were, or a lack of knowledge of the scientific fact connected therewith. They would not affect his claim had he patented the art of transmission of articulate speech. This point has been decided times without number. Let us give your idea a practical application. (5) The public are prohibited from using a microphone constructed after the pattern of a Reis instrument because of Berliner's patent. How absurd. You see where your arguments will lead you. Your premises are entirely wrong.

(6) But no matter what your, Mr. Berliner's or my ideas may be, the question is how will the Supreme Court view it? All the members who decided in favor of Bell as against Reis, Drawbaugh and others are now dead—the Chief Justice who delivered the opinion died within four days after reading the opinion of the court. The Justices who sat in those cases now living are Justices Field and Harlan. Mr. Justice Bradley, now dead, in reading the dissenting opinion said: "Mr. Justice Field, Mr. Justice Harlan and myself are not able to concur with the other members of the court sitting in those cases, in the result which has been reached by them, without expressing an opinion on other issues; the point on which we dissent relates to the defence made on the alleged invention of Daniel Drawbaugh, and applies to all cases in which that invention is set up. We think that Drawbaugh anticipated the invention of Mr. Bell, who, at most, is not claimed to have invented the speaking telephone prior to June 16, 1875." If these Justices thought at that time that Drawbaugh anticipated Bell, they most assuredly think that Reis anticipates Berliner. What new light has since been thrown upon the subject to change their opinion? None at all. We have reason to believe that Mr. Justice Brewer concurs with them in that opinion, and at least one other Justice, basing our belief on the tenor of some of their decisions in telephone cases. This leaves the bench nearly evenly divided. Taking even chances on the remaining Justices, there will be at least six against Berliner to at most three for him.

I am now discussing the broadness of Berliner's claims, not the legality of his patent. I do not think his patent will be annulled. It is a good patent so far as it goes, but like all other specific patents, limited to "as shown and described."

On the other subject referred to, of the Watson patent, permit me to call your attention to the British patent No. 1958, dated May 12, 1880, sealed Nov. 12, 1880, expired May 12, 1894, taken out by George Lee Andrus, of Boston, and Thomas Augustus Watson, of Everett, Mass., containing 32 claims in number, all of which are now public property in the United States. From its specifications I extract: "Its essential features are a switching device which normally connects 'line in' with 'line out' by the weight of the telephone when the latter is on its support, and when the telephone is removed from its support automatically connects 'line in' to earth through the telephone, and is capable of being moved to a position so that 'line in' will be connected to earth through the telephone when the latter is removed from its support; a device which holds the switching device in its position when the telephone is not on its support, but releases the switching device by the action of the weight of the telephone when the latter is placed on its support, and a device which acts to return the switching device to its normal position when released."

The gravity switch of Rooseveldt will not expire until next May, yet all the other elements contained in claim 1 of the Watson patent No. 270,522 are included in the above-mentioned British patent. It will be seen that the British patent was issued before Watson's American patent. HELLO.

Chicago, October 19.

Replying to the above according to bracketed numbers:

(1) The generic difference between the Reis and Berliner methods is that in the former it was intended that the contact should *not* be maintained, and in the latter that it *should* be maintained.

As a matter of principle it does not matter whether the variation in pressure between the electrodes is permitted by the elasticity of the substance of the electrodes entirely or by that and an elastic mounting combined.

The soul of the Blake invention, for instance, consisted in the inertia of the weighted anvil. The soul of the Reis transmitter consisted in the almost entire absence of the inertia in one of the electrodes which enabled it to break contact upon the slightest vibration of the diaphragm.

Practically it does matter, because an elastic mounting of the electrode enables it to follow up the vibrations of the diaphragm through a wider range of vibrations without breaking contact, but the aim of the elastic mounting is to *prevent* breaking contact.

(2) There would doubtless be no difference of opinion between our correspondent and ourselves if we gave the same definition to the word "*tone.*" Musical sounds differ from each other in respect to *intensity*, *pitch* or *tone* and *character* or timbre.

Intensity, pitch or tone can be produced by a make and break circuit, as was employed by Reis. Character or timbre, which depends upon the *form* of the sound waves—upon the *number* and *intensity* of the various *tones* which make up the compound note—cannot be thus reproduced.

(3) Our correspondent's position on this question seems to us too absurd to admit of argument.

(4) Hello's contention that an idea is not patentable is, of course, correct. The mere accomplishing of results is also not patentable, but a new way of accomplishing results is patentable. It does not matter, as he says, whether the inventor's theory of how he accomplishes his results is right or wrong, but it does matter whether his method is the same as or different from existing methods. Supposing that it were true that articulate speech could be transmitted by means of interrupted currents as well as by undulatory currents, A patents a device which transmits speech by interrupted currents and B patents a device which depends for its action upon undulatory currents. Both, we will say, are equally effective. The two patents are thrown into interference. Will any one deny that it would be a good defence for either party to show that the results, although identical, were accomplished in radically different ways?

(5) The public is not prohibited from using a microphone constructed after the pattern of a Reis instrument because of Berliner's patent. There can be no conflict between the two methods unless it is admitted that Reis and Berliner discovered the same method of producing the same results. The evidence seems conclusive to us that Reis's invention and Berliner's or Bell's disclosed entirely different methods, and that Reis's instrument was carefully constructed with the *intention* that it should only act in a given way—that that *way* of action was what constituted his invention, and if he had patented it he would be protected only in so far as it did act in the way intended.

(6) We cannot forestall the opinion of the Supreme Court. Our opinion is, of course, of comparatively little importance, because whatever the opinion of the Supreme Court may be it will be the *law*. But in weighing the evidence as it appears before us we think it exceedingly improbable that the Supreme Court will hold that Reis anticipated Bell and therefore Berliner.

The Philadelphia Consolidation.

Arrangements have been made for a ninety-nine-year lease of the Philadelphia Edison Electric Light Company to the Pennsylvania Light, Heat and Power Company. The latter corporation will guarantee a dividend upon the $2,000,000 stock of the Edison Company at the rate of 8 per cent. per annum, which is the dividend now paid. After two years 9 per cent. dividends are guaranteed. Edison stock has already been issued to the amount of $1,847,222. It is also expected that all the other lighting companies in the city will be absorbed by this new corporation, which is capitalized at $10,000,000. The companies with their present capitalizations are as follows:

Company.	Capital.
Edison	$1,847,222
Brush	1,000,000
Suburban	300,000
Manufacturers	203,560
Powelton	450,000
Diamond	250,000
Columbia	66,000
Total	$4,116,782

The active promoter of the scheme has been Mr. W. W. Gibbs, of the Electric Storage Battery Company, and his associates include Mr. Martin Moloney of the Siemens & Halske Company, W. L. Elkins, Edwin S. Cramp, District Attorney Geo. S. Graham, Samuel R. Shipley, George R. Philler, Hamilton Disston, Rudolph Blankenburg, William H. Rhawn, Edward J. Matthews, Sydney F. Tyler, Charles T. Yerkes, J. J. Sullivan, E. D. Toland, Edward C. Lee and Clement A. Griscom.

The advantages urged for the combine are concentration of authority and the lopping off of unnecessary expenses.

GENERAL NEWS.

What is Going on in the Electrical World.

Creede, Col.—The electric light plant was destroyed in the late disastrous fire.

Phœnix, Ariz.—The Gardiner electric light works have been purchased by the Phœnix Light and Fuel Company.

Harlin, Tex.—The council has accepted the proposition of R. M. Odell & Co. to put in a waterworks and electric system.

Northampton, Mass.—A strong move is being made looking to the building of an electric road from Northampton to Hatfield.

Buffalo, N. Y.—The Aldermen have put off the further consideration of the Niagara Power franchise until November 13.

East Haddam, Conn.—A movement is on foot to establish an electric car line between East Haddam and Moodus, a distance of four miles.

Indianapolis, Ind.—The Citizens' Street Railroad Company is about to add to its plant an establishment for the manufacture of cars.

Saratoga, N. Y.—The board of street commissioners have decided to abolish naphtha lamps and use electricity altogether in lighting the streets.

Hollister, Cal.—The Hollister Water Company are about to put in an electric generating plant on Poscadero Creek, about twelve miles from Hollister.

Little Falls, N. Y.—President Tylee of the Little Falls and Richfield Springs Electric Railroad has accepted the franchise granted by the city council.

Albany, N. Y.—The Railroad Commissioners have approved of the use of electricity as a motive power on the New York, Elmsford & White Plains Street Railroad.

Lansingburg, N. Y.—The Western Electric Company of Chicago have purchased property here for $10,500 on which to establish the plant for the new electric light system.

Jeffersonville, Ind.—It is stated that a Southern syndicate has purchased the property of the Ohio Falls Street Car Company and will convert the railway into an electric line.

Dundee, Mich.—There is every prospect now that the electric street car line connecting Dundee and Monroe will be built. The line will probably cross the Raisin river at Raisinville.

Palmyra, N. Y.—There is talk here of building an electric road for freight and passengers between Palmyra and Marion. The electric light company is in favor of establishing such a line.

Durand, Mich.—The question of bonding this town for $10,000 to put in an electric light plant has been submitted to a vote of the citizens with the usual result—a majority vote in the affirmative.

Jamestown, N. Y.—This city has decided to go into the lighting business on a larger scale than heretofore, and to that end new machines and additional apparatus will be ordered for the municipal plant.

Kansas City, Kan.—Officers were elected recently by the Kansas City and Leavenworth Electric Railway Company as follows: President, Horace Keefer; vice-president, Edward Carroll; secretary, J. C. Stone, Jr.

Lynn, Mass.—The threatened strike at the General Electric works here has been carried out, the moulders having quit work in a body. It is reported that a strike of the moulders at the Schenectady works also is imminent.

Westfield, Mass.—Pomeroy & VanDeusen have had a new electric light plant added to the equipment of their whip factory, which is now lighted by electricity. The proprietors find this a great improvement over the old system of lighting.

Dexter, Mo.—At the election held here a few days ago it was voted to give a ten-year electric light franchise to Grant Gillespie, of Dexter, and E. L. Hawks, of Puxico. They are to furnish the city with forty 32 c. p. incandescent lights.

Chicago.—Preliminary steps have been taken towards extensive improvements in the West Side parks and their connecting boulevards. A $50,000 electric light plant for the lighting of the parks is among the improvements suggested.

Shamokin, Pa.—Work has been commenced on the new trolley line between Sunbury and Seling's Grove, a distance of ten miles. Major J. H. Hamilton, of Shamokin, is the projector of the enterprise, which is backed by Philadelphia capitalists.

Independence, Ia.—The city plant has just been completed here at a total cost of $25,286. All construction has been of the best. The capacity is 3,500 lights, and the large alternator is of the latest type made by the Standard Electric Company of Chicago.

Hartford, Ky.—Col. A. J. Casey, of Owensboro, who is interested in the proposed electric railway between Hartford and Beaver Dam, via Hamilton, says the company is only waiting for the report of the surveyors before proceeding further in the undertaking.

Vicksburg, Miss.—Chester A. McFarland, superintendent of the Vicksburg Transit and Electric Light Company, states that the actual construction of the railway, power house and plant will be commenced within thirty days and pushed to an early completion.

Boston, Mass.—After the 1st of November the law compelling electric railroad companies in this State to heat their cars by electricity goes into effect.—The Edison Electric Illuminating Company of Boston has declared a quarterly dividend of 1¾ per cent., payable on and after October 26.

Egg Harbor City, N. J.—A company to be known as the Philadelphia Electric Light and Water Company has been organized here with the following incorporators: Henry Kuehne, president; Christian Muller, secretary; Charles Class, treasurer, and George C. Cressy, all of Philadelphia.

Le Mars, Iowa.—Creditors representing $24,700 of the indebtedness against the Le Mars Electric Light and Water Company, have applied for the appointment of a receiver for the concern on the ground that the present management is inexperienced and is not conducting it for the good of the stockholders.

Philadelphia.—The Pennsylvania Heat, Light and Power Company has made arrangements to lease the Edison Electric Light Company of this city for a term of 99 years, the Heat, Light and Power Company agreeing to pay an 8 per cent. dividend on the capital stock of the company for two years and 9 per cent. thereafter.

Norristown, Pa.—The Schuylkill Valley Traction Company, owned by the Shepp brothers of Philadelphia, has sold all its lines in Norristown to a Philadelphia syndicate, the price named being $900,000. The purchasers, it is understood, will make extensive improvements and will also extend the line to other suburban districts and towns.

Fort Wayne, Ind.—The board of public works has granted a franchise to C. Everett to bring his electric street car line from Columbia City and Lake Everett into the city and on Harrison street to the Union Depot. The concession is an important one and assures the building of the line.

Frankfort, Ind.—The electric light plant in this city has been sold by the Citizens' Electric Light Company to the Indiana Natural Gas Company. The plant will remain under the local management. Incandescent lights will probably be added and street lighting put in in the near future.

Emporia, Kan.—J. O. Patterson, a wealthy Chicago capitalist, has made application to the city council here for a franchise for an electric street car line. It is to run east and west, north and south to all parts of the city, and work is guaranteed to be begun within one year and the line to be completed and running within two years.

New Haven, Conn.—The Manufacturers' Street Railroad Company, of which George S. Barnum is president, as under consideration an electric railway plan for connecting the manufacturing plants in the Grapevine Point district with the Consolidated road. It is proposed to use a motor car for hauling the freight cars, the line being intended principally for freighting purposes.

Niagara Falls.—The Carborundum Company received its first power from the Niagara Falls Power Company on the 19th inst., when 1,000 horse-power, transmitted over the copper cables from the great power house, was applied to the manufacture of the new material—carborundum, a cheap and effective substitute for diamond powder and emory. Everything worked satisfactorily.

Chattanooga, Tenn.—The Chattanooga Electric Street Railway, which has been in the hands of the court for some time, is to be sold on December 20 next, and it is understood here that the General Electric Company will be one of the bidders, and that the intention is to consolidate the railway with the electric light company, the latter of which is a G. E. concern. The railway plant is valued at $1,000,000.

St. Louis.—The number of passengers carried by the various street railroads in this city during the third quarter of 1895 was as follows: Cass Avenue and Fair Grounds, 2,469,637; Citizens', 1,825,037; Jefferson Avenue, 317,471; Lindell, 5,489,968; Missouri, 3,810,118; People's, 1,024,575; St. Louis, 3,012,457; St. Louis and Suburban, 2,096,614; Southern Electric, 1,210,403; Union Depot, 6,034,209; total, 27,290,489.

Hagerstown, Md.—The Crawford Bicycle Works of Hagerstown have just completed a horseless buggy, built for the great race on the road between Chicago and Milwaukee which takes place next month. The buggy, which is very light and elegant in structure, will be propelled by electric motors with storage batteries. In the construction hollow steel tubes were used with the design to combine the greatest strength with the least weight. The vehicle has been tried and works successfully.

Duluth, Minn.—A number of Eastern capitalists have effected the consolidation of the Minnesota Canal Company, the Altramonte Canal Company and the Jay Cooke interests, and intend going largely into the business of smelting the low grade iron ore from the Mesaba and Vermillion ranges by means of electricity. On the property that has come into their possession by the consolidation there is water power sufficient to operate the electrical machinery needed.

Hempstead, L. I., N. Y.—The Hempstead Electric Light and Power Company, represented by Arturo Garcia & Co., of New York, have applied to the trustees of Rockville Center for a franchise for lighting privileges. They have also applied to the trustees of Freeport village for the same privileges, and will petition the Hempstead town board for a franchise for the town outside of incorporated villages. They wish to erect a central plant and supply the villages of Lynbrook, Rockville Center, Milburn and Freeport with light and power.

Millbury, Mass.—The stockholders of the Blackstone Valley Electric Railroad have elected the following directors: F. A. Lapham, S. E. Hull, Charles Buck, James H. Ferguson, L. H. Clarke and Herbert A. Ryan, of Millbury; S. M. Snow, of Providence; L. E. Chase, of Wilkinsonville, and E. E. Howe, of Fisherville. The directors elected the following officers: F. A. Lapham, president; Herbert A. Ryan, treasurer; L. H. Clarke, clerk; executive committee: Messrs. Howe, Hull and Ryan; auditing committee: Messrs. Ferguson, Snow and Clarke. The contract for building the road has been awarded to the Worcester Engineering Company.

Milwaukee, Wis.—The "Sentinel" states that the construction of an electric line to Waukesha is beginning to assume shape. It is learned that the Thayer Electric Company has agreed to construct and equip the whole line for $185,000. The line is to form its connections with the Milwaukee & Wauwatosa Motor Railway Company, whose line is to be turned into an electric road. A loop is to be built in Wauwatosa to the county institutions and buildings, and the road is expected to be fully built and equipped for $350,000, which the projectors expect to raise by the issuance and sale of twenty year bonds.—The Badger Illuminating Company will get the contract for street lighting in Milwaukee for the term beginning January 1, there being no competition.

Pittsburg, Pa.—The Ohio Valley Electric Railway Company, just incorporated, proposes to build an electric road to connect with the Pleasant Valley road at Bellevue, and extend the tracks through West Bellevue, Avalon, Ben Avon, Emsworth, Clifton, Dixmont, Glenfield, Agnew, Haysville, Osborne, Sewickley, Quaker Valley, Edgeworth, Shields, Leetsdale, Fair Oaks, Economy, Legionville, Logans, Linmore, Baden, Remington and Conway to Freedom.

Hoboken, N. J.—The common council has granted a franchise to the Hoboken Railroad, Warehouse and Steamship Connecting Company to operate an electric freight railway within the limits of the city. The object of the company is to run a freight line on upper Hudson street and along the river front, so as to give direct communication between the various steamship lines, the warehouses along the river front and the principal railroads.

Fall River, Mass.—The Globe Street Railway has been granted permission to run its cars over Slade's Ferry bridge. The bridge is 1,000 feet long and the right to use it enables the railway company to bring in traffic from Providence, R. I., on the west and from Taunton on the north, and, by connection with the Gee Whiz road it can send a passenger from Taunton through Dighton, Somerset and Fall River, Westport and Dartmouth, through New Bedford to Fairhaven on electric cars.

Salt Lake City, Utah.—The directors of the Salt Lake and Ogden Gas & Electric Light Company have accepted the resignation of the three London directors and filled their places by electing George M. Scott, L. S. Hills and Thomas G. Webber, all residents. The English directors were alarmed at the antagonism of the Salt Lake public toward the company and tendered their resignations, hoping by making it a home concern to put a check to the growing popularity of the new Citizens' Electric Company.

Newark, N. J.—In the course of a few months Newark and Passaic will be connected by a trolley line. To reach the latter city from Newark heretofore it was necessary to go either to New York or Paterson and then take the steam railroads. The new road is known as the Newark & Passaic Traction Company's.—The Consolidated Traction Company has made an arrangement by which the United States Express Company will do business over its various lines in special cars built for the purpose, and six of the cars are now being built in Philadelphia by the J. G. Brill Company for the experiment. They will be roomy box-cars, equipped with a a trolley, and it is proposed to trail a passenger car behind each of them. By means of these cars the express company will be able to do business in every town entered by one of the trolley lines, and it is hoped will pick up considerable business which is now done by individuals who drive express wagons.

Tonawanda, N. Y.—The promised test of electricity as a motive power on the canals was made here on Saturday. A large number of spectators were present and ex-Governor Flower delivered an oration in which he predicted a great future for the canal people when electricity proves its success as a towing power. The system tried was the trolley, by means of a motor car to which a hawser from the boats was attached. Over the experimental mile the system worked successfully. The power was transmitted over a wire from the works of the Niagara Power Company.—It has been announced here that capitalists are about to resume operations and complete an electric railroad from North Tonawanda to Sanborn and Pekin. The route was surveyed and some grading done about two years ago, when funds gave out and the project was dropped. It has now been taken in hand again and will be constructed at once. The line will be about eight miles long.

New Orleans.—After a delay of several months, owing to various reasons, the Villere street cars (electric) have commenced running. The line runs through one of the oldest districts of the city and when the cars were started they created a commotion. There were all sorts of people out to see them, including ancient Creoles, who seldom go away from home; black negroes by hundreds, who live along Villere street and in the intersecting streets; Turks, Italians, black, brown, yellow and all sorts of looking people. They showed wonderful interest in the cars, and one of the officials said that some of them had been sitting in one position watching them since they started in the forenoon and if they had moved at all it was not apparent.—The directors of the Chalmette Railroad Company have accepted the survey of a route for their proposed electric road in the suburbs. The capital stock of the company has been placed at $100,000. The officers and directors are: President, H. T. Beauregard; vice-president, R. V. Ducros; secretary, James Alexander; and Messrs. Albert and J. Estopinal, E. E. Nunez, Sebastian Roy, Christian D. Armstrong, M. T. Ducros and Judge R. T. Beauregard.

St. Paul, Minn.—With the advent of spring, says the "Dispatch," the last cable line will disappear from the St. Paul street car system, and a long-drawn breath of relief will go up from a large territory whose people have been compelled to submit to the trials and tribulations of the erratic and slow-going grip cars. At the time stated the company will replace the Fourth street and Selby avenue cars with an electric line, in furtherance of plans long under contemplation. The difficulty attending the steep grades on the Third street line will be avoided by the adoption of a device which consists of a weight car running in an underground conduit that connects with the surface cars and acts as a balance.—The city and county of Ashland, it is said, propose to give $200,000 to aid the scheme of building an electric road between this city and Ashland. The "Pioneer Press" says the purpose is to make Ashland with its splendid harbor, the entrepot upon Lake Superior of the great traffic of the two cities instead of Duluth. The advantages claimed for it over the Duluth route is that the railroad from Ashland to St. Paul would be only twenty-eight miles longer than the shortest line to Duluth, while it would save ninety miles of navigation, back and forth, or 180 miles in all, and afford an unequaled harborage.

PERSONAL.

Among our out-of-town visitors last week were Mr. J. R. Rhotehamel, president of the Columbia Lamp Company, Charles E. Gregory, of Chicago, and Geo. D. Rosenthal, of St. Louis.

It is reported from Chicago that Mr. O. W. Meysenberg has retired from the Siemens & Halske Company in order to devote all his energies to the affairs of the Wells & French Company.

Messrs. F. L. Babcock, of Cuyahoga Falls, David Starr, of Montreal and Charles Burns, of Rochester, were among the out-of-town hustlers in the city this week.

COMMERCIAL PARAGRAPHS.

We have received from Mr. Chas. Wirt, corner Ludlow and 31st streets, Philadelphia, Pa., a copy of catalogue of the Wirt Brush, which contains practical information interesting to engineers, drawn from an extended experience *and intimate* acquaintance with the practical provisions under which dynamos are worked.

Fred. M. Locke, Victor, N. Y., manufacturer of the well-known Indestructible High Potential line material, has just closed three large contracts for his Porcelain Insulators and Steel Pins to be used on long-distance transmission *lines.*

The superior qualities of the Partridge Motor Brush have been known so long to the street railway trade that an *elaborate* exhibit at the Montreal Convention was not really necessary. Mr. J. S. Speer, secretary of the Partridge Carbon Company, was there however, and the results that have followed the Convention in the shape of *increased* orders clearly show what a good man can do with a good thing and still have a good time.

Lamps may come and lamps may go, but the old Sawyer-Man lamp retains all its claims to popular favor which made it such an important factor years ago. It is to-day as good as ever, and that is saying alll that is necessary.

New Fort Wayne Book.

One of the most elaborate trade publications recently issued by any manufacturer of electrical apparatus is the "Complete Catalogue of the Wood Systems of Electrical Machinery and Apparatus for Light and Power" now being distributed by the Fort Wayne Electric Corporation. This book consists of 132 pages. to the embellishment of which the arts of the engraver and printer have been applied with most pleasing results. The descriptive matter is brief, but it is supplemented by a liberal use of illustrations reproduced from photographs.

The details of the Wood apparatus are shown and described with clearness and conciseness, so that every reader, however much he may lack in practical knowledge, will have an intelligent comprehension of the subject after a study of this Catalogue.

Western Electric's New Factory.

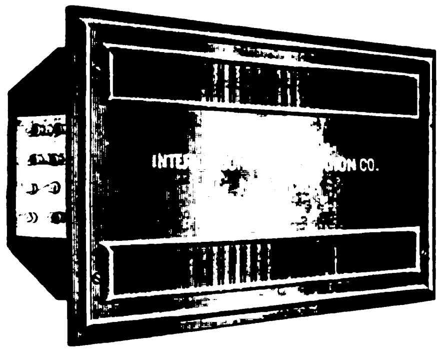
The Western Electric Company is makinganother extensive addition to its Chicago factory. The new building is at West Congress and Jefferson streets, in the rear of the present factory. When this is completed the works of the Western Electric Company will cover 104,000 square feet of space.

The new factory building fronts on Jefferson street and is 180 feet long by 50 feet wide and will be eight stories high. It is fire-proof, of steel construction, built to accommodate a traveling crane with a span of 25 feet, which will run the entire length of the building and takes up the basement and first story. This will be used for handling the heavy castings used in the new types of dynamos and motors. It is expected the building will be finished by January 1, 1896.

A New Electric Car Heater.

The Interior Conduit and Insulation Company of New York have introduced this season an Electric Car Heater which embodies great improvements in this class of apparatus.

A much higher efficiency has been obtained in these heaters than in other machines which have heretofore made their appearance, and this economy of operation is by far the most important factor which is considered by any railway ompany. All the electric energy absorbed by any electric heater is converted into heat units, and it has in consequence been assumed by many that electric heaters are of necessity of equal efficiency, but this is not the case. It is not sufficient merely to create heat, but also to utilize it to he best advantage, and in order to do this it is imperative hat the heat should be distributed and circulated where it needed, and as fast as it is generated. In other heaters, large proportion of the heat produced has been non- fective for any useful purpose owing to lack of proper stribution, as most of the air current passes around the ils leaving the heat dormant, and the case of such heats absorbs a large quantity of heat, so much so that in some stances fire has been caused, endangering the lives of passngers. Such machines require from six to twelve amres at five hundred volts to sufficiently warm the car.



New Electric Car Heater.

In the heater manufactured by the Interior Conduit and sulation Company, a continual circulation of air is mainined. All the air passes through the coils, and all the at generated is carried off and distributed into the body the car, the case of the heater remaining perfectly cool. here is absolutely no waste, and consequently a much gher degree of efficiency is obtained than has hitherto en practicable. These heaters are thoroughly well made, at in appearance, easily installed, and are amply guaranted.

"Roll-Drop" in Pen and Ink.

The Forest City Electric Company, Cleveland, Ohio, have ued a very handsome booklet devoted to their already ll-known "Roll-Drop" Commutator Bars. Considerable ce is devoted to data concerning the numerous forms d sizes of Commutator Bars now in commercial use rticularly those employed on railway generators and motors. The methods of manufacture of "Roll-Drop" Bars are described in a brief and catchy manner, and aptly illustrated with clever pen sketches. The book is for distribution and should be in the hands of every commutator user.

Four New Turbines for Niagara.

The Niagara Falls Hydraulic Power and Manufacturing Company have recently contracted with James Leffel & Company, of Springfield, Ohio, for four of their Improved Double Discharge Horizontal Shaft Water Wheels, to be of eight thousand horse power capacity under a maximum head pressure of 218 feet, which is far the highest head under which turbines of large capacity have ever been applied in this country or elsewhere. These wheels will drive eight electrical generators, which will be connected direct to the horizontal turbine shafts without gears or belting, the wheels and generators all running in vertical planes. This is the second large order for turbines built by James Leffel & Company for Niagara Falls, there being already several of this make of wheel, each of 1,200 horse power, in daily operation in the Cliff Paper Company mills, located at the cliffs, near the tunnel. This water wheel company is also building four of their Cascade wheels for one company, to be operated under 730 feet head; part of the power to be electrically transmitted by connecting the wheel shaft directly to the generators. The Cascade wheel is, however, essentially and entirely different in construction and operation from the turbine, being in principle an impulse and reaction wheel. This Cascade wheel plant will have an aggregate capacity of six hundred horse power.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

NOVEMBER, 1895.

Date.	Light.	Date.	Exting.
1	3.30 A. M.	1	5.30 A. M.
2	No light.	2	No light.
3	"	3	"
4	"	4	"
5	5.20 P. M.	5	7.40 P. M.
6	5.20 "	6	8.40 "
7	5.20 "	7	9.50 "
8	5.20 "	8	11.10 "
9	5.20 "	10	12.20 A. M.
10	5.20 "	11	1.00 "
11	5.20 "	12	1.30 "
12	5.10 "	13	2.50 "
13	5.10 "	14	4.00 "
14	5.10 "	15	5.20 "
15	5.10 "	16	6.00 "
16	5.10 "	17	6.00 "
17	5.10 "	18	6.00 "
18	5.10 "	19	6.00 "
19	5.10 "	20	6.00 "
20	5.10 "	21	6.00 "
21	7.30 "	22	6.10 "
22	9.00 "	23	6.10 "
23	10.20 "	24	6.10 "
24	11.00 "	25	6.10 "
25	11.20 "	26	6.10 "
26	...... "	..	....
27	12.20 A.M.	27	6.10 "
28	1.20 "	28	6.10 "
29	2.20 "	29	6.10 "
30	3.20 "	30	6.10 "

BUSINESS HINTS.

Allegheny, Pa.—Charles Lockhart has begun the building of a new business block, 6 stories, on Penn ave., to cost $50,000; Architect W. S. Frazer.

Baltimore, Md.—The plans for a ten story apartment house, to be erected at northeast corner of Cathedral st. and Mt. Vernon Place, have been completed.

Brooklyn, N. Y.—Moller & Bro. & Co., will erect 2 four story apartment houses on north side of South 9th st., east of Bedford ave., to cost $27,000.

Buffalo, N. Y —Architect H. H. Little is preparing plans for the new six story building of the Buffalo Drug, Paint and Glass Co., to be erected on Swan st., near Ellicott, to cost $300,000 ... The 20th Century Club house will be erected on Delaware ave., just below Temple Beth Zion; Architects Groon & Wickes.

Macon, Ga.—Charles B. Moling, of Columbus, O., who recently purchased the Paterson plantation near Macon, is interested in the erection of a modern hotel at this place, to cost $250,000.

Newport, R. I.—Robert Goelet, 9 West 17th st., New York City, is said to be planning to erect the finest villa in Newport, on the Cliffs.

New York City.—The American Society of Civil Engineers have purchased a plot on south side of 57th st., between 7th ave. and Broadway, and will erect a club house on the site....George J. Schreiner and George Fennell, of 101 West 121st st., will erect 4 five story brick flats and stores, northwest cor. of 108th st., and Madison ave., to cost $79,000.

Ottawa, Ill.—The Western Cottage Piano and Organ Company will erect a $30,000 factory, after plans prepared by W. A. Youmans & Bros., 706 Tacoma Building; the factory will be fitted with a dynamo, electric fans, etc.

Philadelphia, Pa.—Plans have been drawn by Bailey & Truscott for the proposed new building for Cyrus H. K. Curtis, to be erected at 6th and Walnut sts; the building will be nine or ten stories high.

Portland, Me.—The Hooper Building, cor. of Pearl and Congress sts., will be converted into a variety theatre.

Washington, D. C.—Mrs. General D. D. Colton, formerly of San Francisco, Cal., has had plans made for a handsome and expensive home on Connecticut ave. between R and S sts. Northwest, from designs drawn by C. B. Keferstein; it will be lighted by electricity and gas and heated by steam.

Whatcom, Wash.—The Normal School trustees have accepted the plans prepared by Skillings & Conner, of Seattle, for gymnasium, assembly hall, etc.; the building will be provided with electric clocks and other electrical equipments.

ELECTRICAL PATENT RECORD.

Letters Patent Issued October 22, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

548,371. Electric Locomotive. Walter H. Knight, New York, N. Y. Filed June 15, 1888.

548,389. Three-Wire Electric Railway. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Aug. 8, 1895.

548,481. Underground Conduit for Electric Railroads. Richard Uren, Hancock, Mich. Filed May 10, 1894.

548,504. Combined Electric and Cable Railway. Gardner E. Beach and Morris J. Kern, San Francisco, Cal. Filed Aug. 1, 1892.

548,514. Underground Conduit System. Hiram C. Burk, Cleveland, Ohio. Filed Feb. 28, 1893.

548,599. Electric Street-Car Controller. Gustaf Valley, Cleveland, Ohio, assignor to the Steel Motor Company, same place. Filed Dec. 5, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

548,369. Electric Desk-Light. Walter R. Kinsman, Arlington, N. J., assignor to Thomas I. McLeod, New York, N. Y. Filed Oct. 14, 1893.

548,413. Electric-Arc Lamp. Thomas E. Adams, Cleveland, Ohio, assignor to the Adams-Bagnall Electric Company, same place. Filed July 8, 1895.

548,414. Electric-Arc Lamp. Thomas E. Adams, Cleveland, Ohio, assignor to the Adams-Bagnall Electric Company, same place. Filed July 10, 1895

548,574. Phosphorescent Electric Lamp. Daniel McF. Moore, New York, N. Y., assignor to the Moore Electrical Company, same place. Filed Jan. 3, 1895.

548,575. Phosphorescent-Electric-Light Condenser and Accumulator. Daniel McF. Moore, New York, N. Y.; assignor to the Moore Electrical Company, same place. Filed Jan. 24, 1895.

548,576. Phosphorescent Electric Lighting by Interruptions. Daniel Mc F. Moore, New York, N. Y., assignor to the Moore Electrical Company, same plaee. Filed Jan. 24, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

548,217. Method of and Apparatus for Rectifying Alternating Currents. Jules E. Neher, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Aug. 7, 1893.

548,230. Method of and Means for Temperature Adjustment for Inductance-Coils. Oliver B. Shallenberger Rochester, Pa. Filed April 15, 1895.

548,266. Automatic Switch for Electric Transformers. Anthony G. New, London, and Arthur J. Mayne, Woking, England, and Richard N. Lucas, Galway, Ireland. Filed June 25, 1894.

548,280. Electric Stop Mechanism. William M. Wood and James C. Miller, Elmira, N. Y. Filed June 7, 1894.

548,383. Magnetic Separator. James D. McKinnon, Portland, Oreg. Filed April 16, 1895.

548,388. Regulating Electric Motors. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed July 22, 1895.

548,400. Regulator for Alternating Currents. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 18, 1895.

548,401. Electric Motor. Imle E. Storey, Hornellsville, N. Y., assignor to the Storey Electric Drill and Power Company, of Colorado. Filed Jan. 28, 1893.

548,402. Electric Motor. Imle E. Storey, Hornellsville, N. Y., assignor to the Storey Electric Drill and Power Company of Colorado. Filed Jan. 28, 1893.

548,406. Dynamo-Electric Machine. Elihu Thomson Swampscott, Mass., assignor to the General Electric Company of New York. Filed March 29, 1895.

548,448. Controller for Electric Motors. Daniel J. McLane and George W. McClintock, Quincy, Mass. Filed May 25, 1895.

548,511. Method of Converting or Transforming Periodic Electric Currents to Obtain Constant Effective Intensity or Voltage. Paul Boucherot, Paris, France. Filed Dec. 10, 1892.

548,589. Electric Stop-Motion for Engines. Louis St. Peter, Springfield, Mass., assignor of two-thirds to John D. Millea and Thomas D. Millea, same place. Filed March 1, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

548,22[illegible]. Telephone-Receiver Support. Isidor J. Kusel. St. Lous, Mo. Filed Feb. 18, 1895.

548,227. Telephone-Exchange Apparatus. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed March 5, 1892.

548,228. Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 28, 1895.

548,229. Keyboard Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 7, 1893.

MISCELLANEOUS.

548,176. Magnetic Ore-Separator. Charles G. Buchanan, Brooklyn, N. Y. Filed Feb. 13, 1895.

548,265. Hydrostatic Electric Amalgamator. James D. McKinnon, Portland, Oreg. Filed Dec. 14, 1894.

548,282. Electromechanical Lock. William W. Alexander, Kansas City, Mo., assignor to the Gill-Alexander Electric Manufacturing Company, same place. Filed Nov. 15, 1889.

548,320. Manufacture of Stereotype-Plates. Victor Lowen Dahl, Stockholm, Sweden. Filed Oct. 11, 1894.

548,331. Magnetic Brake Oakley S. Walker, Worcester, Mass. Filed Feb. 20, 1895.

548,396. Electric Cigar-Lighter. Friedrich W. Schindler-Jenny, Kennelbach, Austria Hungary. Filed Feb. 19 1894.

548,415 Dry Battery. Frank M. Archer, New York, N. Y., assignor to Siegfried Silberberg, same place. Filed Dec. 15, 1890.

548,419. Electric Metering Apparatus. William S. Barstow, Brooklyn, N. Y. Filed April 6, 1895.

548,435. Electric Block-Signaling Instrument for Railways. Arthur C. Fraser, Brooklyn, N. Y. Filed Feb. 26, 1891. Renewed March 26, 1895.

548,467. Electric Meter. William H. Scott, Norwich, England, assignor to Laurence Scott & Co., Limited, same place. Filed Nov. 4, 1892.

548,469. Automatic Block System. Judson Shoecraft Harveyville, Kans., assignor of one-half to Orison C. Miller, Wabaunsee County, Kans. Filed March 27 1895.

548,509. Electromagnetic Brake. John L. Black, St. Louis Mo., assignor to the St. Louis Electric Brake Company East St. Louis, Ill. Filed May 9, 1894.

548,510. Electromagnetic Brake. John L. Black, St. Louis Mo., assignor to the St. Louis Electric Brake Company same place. Filed April 13, 1895.

THE TELEPHONE WORLD.

THE STANDARD AT RICHMOND, VA.

Some Light Thrown on the Methods of "The Boys in the Real Pot."

At no place has so spirited a contest for a telephone franchise taken place as at Richmond, Va. Some weeks ago applications for a franchise were made by the Richmond Standard Telephone Company and the Home Telephone Company. The former is one of the many sub-organizations of the Standard Telephone Company of Arizona, 253 Broadway, New York, and elsewhere. The Home Company is composed of Richmond and Baltimore capitalists, the Board of Directors being J. N. Cullingworth, J. D. Patton, S. W. Travers, P. Whitlock, E. A. Catlin, Junius A. Morris, J. D. Crump, J. J. Montague, F. B. Hubbell, James Russell and W. J. Atkinson.

To the City Council the Standard representatives made plausible, though extravagant, statements as to the accomplishments of the Standard Company and the capabilities of their "only perfect" telephone. They promised to establish one of their numerous factories in Richmond if they were given the franchise. The Home Telephone Company stated that they would use the well known "Mason" telephone, manufactured in Richmond by the Mason Telephone Company, and already in use in a large number of exchanges. The City Council appointed a committee consisting of W. E. Cutshaw, City Engineer, and W. H. Thompson, Superintendent of Fire Alarm, to make a test of the instruments of the competing companies. As a result of the test the committee reported that they "are led to believe the Standard to be the better 'phone." The following letter gives some interesting facts concerning the test made by this committee:

To the Editor of ELECTRICITY.

DEAR SIR: I have had an opportunity to become fully conversant with the methods which the Standard Telephone Company employ, as laid down in their circular "To the Boys in the Real Pot" In this city, I submitted 'phones of my manufacture constructed for ordinary exchange service, as well as for long distance service, to the committee, who tried them in competition with one of the 'phones which the Standard Company claims to be manufactured under their patents. Of these patents, however, they refuse to give any information. They refused to allow any one to see the inside of their transmitter excepting the two men who were appointed on the committee. These men were not experts in telephone matters, and did not know a long-distance Bell telephone from any other ordinary transmitter. The examination of the instruments was made in a star chamber session, with no one present excepting the representative, of the Standard Company and the two experts who composed the committee.

The writer accused the representatives of the Standard Company of having on exhibition a regular long-distance American Bell telephone, and they, being aware that he was right, refused to allow the internal construction of the instrument to be seen by myself or any other expert who was conversant with such matters. Before the committee made its decision, I took into the room a regular long distance Bell instrument and showed the committee the internal arrangements of the same. In the formal report of the committee they recognized the fact that the instrument which the Standard Company had before them "approaches more nearly 'phones now in use" by the American Bell Telephone Company, as they say, than the 'phone offered by the writer. The committee made their report knowing that I had 'phones in use all over the country. I read testimonials to them from people who are using my 'phones and who speak in the highest way of them, while the Standard Company had no testimonials whatever to offer and could not name a single place where their 'phones were in use in any kind of service, excepting on exhibition lines and under their own care.

The action of the Standard people in refusing to allow any disinterested expert, or a man of national reputation and above suspicion, to examine into their 'phone, puts them, in the mind of any fair man, in a very questionable light. I am ready at any time to submit the instruments and devices on which I hold patents to any test which they will submit their 'phones to, and not only to do that, but to allow any one to examine into their merits, feeling confident that they will stand any test. I am inclined to believe that certain people have profited by the hints contained in the letter of the Standard people "To the Boys in the Real Pot."

I appreciate very much the stand you are taking. I speak for myself individually, because I am directly interested in the devices which I am putting on the market. Wishing you success, I remain yours truly,

G. S. MAXWELL.

Richmond, Va., October 18, 1895.

After the committee had made its report Mr. Maxwell, who is general manager and electrician of the Mason Telephone Company, published a card in the local papers of Richmond offering a reward of $100 provided he could not prove to any committee of disinterested experts that the so-called Standard telephone "is either a Bell long-distance telephone or a rank infringement of the Watson, Rooseveldt and other patents controlled by the Bell Telephone Company." He offered $10 reward for the number of any patent owned by the Standard Company, and $10 reward for proof that the Standard Company have a telephone exchange in operation anywhere in the world. The challenge has not been accepted by the Standard Company, but John C. Robertson, president, sent a circular letter to all the members of the City Council, making, among others, the following statements:

. . . The Standard Telephone Company has never issued any such circular as that quoted by our opponents from ELECTRICITY, a journal of unsavory reputation which is not recognized in the electrical profession; nor has it made any suggestion of corrupt dealings with councils.

The Standard Telephone Company does not use or propose to use the Bell telephones or any infringements on their patents, but owns its own patents, lists and numbers of which have frequently been proclaimed and published.

The Standard Telephone Company has its own factory now in active operation in New York, and is establishing several now in the North.

The Standard Telephone Company will, if we are granted a franchise here, establish a factory in Richmond for the supply of at least six Southern States.

I have already published the names of a dozen or more gentlemen of national reputation and great wealth, whose connection with the active management of the Standard Company should be a sufficient refutation of the calumnies so industriously circulated.

Finally, I hope and believe that the Richmond Standard Telephone Company will receive the city's franchise for the following reasons, all of which are proven facts:

1. It has the best telephone for local service.
2. It has the best and only long-distance 'phone.
3. It is backed by the strongest company, and the only one able to cope with the Bell monopoly.
4. It will employ the largest number of skilled laborers.
5. It will bring here *and keep here* the most money.

The report of the expert committee above referred to does not settle the question of franchise. The report has yet to go to the City Council.

A Railway Telephone.

Superintendent E. B. Baker of the Southern New England Telephone Company has constructed a device for telephoning from moving trains. One part of the apparatus consists of what is called a "hanging set," to be carried on every baggage car and caboose. If a train comes to a standstill through accident or otherwise the hanging set, consisting of spliced rods with a cross-arm at the top, is dropped on the wires at the pole line alongside the track, thereby establishing telephonic connection with the despatcher's office.

"Doing It Well."

To the Editor of ELECTRICITY.

DEAR SIR: Your article on "Speculative Telephone Enterprises," in last week's issue, has attracted the attention it deserves in Richmond at least. The events there, and letters received from telephone companies elsewhere, it seems to me, tend to confirm the position you take in your article, that the Standard Telephone Company is one of the worst swindles of the century, and that you deserve the thanks of every business man in the country, especially those engaged in the telephone business, for your fearless exposure of their methods. You are doing a magnificent work and doing it well. Respectfully yours,

W. J. ATKINSON.

Baltimore, Md., October 22, 1895.

The New York and New Jersey Telephone Company have acquired the right of way along the shore front from Point Pleasant to Atlantic Highlands, N. J., for a new telephone line, with three additional exchanges at convenient points along the coast. Beside touching all the sea coast towns, this line also will tap Keansbury, Port Monmouth, Redbank, Keyport, South Amboy and Perth Amboy, N. J., and go across the Kills by cable to Staten Island and thence into New York.

The Claiborne Telephone Company has been organized at Port Gibson, Miss., with Jacob Bernheimer, president; Chas. A. French, vice-president; Dr. W. Reduse, secretary, and William Cahn, treasurer. The object of the company is to connect all the towns of the county with Port Gibson, the county seat.

The Automatic Telephone and Electric Company of Chicago has brought suit for $50,000 damages against H. S. Bower, of Bloomington, Ill. Bower was instrumental in organizing the Home Telephone Company in Bloomington. The plaintiff claims that Bower contracted for its automatic telephone switchboard, and instead of taking this device installed the old-fashioned board.

A meeting of delegates of the several commercial organizations of Buffalo was held on the 21st inst., at which it was decided that a letter should be sent to each candidate for the Assembly and the Senate asking if he were in favor of a bill similar to the Gerst-Persons telephone bill which was submitted to the Legislature last year.

The Hyde Park District Telephone Company has commenced laying conduits for its telephone service in the village of Hyde Park, Chicago. The company is an independent concern, and is backed by capitalists from Springfield, Ill.

Money has been subscribed and a company organized for the construction of a telephone line from Eastland, Tex., to Breckinridge, via Gunsight. Work will begin immediately.

Frank S. Vincent, representing the Chase Telephone Company, has secured a fifteen-year franchise in Petoskey, Mich.

The Luzerne County Telephone Company is being organized to operate in all of the cities and towns of Luzerne County, Pa. Sol Hirsch, of Wilkes-Barre, is promoting the enterprise, which is said to be backed by New York capital.

The Elko Telephone Company, Elko, Ga., have connected Elko with Perry and Fort Valley.

The American Telephone and Telegraph Company has asked for permission to enter Richmond, Va., with its long-distance lines.

New Companies Incorporated.

The Altoona Phœnix Telephone Company of Altoona, Pa., recently incorporated, will operate a telephone plant in the counties of Blair, Huntingdon, Cambria, Clearfield and Bedford, Pa. The capital stock of the company is ·15,000. The officers are: H. Price Graffius, president; A. V. Dively, treasurer; John M. Hamer, general manager, and Willard P. Beardsley, secretary. Directors: H. Price Graffius; A. V. Dively; John Flanigan, Hon. J. D. Hicks and Wm. A. Ambrose, all of Altoona, Pa.

Simplex Interior Telephone Company, Cincinnati, O. Capital stock, $5,000. Incorporators: Walter L. Bradshaw John Seymour, Emile Koel, Robert G. Stevenson and James McClain.

The Vacaville and Winters Telephone Company, Vacaville, Cal. Capital stock, $5,000. Directors: E. R. Thurber T. K. Buck, William H. Buck, F. B. McKevitt, Vacaville; Henry Bruick, Winters.

The Lincoln and Knox Telegraph and Telephone Company, Waldoboro, Me.—to own, construct, maintain and operate lines of telephone or telegraph. Capital stock, $3,000. Officers; George Bliss, president; Lincoln N. Kennedy, treasurer.

The Home Telephone Company, Jersey City, N.J.—to erect and operate telephone lines in all the cities and towns of Hudson county, New Jersey. Capital stock, $300,000. Incorporators: Ernest J. Ford, P. Justus Atkinson and George N. Atkinson.

The Automatic Telephone Exchange, Detroit, Mich.—to manufacture and sell an automatic telephone exchange. The company has a nominal capital of $1,000,000, represented mainly by the value put upon its patents. The officers and stockholders are: Charles A. Gates, of Saginaw, chairman; William Rebec, of Saginaw, vice-chairman; Charles P. Cavin, of Saginaw, treasurer; Arthur B. Harford, of Detroit, secretary and general manager; Malcolm McGregor, of Detroit, treasurer.

INCORPORATIONS.

The Munson Electric Conduit Company, Davenport, Iowa—to manufacture, buy and sell and do a general business in goods and appliances and construct electric railways. Capital stock, $10,000,000. Promoters: John H. Munson, James E. Merritt, Wm. F. Robert.

The Evanston Electric Railway Company, Chicago, Ill—to conduct, lease or otherwise acquire horse, dummy and electric street railways; maintain and operate same. Capital stock, $200,000. Promoters: Andrew Crawford, Thos C. Milsted, Park E. Simmons.

The Victor Electric Company, Chicago, Ill.—to manufacture and deal in electrical and mechanical machinery and devices and to do all kinds of electrical work. Capital stock, $2,400. Promoters: C. F. Samms, J. B. Wantz, E. P. Vickers.

The Big Four Electric Company, Chicago, Ill.—to manufacture, buy and sell, lease or otherwise deal in electrical apparatus, devices and machinery, and light, heat and power. Capital stock, $200,000. Promoters: Henry D Ames, Wm. H. Brown, Louis K. Gillson.

The Ohio Valley Electric Railway Company, Pittsburg, Pa.—to build a railway in Allegheny County, Pa. Capital stock, $25,000. Promoters: Wm. T. Lindsay, Henry E Lineaweaver, Pittsburg; Edgar C. Gerwig, Allegheny.

The St. Mary Mining Company, Spokane, Wash.—to do a mining and real estate business; erect and operate electric light and power plants. Capital stock, $500,000. Promoters: C S. Voorhees, J. L. Willson, R. H. Voorhees, J. M Burke, T. E. Jefferson, H. L. Willson.

The Lima and Piqua Electric Street Railroad Company, St. Mary's, Ohio—to build and operate a street railroad between Piqua and Lima, O., to be operated by steam, horse, electric or other motive power, and to furnish light, heat and power. Capital stock, $9,000. Promoters: B. C. Faurot, D. W. Jay, D. Armstrong, Wm. H. Hartman, S. W McFarland, Edward Burns.

The Union Power Company, Cleveland, Ohio—to generate and distribute from one or more centers electric or other power for motive, electro-chemical, welding, heating and other purposes. Capital stock, $50,000, Promoters H. N. Chamberlain, J. Henry White, F. C. Phillips, Geo. C Wing, Morris S. Towson.

The Chicago Water Heater Company, Chicago, Ill.—to manufacture and sell heaters, ranges, stoves and any and all kinds of machinery, utensils and apparatus for heating buildings, cars and other structures by means of water, steam, air, electricity and other methods. Capital stock $10,000. Promoters: B. W. Sherman, Samuel E. Hibben, John L. Jackson.

The Lucas Electric Construction Company, Baltimore, Md.—to deal in all kinds of electrical supplies. Capital stock, $2,000. Incorporators: J. Clarence Lucas, Ridgeway Moseman, Chas. E. Burgar, Wm. D. Wilson, Jr., and Wm. M. Burgar.

Gray's Electric Railway Supply Company, Saco, Me.—to manufacture, rails, cars, apparatus for electric and other railways, etc. President, Robert Johnson; treasurer, R. Powers, both of Boston, Mass.

The Dansville Gas and Electric Light Company, Dansville, N. Y. Capital stock, $25,000. Directors: W. W. Cramer, W. T. Spinning, Charles H. Rowe and others of Dansville.

Wicke & Reinhardt Car Fender Company, Brooklyn, N.Y.—to manufacture car fenders. Capital stock, $10,000. Directors: Philip Reinhardt, O. A. Wicke, George E. Koch, F. W Grau, and R. Koch of Brooklyn.

The National Coal Mining Company, Portland, Ore.—to do a general mining business, acquire and conduct hotels, do a general improvement business, construct and equip railroads, telegraph, telephone and electric lines, etc. Capital stock, $220,000. Incorporators: J. B. Parker, F. M Batchelor, J. S. Stephenson, G. Balsamy, R. A. Reid and T. A. Edwards.

Hot Springs, Va.—President Ingalls of the Big Four and Chesapeake & Ohio Railroads has received plans for a $100,000 hotel to be built at Hot Springs.

Jersey City, N. J.—Edward Schroeder will build two handsome five story flats, southeast corner of Jersey ave and 9th st ... Ex-County Clerk Dennis McLaughlin is about to expend $40,500 in the erection of four five story brick flats, two of which will face West Hamilton Place, near 9th st

The Sac City Electric Company, Sac City, Iowa—to erect, establish and maintain a plant to furnish customers light, heat and power. Capital stock, $15,000. Promoters: L. C Early, Asa Platt, D. E. Hallett, E. W. Bailey, J. E. Robbins W. Cheney, J. Y. Campfield, D. I. Dixon, C. W. Marey, Geo A. Martin, Geo. A. Miller, J. W. Wilson, Phil. Schaller.

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EDITORIAL NOTES.

When the "Kiting" Epoch Will End. If further confirmation of the statements made in these columns touching the disastrous results of over-capitalization of electric railways were needed, none could be stronger than the declarations made by Col. H. G. Prout, editor of the *Railroad Gazette*, in an address which is reported elsewhere in this issue.

Col. Prout is a well posted and observant student of progress in the transportation world. Conservative, as most steam railroad men are, he is not oblivious to the fact, nor does he hesitate to admit it, that the electric motor has made a formidable invasion into the field hitherto exclusively occupied by the locomotive. Like all other well-informed engineers, Col. Prout recognizes the limitations in the application of electricity to lines of railroad now operated by steam, yet he is aware that the time has fully come when practical railroad men must needs give careful consideration to the problem of improved suburban and interurban service.

Some of Col. Prout's suggestions as to the best methods to be employed by railroads in order to retain or to increase their local traffic within suburban zones, are eminently practical, and we doubt not that the enterprising managers of roads which serve large centers of population will be quick to adopt them.

In this connection it is encouraging to note that railway and electrical interests are co-operating more heartily than ever before in an effort to reach a solution of the rapid transit problem. This bodes no ill to the electric motor.

It is not from a professional engineering standpoint alone that Col. Prout's view of the situation is clear. His opinions of the commercial side are as sound as they are vigorously expressed. He says:

> There is, however, a set of conditions at work which will change the situation of the present electric railroads a good deal before long. Up to the present time it has been, and still is, easy to finance them, because rail mills and electrical manufacturers are glad to help float the bonds of new electric railroad projects; the public is credulous and investors look for great profits. We are, therefore, in the midst of the "kiting" epoch of electric railroads, when bonds which are sold to-day pay the interest on the bonds sold last month or last year. But, naturally, this situation must come to an end before long.

The end will not come so long as the electric railroad "promoter" is permitted to ply his iniquitous trade; it will not come so long as roads costing less than $15,000 per mile are capitalized at $250,000 or at even $95,000 per mile; it will not come so long as bonds are issued to pay for the worthless stock of consolidated companies, or to pay interest on bonds already issued, or to pay dividends on watered stock.

It *will come* when the electric railroad business is as carefully, as honestly, and as conservatively managed as any other legitimate business.

Then, but not till then.

* * *

Safety in Electrical Wiring. In the electrical lexicon of Captain William Brophy there is no such word as "shoddy." He has always maintained, with an earnestness born of a firm conviction, that the highest factor of safety in the electrical wiring of buildings can be obtained only by the use of the best material, installed by honest, capable workmen. Captain Brophy's long and varied experience in the field of electrical inspection, coupled with the thorough investigation of the many problems which have come to his official and individual notice, eminently qualify him to speak with authority. In his remarks upon the "Defects in Electrical Wiring," published elsewhere in this issue, there is perhaps little that is new, unless, indeed, it be new or strange to insist that good work *must* be done in order to insure the nearest approach to perfect safety.

That the application of electricity to lighting and power purposes has been somewhat restricted is due, in no small measure, to the use of faulty material, carelessly installed. The degree of excellence which is now admitted to be essential in all material used in electrical installations has been attained only after years of experiment and improvement. There was, therefore, a reasonable excuse to be offered for the employment of such material as underwriters' wire for interior work, as was common six or eight years ago. But the absence of interior conduit, high grade insulated wires, and other appliances as now perfected, can never be urged as a justification for stringing 110 volt wires to a damp ceiling by bell tacks, or attaching them to gas fixtures without cut-out or insulating devices, or making a service tap with both sides of a circuit run through one hole in a window casing, or any other of the practices which unskilled workmen employ even at this day.

Happily for the increasing growth of the electrical industry, and the more certain stability of the trade, the improvements in devices and material and the growing demand of architects, engineers and owners for the best, tend more and more to drive the shoddy goods, the shoddy contractor and the shoddy workman out of business. Captain Brophy notes this encouraging sign of the times, and while he feels warranted in expressing the "firm belief that the transmission of electric energy and its conversion into light, heat, sound and articulate speech, or its reconversion into motive power, can be accomplished with nearly perfect safety," he is convinced that this condition can be approximated only by the use of the best material, honestly installed under skilled direction and according to intelligent plans.

Such a consummation will demand of the manufacturer his best product, of the architect and engineer accurate knowledge, and of the contractor something more than a desire for big profits.

Fortunately these qualifications already exist, but unfortunately they are too rarely combined.

* * *

"What's In It For Me?"

Under this heading there was published in ELECTRICITY for October 16 an article devoted specially to the subject of payment of commissions by manufacturing companies to purchasing agents—in plain English bribery. The article, to put it mildly, attracted considerable attention. We showed as conclusively as was possible in the space used the evil effects of the system, by specific examples; first, that the employer of the purchasing agent was robbed by the practice, and, second, that manufacturers who refused to pay commissions suffered an injustice at the hands of the purchasing agent and his co-conspirators. In the entire article there is not one word which we wish to retract. ELECTRICITY stands first, last and all the time for purity in business methods.

Among the companies charged with having paid bribes to L. H. McIntyre of the People's Traction Company, Philadelphia, was the Peckham Motor Truck and Wheel Company of this city. It was also charged that, under the same influences, Brill trucks, purchased by the board of directors in spite of McIntyre's protest, had been discarded after a few months of service, at great loss to the railway company and injury to the business of the Brill Company.

It was also stated, *upon information furnished to* ELECTRICITY *by a director of the People's Traction Company*, that in this period the Brill trucks had cost nothing for repairs, and that the Peckham trucks had cost a good deal for repairs.

In an advertisement in the current issue of the *Street Railway Journal* the following letters are printed:

> THE PECKHAM MOTOR TRUCK AND WHEEL COMPANY,
> New York, October 23, 1895.
>
> GENTLEMEN: Referring to the recent article in a so-called electrical journal, distributed at the recent Convention at Montreal, which referred to our trucks in use on the People's Passenger Railway of Philadelphia, I beg to call your attention to the enclosed letter just received from the President of the People's Passenger Railway Company, referring to this article, and which explains itself. This letter is our reply to the article referred to. Very truly yours,
>
> E. PECKHAM, President.

> PEOPLE'S PASSENGER RAILWAY COMPANY,
> Philadelphia, October 22, 1895.
> Peckham Motor Truck & Wheel Company, New York.
>
> DEAR SIRS: We have seen the notice in ELECTRICITY relative to your sales to this company, and our action in regard to the Brill trucks. The statement is made in ELECTRICITY that "At the end of ten (10) months, not one dollar had been spent for repairs on the Brill trucks, and the Peckham trucks had cost this company nearly their original purchase price in rebuilding.' The situation is exactly the reverse. That is to say, the Peckham trucks cost us comparatively nothing, while the Brill trucks proved much more expensive in maintenance. We write you this in justice to the construction of your work and our experience with the trucks under severe conditions. We think it is but justice to you to make this statement. Yours very truly,
>
> (Signed) WILLIAM H. SHELMERDINE, President.

Notwithstanding all this, we maintain our original assertion, and will take pleasure in making the history of the whole deal, with side lights on other deals, a matter of legal record.

It is proper that the following letter from the J. G. Brill Co. be given equal prominence with those of Messrs. Peckham and Shelmerdine, and to state that the latter was not *president* of the People's Traction Co. when this purchase of trucks was made.

> PHILADELPHIA, November 1, 1895.
> EDITOR OF ELECTRICITY,
> 6 Park Place, New York City.
>
> DEAR SIR: In the advertisements in the *Street Railway Journal* for November there is a page from the Peckham Motor Truck and Wheel Company which contains a letter purporting to have been written by Mr. Shelmerdine, president of the People's Passenger Railway Company, which flatly contradicts the statement in your article in issue of October 16th as to the relative performance of the Brill trucks and the Peckham trucks on the road of that company. This letter does not contain a true statement of the facts, and its writer has evidently been deceived. Mr. Shelmerdine was not in that position when the matter referred to happened, and has evidently had his information from the assistants and appointees of McIntyre, who are still employed by the Railway Company. **If the Peckham Company can get a letter of a similar purport or anything nearly approaching it from the predecessor of Mr. Shelmerdine who was in office and cognizant of all the facts at that time, we will be glad to give a thousand dollars to any worthy object named by Mr. Peckham.** The facts are that an order was given by the People's Company to ourselves and the Peckham Company for 125 trucks each. The model submitted by Peckham was the one on which his first few trucks were made, and this would not hold up the ends of the open car bodies, and a different truck was substituted at a higher price. The second type of Peckham truck was also found incapable of doing this work, and two changes in the trusses were found necessary before they were accepted; nor do they now properly support the open car ends, as is patent to any observer. The Brill trucks worked steadily and admirably, and were duly accepted and paid for in full by the railway company, and they continued to do the work until the consulting engineer of the Peckham Company, McIntyre, had worked the matter so as to have the Brill trucks discarded by the People's Traction Company. The subsequent career of McIntyre affords a shrewd indication of the probability of the honesty of this arrangement. The Peckham Company has been unfortunate in not having a consulting engineer in the service of other roads, notably the Pittsburgh Traction Company.
>
> We can moreover state this fact, that 21 of the Brill trucks which were condemned by the late general manager, McIntyre, were bought by the Pennsylvania Railroad Company for their Atlantic City road, where they have been in successful operation during all of the past summer on that company's most admirable electric railway. Yours very truly,
>
> J. G. BRILL CO.

The statements made by ELECTRICITY in regard to this truck question were correct.

Plenty of similar examples of McIntyre's conduct might have been cited; for instance, his discarding Lewis & Fowler registers, and replacing them with Meaker registers within six months after taking control at Philadelphia. At that time the Lewis & Fowler register was standard; three times as many of them were in use as of any other type. The Meaker register at that time certainly had no points of superiority. The reason for the change was the usual McIntyre reason.

And now we have a few words to address to Mr. Peckham:

Is the charge that trucks made by your company happened, in one instance, to be improperly made, more damaging to your reputation than the charges as to your relations with Mr. McIntyre? Is it less honorable for you to bear the responsibility of mistakes made by your mechanics than to rest under the charge that while L. H. McIntyre was a salaried employee of the People's Traction Co., vested with the authority of purchasing all apparatus, he, as "consulting engineer," received large sums of money from your company contemporaneous with this purchase of trucks from your company?

You have attempted, Mr. Peckham, to dodge the main question at issue.

The subject of our article was, "What's in it for me?" The meaning of this question was thoroughly elucidated. The questions involved in the truck matter were minor ones.

Being an honest man, familiar with the English language, also familiar with McIntyre, his methods, and the methods of others of the same class, you are specially fitted to write an answer to our arguments on this subject.

Any reasonable amount of space, say two pages, is at your disposal for a letter of this kind, and there will be no charge.

Directors of the railway companies of the country know that you generally make very fair trucks. But they don't know whether your company is a safe one to deal with until you have explained in full your relations with L. H. McIntyre.

* * *

Canal Traction and Newspaper Duty.

Something over four pages of the *Electrical Engineer*, and one page of the *Electrical World*, were given up last week to an illustrated description of an experiment in electric traction on the Erie Canal. The "system" consists of an electric motor and carriage suspended from a cable on the heel path of the canal, drawing one or more canal boats.

The comments of our contemporaries on this matter show that notwithstanding all their loss of prestige from indiscriminate puffery of enterprises of a like character during the past fifteen years, the lessons of experience have been wasted upon them, and they are still ready to lend their names to any scheme brought forward which promises them financial return, or which helps to fill space with pretty pictures. No matter how unstable or culpable the scheme; these journals can always be relied on to help it along and co-operate in the deception of the public.

The only common sense views expressed on this canal towage enterprise in the electrical press, outside of our own columns, have been found in the *Western Electrician*, as follows:

> There has been no data presented showing the efficiency of the electrical apparatus, nor is there any other means at hand of making a comparison with the older methods which it is hoped to supplant. Of course the economy and efficiency of the proposed system will have much to do with its general adoption, and until further particulars on these points are to be had there is no use considering the scheme as a practical measure.

No data on the question of cost of this power to the company proposing to supply it have been given out. None of the representatives of the technical press present appeared to have any interest in making tests to see how much power was required. It was enough for them to see the wheels turn round. The wheels turned, *ergo* the entire scheme is already a success. The *Electrical Engineer* said editorially:

> Hearty congratulations are to be extended Messrs. Lamb and Hawley, as inventor and promoter respectively of the ingenious method *adopted successfully* last week for operating the Erie Canal by electricity. It will be remembered that Mr. Hawley made a previous trial with the ordinary trolley system; but the ideal plan of hauling from the bank has been adopted and we believe great results for good will ensue. The inexhaustible energy of Niagara will not only be applied to the canal, and following its lines penetrate into the interior of the State, but other canals now grassgrown or green with the slime of years will be reclaimed. We may see even a period of canal "grayhounds" furnishing cheap and very comfortable transportation for passengers; but the freight part of the question will of course be first dealt with.

Mr. Lamb invented (?) his system for application in a logging camp where a solid roadway was next to impossible—a very proper reason for putting the motor in the air; and the only proper reason.

Along the Erie Canal from Buffalo to Albany there is one of the finest roadways in the world—already prepared fit for a steam or electric railway at the cost of millions to the State. Is not this the proper place for whatever kind of traction engine is used? The *inevitable* sag of the cable is enough of itself to double the power required to move a canal boat.

Some days before the latest test was made Mr. Frank W. Hawley called upon us to invite us to be present on the occasion. Incidentally he complained that we had pronounced against his scheme and himself, and had thereby seriously injured him. We told him that his personality had not been a factor with us at all, but that *we regarded* the plans as published entirely unfeasible and sure to end in failure. We regarded the whole scheme as an attempt to gull the public for stockjobbing purposes, and told him that while no attempt to discredit the electrical industry could find space *in* our columns except in the way of exposure, any legitimate scheme that would benefit the industry could have all the space that was desired, and without cost. We did not, however, believe that Mr. Hawley's scheme belonged to the latter class.

He protested so strongly and argued so well for the honesty of his purpose that we were half inclined to believe that we had misjudged the man if not the scheme, and had decided to withhold further judgment pending developments. On October 21 a preliminary trial was made of Mr. Hawley's scheme, and, although it proved a failure in this instance it is not the failure that we wish to advert to at this time, but Mr. Hawley himself.

One of the New York daily papers on the following day published the following :

> Mr. Hawley says that if the plan is approved by the State he is prepared to furnish electric motive power for 3,000 canal boats now moved by horses. Regarding the transmission of electric power over long distances, Mr. Hawley said that it was as easy to propel a car up the Capitol Hill at Albany with power generated at Niagara Falls as it was to operate an incandescent lamp at Goat Island in the Niagara River.
>
> "Ships in New York harbor will be loaded and unloaded before long with derricks operated by electricity generated at Niagara Falls," he said.
>
> It is claimed for this system that it will give any speed desirable, and will not injure the banks of the canal. The power will be furnished to canal boat owners at $20 per horse power per year. The locks and bridges can be operated by electricity, and the canal can be illuminated at night from the same wires that carry the power.

These claims are so absurd that if Mr. Hawley is really guilty of having made them he has thereby enrolled his name among the list of charlatans which includes the names of the manufacturers of the Electric Belt, the Electropoise, the Earth Magneto and Dr. Beckwith's Thermo-Ozone Battery.

We do not care whether Mr. Hawley's scheme has merit or not (we are sure that it has not), it must receive the condemnation of every honest man simply because charlatan methods, as above quoted, are employed to bring it before the public.

The triumphs of electricity require no fiction to make them appear remarkable. When we see a man gilding refined gold or painting the lily, we are very apt to conclude either that the man is a fool or that the gold or lily is bogus.

We do not think Mr. Hawley is a fool.

Four days after the second trial of this "ingenious method successfully adopted" there was a mass meeting at Cooper Union attended by over 3,000 people in the interest of the proposed appropriation of $9,000,000 for improving the efficiency of our canal system. If the economy and consequent desirability of hanging a motor carriage in the air have been so clearly proved, why was it that none of the dozen or so speakers—the men of all others best posted on the needs of the canals—did not present an argument for the "system."

An electric railway on the towpath for towing canal boats would no doubt be a long step in advance of present methods. A steam road for the purpose would long since have been built there had it not been for the successful opposition of railway interests.

But after a close study of the canal problem, extending over several years, we have no hesitation in declaring it as a proven fact that what the canals need is *more water*, a wider and deeper channel. Until this is provided the problem will not be solved either by electricity or any other method of applying power.

When the water has been provided, electric towing engines, supplied with power at intervals of twelve or fifteen miles, will do the rest.

* * *

THE circumstances of Franklin L. Pope's death recall the testimony given by him at the time efforts were being made to set aside the electrocution law in New York State. In July, 1889, counsel for William Kemmler, applied for a writ of habeas corpus on the ground that the State Constitution forbids the execution of a criminal by cruel and unusual means. Tracey C. Becker, of Buffalo, was the referee before whom testimony was taken. Among the many experts examined none gave more complete or more impartial testimony than Mr. Pope.

Bourke Cockran began the direct examination of Mr. Pope with a series of questions to show that there did not then exist, and probably there wouldn't be devised, any means of measuring accurately the resistance of the human body, and that the death of a man by electricity depends upon several contributing causes. Mr. Pope stated, as the result of experiments made by himself, that the resistance of his own body, as measured by a Wheatstone bridge, varied from 6,300 ohms with a current of one volt E. M. F. to 3,500 ohms with a current of 100 volts. This variation, he said, "is due to the chemical actions upon the fluids of the body." Answering the question, "Can electrical science measure the resistance of a living organism?" he said : "Well, you would get a result each time, but you can't tell whether it would be accurate."

Other questions propounded and their answers were:

Q. Do you know whether death by electricity is painful or not?

A. I believe it is very painful.

Q. Is it recorded anywhere in science what voltage would be required to kill a human being ?

A. No. Wires for lighting are always charged to a certain extent. Sometimes the current, when a person comes in contact with it, kills and sometimes it does not.

Q. Then there are contributing causes?

A. Yes, sir.

Q. Could you, as an expert, describe a current which in every case and with every person would absolutely cause death?

A. No, I could not.

Under the Searchlight.

Views and Opinions on Timely Topics.

IF the General Electric Company have, as reported, paid $500,000, or any other considerable sum, for the Love conduit patents, they certainly have more money than brains. What New York City is waiting for is a successful conduit system not costing a prohibitive price for construction. What the trade wants and needs, and must have if it is ever to be upon a basis of profit earning, is the eradication of what may be termed the patent disease. The large electrical companies, after wasting millions upon millions in ready-made patents and patent litigation, are still spending the money of their stockholders for worthless patents and using their patent claims for stock-jobbing purposes to the neglect of their natural business—the manufacture and sale of apparatus. And we cannot express our sense of regret when it became apparent that another electric company, from whom was expected nothing but conservatism and aid in purifying the trade, had become a victim of the same disease which has been the main cause of the unsatisfactory conditions existing in the electrical trade of America to-day. We advise every company in this business to let trades, deals and patent manipulations severely alone and saw wood.

* * *

Mr. Westinghouse's Views.

Mr. Westinghouse is reported as follows in conversation with President Roberts and other officials of the Pennsylvania Railroad :

> The Pennsylvania Railroad to-day, it is said, consumes about 5,000,000 tons of coal per annum on its lines east of Pittsburg, taking approximately 20 loaded trains each day for its transportation and consequently the return of 20 empty trains, and requiring for the service of the company alone fully 3,000 cars and a proportionate number of locomotives.
>
> If this power was to be generated by gas locomotives only about one-eighth, or 600,000 tons of coal per year would be required, effecting a saving of over 4,000,000 tons of coal, now costing the railway about $5,000,000, a saving which would justify a large enough capital expenditure to cover the complete equipment of the railway.
>
> To carry out an arrangement of the trains Mr. Westinghouse said that stations having electric generating plants, with gas engines and producers, could be located at intervals of from ten to twelve miles so that there would always be two or three stations furnishing current for any particular part of the line.

We desire to call the attention of all transmission cranks and visionaries to the intervals between stations suggested above.

* * *

EXCITEMENT IN A QUIET TOWN.

(From the Philadelphia Inquirer, Oct. 31.)

> The Philadelphia stock market had the liveliest shake-up yesterday it has experienced since the Reading Railroad collapsed, nearly three years ago. The "Philadelphia Kaffirs," as they have been called, went all to pieces, one stock breaking $17 a share in two hours' time.
>
> Symptoms of weakness in this group appeared on Monday night, when the United Gas Improvement directors suggested a stock dividend of only 15 per cent., instead of 20, as had been considered probable. The next day United Gas, Welsbach Light, Electric Storage and Pennsylvania Light, Heat and Power, which constituted this group of stocks, were all lower. Electric Storage, which sold at 73½ on Monday morning and 70 on Monday night, broke to 65 on Tuesday, but the speculative community all imagined the directors would support the stock and hence were not particularly alarmed. Yesterday morning, when the stock sold up to 66¼, they felt quite easy. They imagined the insiders were ready with supporting orders and would prevent a serious decline.
>
> But the bank officials of the city were not as well satisfied on this point. Some of them had made loans to stock brokers, taking as collateral in part Electric Storage stock. They did not like the decline in the price, and yesterday morning suggested to some of the brokers that the loans be reduced in size or additional collateral be put up. That was enough. The brokers at once attempted to sell the stock out and found the insiders were not there with supporting orders. Then the market went all to pieces.
>
> A few shares were sold from 65 down to 60 and then there was a brief wait for the inside support to come out. It did not come. The stock dropped at once from 60 to 58. Still no support. Then came a break to 55 and then a downward plunge to 48. Between 60 and 48 only 2,500 shares were sold. But at that price outside buyers came in and put the stock up to 55. This was taken at first for inside support, but it was a mistake. There was no such thing, and the stock broke again to 47. In the last hour, however, it rallied. While this was going on the preferred stock, Welsbach Light, United Gas, and Penn Light, Heat and Power were all going through the same experience.
>
> The Street simply boiled with excitement. Clerks were running about with notes to people who had the stock to put up more margin. Many were unable to respond and their brokers at once sold them out. In every office crowds gathered about the ticker and every decline was shouted out. On the floor of the Exchange the scene resembled a fight in a madhouse. Brokers were howling and jumping about in a crazy manner. All were glad when the close came. But there were many white faces in the crowds of people that surged out of the brokers' offices when the clock struck 3.

* * *

What President Gibbs Says.

W. W. Gibbs, president of the Electric Storage Battery Company, says that "the decline in the securities of the company is unwarranted. The business of the company is growing rapidly, current receipts are constantly increasing and numerous extremely important installations are in process of consummation. No business is upon a more substantial basis to-day than the storage battery business. While litigation has delayed the exploitation of that industry in this country until six months ago, when we obtained control of all the patents, the enormous business and large profits secured by the storage battery companies in Germany, France and England give an earnest of what is awaiting us here. We have installed a large number of extremely important plants; our factory is working full time and a very large extension to it is now in progress."

* * *

THE list of electrical newspaper men who have shown their wisdom and stability during the last year or two includes Messrs. Kreidler, Keily, F. L. Perry, Nelson W. Perry, Wetzler and Montgomery. The only hesitant remaining, so far as we know, is Mr. W. D. Weaver of the *Electrical World*. We trust

Mr. Weaver may soon be brought to a realizing sense of his unfortunate position and find a wife. Perhaps not the only, but certainly the biggest, cranks in the world are old bachelors and old maids—and the latter are not to be blamed because they would not be so if every man did his duty. The community now waits for Mr. William Delinquent Weaver.

* * *

The Barnes Boys.

(From the Buffalo Express.)

Several newspapers have been mixing the Barnes boys up. The Thurlow Weed Barnes who has bolted the nomination of Frank D. Pavey for the Senate is not the owner of the Albany *Journal*, but that young gentleman's elder brother, and like him, a member of the Republican State Committee. While William Barnes, Jr., lives in and nominally bosses Albany, Thurlow Weed Barnes represents one of the New York districts. William Barnes has been longer in politics, and is therefore better known than his big brother.

For the information of those who have not seen both, it may be said that Thurlow looks like Willie, but is twice as large and built like a prize-fighter. Thurlow is on Easy street, financially, by dint of a judicious marriage with a daughter of John A. Morris, the lottery king. He used to be a member of a publishing house in Boston, but has returned to New York and engaged in politics. Heretofore he has been chiefly known to fame on account of a cable despatch he is said to have sent to the Prince of Wales announcing the death of Thurlow Weed. This historic message read simply: "Grandpa is dead."

The peculiar reputation of the Barnes brothers rests on the fact that they say things that older politicians only allow themselves to think.

* * *

Is Mr. Morgan Tired?

(From the Boston News-Bureau.)

Brokers who have been watching the selling of the market very closely this week say there have been unmistakable signs of large selling orders coming from Morgan interests, and that the break in Reading and General Electric can be traced rather directly to this source.

* * *

MR. W. J. HAMMER is now making a trip through the West as a plain everyday arc lamp salesman. We suppose he will, of course, call on Mr. Andrew Hickenlooper when in Cincinnati.

* * *

The Way It is Done in Chicago.

[COPY.]

Chicago, Ill., October 24, 1895.

Sealed proposals will be received until November 2, 1895, for furnishing the city of Chicago with 19,648 feet, more or less of Day's Kerite, single conductor, electric light cables, as per specifications on file in the office of the Superintendent of City Telegraph. Proposals must be made out on blanks furnished by the latter official and addressed to Comptroller, City Hall, Chicago, Ill., and endorsed "proposals for Day's Electric Light Cables." Each proposal must be accompanied by check for $200.

O. D. WETHERELL, Comptroller.

* * *

Echoes from the West.

(From the St. Louis Chronicle.)

SWINDLED.

ST. LOUIS CAPITALISTS SAID TO HAVE BEEN VICTIMIZED.

It is rumored that ex-Judge George A. Madill, Wm. H. Thompson and a dozen more prominent capitalists have been victimized by the Standard Telephone Company.

John W. Candler, a Boston banker, came here several months ago to organize the company and got fifteen men to put in $1,000 each. ELECTRICITY, a New York class paper of high standing, says the whole thing is a bare-faced swindle.

* * *

HERBERT E. RIDER, inventor of the Earth-Magneto fake, is a prolific genius. Not content with having discovered a method that will permanently cure all forms of nervous diseases, gout, dyspepsia, constipation, rheumatism, neuralgia, sciatica, insomnia or sleeplessness, melancholia, paralysis, lumbago, pain in the back or limbs, and kidney, bladder or liver complaints, headaches, nervousness, female complaints, wasting diseases, he is tackling problems of greater magnitude.

The most recent product of his gigantic brain is a plan for running mighty dynamos by power that can be taken from the rise and fall of the ocean's tide and the turbulence of its waves. He says that some noted engineers are considering his plan, and they pronounce it highly practicable. Instead of utilizing the back-and-forth motion of the tide and waves, he gets his power from the vertical motion.

"I can get enough power from the waves along Coney Island to heat and light the whole of New York City," is the inventor's modest estimate of the possibilities of his latest discovery.

* * *

THE CORBETT-FITZ FIGHT A GO.

(Special despatch to ELECTRICITY.)

HOT SPRINGS, Ark., Nov. 5.—The Corbett-Fitzsimmons contest is to be pulled off after all. New articles of agreement were drawn up and signed today, by the terms of which the contestants agree to do battle in the most approved style of modern pugilism. Two phonographs are to be placed in the diagonally opposite corners of a 24-foot ring. Into the receivers of these instruments the principals are to talk for six consecutive hours, the battle to be awarded to the contestant who shall speak the greatest number of words within the time limit.

The phonograph people have sent telegraphic orders for a car load of cylinders.

The betting is active, with odds about even.

The Standard Telephone Co.

Questionable Methods and Conduct.

On October 16, there was printed in ELECTRICITY a photographic fac-simile of a circular prepared and issued by the Standard Telephone Company, of New York. Gen. James S. Clarkson made a somewhat equivocal denial of the authenticity of this circular, but no other denial from any of the heads of the concern has so far appeared. No answers have been received to the following letters mailed to Messrs. Clarkson and Barnes nearly two weeks ago:

[COPY].

"ELECTRICITY,"
6 Park Place, New York.
October 25, 1895.

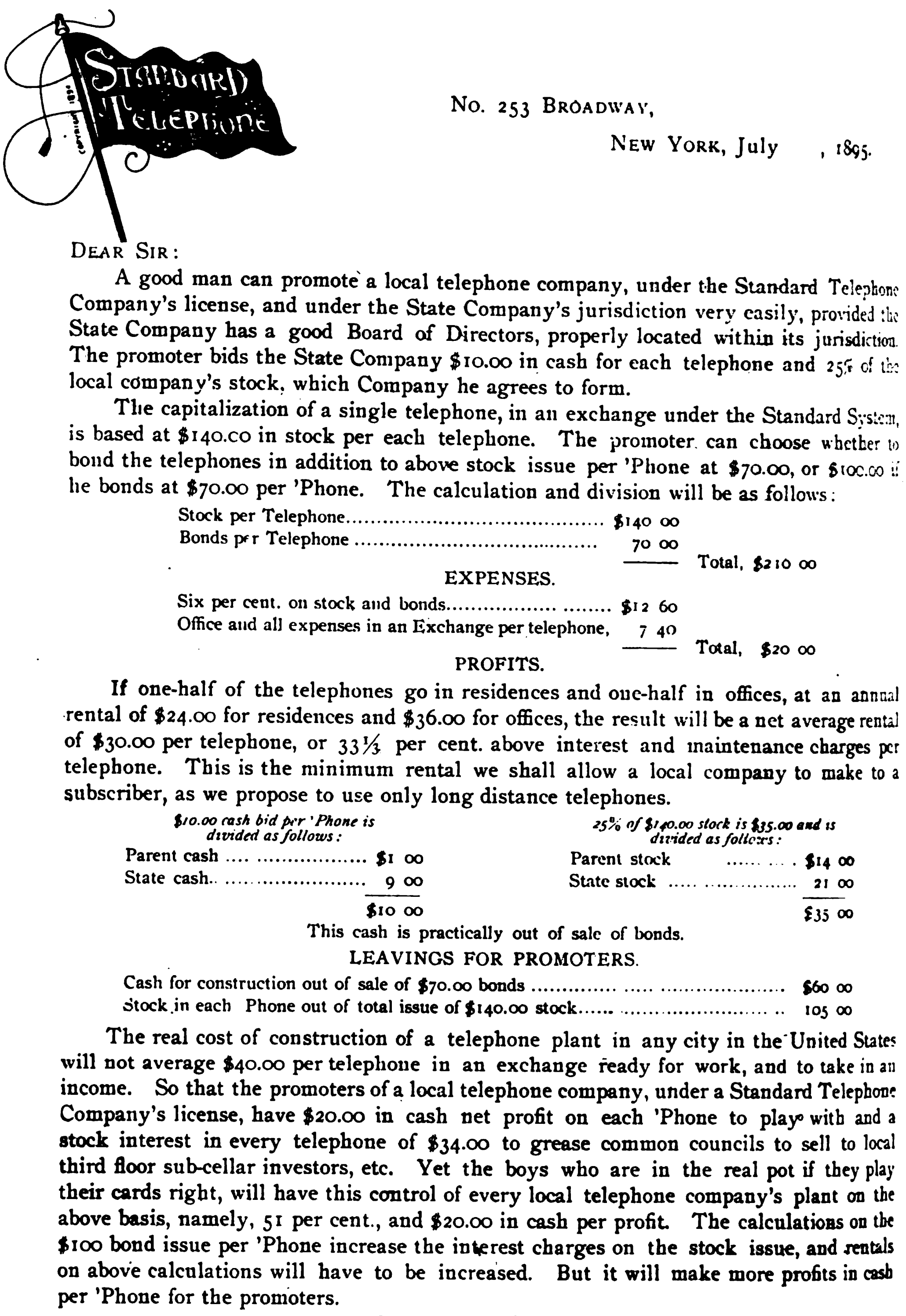
HON. J. S. CLARKSON,
Fifth Ave. Hotel, New York.

DEAR SIR: I notice in a recent interview attributed to you, in the *New York Herald*, a denial of the authenticity of a Standard Telephone circular recently published in this paper, and would esteem it a favor if you will make such denial over your own signature, and forward to me.

Yours very truly,

(Signed) B. E. GREENE, Publisher.

(Dictated.)



STANDARD TELEPHONE

No. 253 BROADWAY,
NEW YORK, July , 1895.

DEAR SIR:

A good man can promote a local telephone company, under the Standard Telephone Company's license, and under the State Company's jurisdiction very easily, provided the State Company has a good Board of Directors, properly located within its jurisdiction. The promoter bids the State Company $10.00 in cash for each telephone and 25% of the local company's stock, which Company he agrees to form.

The capitalization of a single telephone, in an exchange under the Standard System, is based at $140.00 in stock per each telephone. The promoter can choose whether to bond the telephones in addition to above stock issue per 'Phone at $70.00, or $100.00 if he bonds at $70.00 per 'Phone. The calculation and division will be as follows:

Stock per Telephone	$140 00	
Bonds per Telephone	70 00	
		Total, $210 00

EXPENSES.

Six per cent. on stock and bonds	$12 60	
Office and all expenses in an Exchange per telephone,	7 40	
		Total, $20 00

PROFITS.

If one-half of the telephones go in residences and one-half in offices, at an annual rental of $24.00 for residences and $36.00 for offices, the result will be a net average rental of $30.00 per telephone, or 33⅓ per cent. above interest and maintenance charges per telephone. This is the minimum rental we shall allow a local company to make to a subscriber, as we propose to use only long distance telephones.

$10.00 cash bid per 'Phone is divided as follows:

Parent cash	$1 00
State cash	9 00
	$10 00

25% of $140.00 stock is $35.00 and is divided as follows:

Parent stock	$14 00
State stock	21 00
	$35 00

This cash is practically out of sale of bonds.

LEAVINGS FOR PROMOTERS.

Cash for construction out of sale of $70.00 bonds	$60 00
Stock in each Phone out of total issue of $140.00 stock	105 00

The real cost of construction of a telephone plant in any city in the United States will not average $40.00 per telephone in an exchange ready for work, and to take in an income. So that the promoters of a local telephone company, under a Standard Telephone Company's license, have $20.00 in cash net profit on each 'Phone to play with and a stock interest in every telephone of $34.00 to grease common councils to sell to local third floor sub-cellar investors, etc. Yet the boys who are in the real pot if they play their cards right, will have this control of every local telephone company's plant on the above basis, namely, 51 per cent., and $20.00 in cash per profit. The calculations on the $100 bond issue per 'Phone increase the interest charges on the stock issue, and rentals on above calculations will have to be increased. But it will make more profits in cash per 'Phone for the promoters.

Yours very truly,

[COPY].

"ELECTRICITY,"
6 Park Place, New York. October 25, 1895.
THURLOW WEED BARNES, ESQ.,
President Standard Telephone Co., New York.

DEAR SIR: I notice that in interviews with various people connected with your company, the authenticity of one of your telephone circulars, recently published in this paper, is denied, and I beg to advise you that you are at liberty to use whatever space in our columns is necessary to deny that the circular in question was prepared and issued by the Standard Telephone Company of New York.

Yours very truly,
(Dictated.) (Signed) B. E. GREENE, Publisher.

We have deemed the matter of sufficient importance to the telephone public to reproduce the circular again this week. It appears on the preceding page.

It was prepared in and issued from the New York office of the Standard Telephone Company early in July.

On July 27 an original copy of it, properly dated and signed by an officer of the company, was sent to the *New York Herald* by a gentleman who had received it in his mail. It was sent for publication as news matter, and just why the *Herald* did not use it we do not know. It is scarcely possible that they would suppress it for pay.

We print below another circular issued by this remarkable concern. It contains no reference to greasing common councils, yet it is as clear proof of the flimsy character of the Standard Telephone Company's plan as could be desired. The claims made are ridiculous and could not be made by any man familiar with the telephone business unless he planned a stockjobbing scheme to secure the money of men wholly ignorant of telephone possibilities:

(CONFIDENTIAL.)

OFFICE STANDARD TELEPHONE COMPANY,
253 Broadway, New York,
Postal Telegraph Building.
ALLEN T. NYE, General Manager.

PROSPECTUS of Parent and State Standard Telephone Companies as to the capitalization of a single telephone in an exchange, complete and ready for work:

(1) That a uniform capitalization of $140 per telephone shall be compulsory throughout our systems, with the privilege to promoters of local companies to issue bonds on each plant to the amount of $70 per telephone, which, by the written consent of the Parent and State Telephone Companies, may, under certain conditions, be increased to $100 per 'phone for constructing the necessary plant and exchange system.

(2) The bonds issued by each local company must be retired and cancelled within twenty years from the surplus earnings of the plant and cancelled within less time if it be possible to place the bonds for a less period at an equally advantageous rate of interest.

(3) The promoter of local companies must accompany his written proposal for the concession of territory with an agreement to pay $10 in cash per telephone, and to deliver twenty-five per cent. of the $140 in stock issued against each telephone in his district to the Parent and State Companies. The cash and stock thus paid being divided as follows:

$1 to the Parent Co.,	$14 in stock to Parent Co.,
9 to the State Co.,	21 in stock to State Co.,

Total, $10 in cash per 'phone. To., $35 in stock for license.

(4) Promoters of local companies will be required to give the general managers of the Parent and State Companies satisfactory proof that they possess the necessary financial ability, and are men of sufficient responsibility and character to secure charters and subscribers in the territory in which they desire to establish exchanges, as well as credit and rating for any bonds that may be placed on the market by them for constructing their proposed plants.

(5) The money realized from the sale of the seventy dollars in bonds issued against each telephone is to be used in the construction of the local telephone system, the detailed disbursement of the money thus secured being estimated as follows:

Purchase of telephone	$20
Construction of lines, allowing one mile of No. 12 copper wire per 'phone	20
Construction and installation of exchange per 'phone	20
License—cash bid as above	10
Total	$70

The cost of construction here set forth is very liberally estimated for any city in the United States, while in many it will be far less.

On the completion of the local telephone system, the fixed charges per 'phone and annual cost of maintenance will be as follows:

Interest on bonded indebtedness of $70 per 'phone at 6 per cent. per annum	$4.20
Cost of maintenance and operating per annum per 'phone	16.60
Total for operating and fixed charges per annum.	$20.80

Taking the average annual rental of each telephone at $30, which is the lowest rental that the Parent and State Companies will consent to for a long distance telephone, and the cost of the operating and fixed charges as above, the following comparison is presented:

Gross annual income per telephone	$30.00
Fixed charges and operating expenses per annum	20.80
Net income per 'phone per annum	$9.20

The real profits realized by the promotion company building the local system will be, at least $20 in cash out of the estimated construction cost of $60 per telephone, less license fee; and, after the bonds of $70 per telephone have been cancelled by the surplus earnings of the plant, the promotion company will absolutely own seventy-five per cent of the local company's stock, or $105 of stock of each telephone in its district, with all the immense earning capacity of the plant at above low rentals, and this promotion company in the construction of its plant will deal directly with the electrical construction companies on a business basis—lowest bidder first class work securing the contract.

On the completion and installation of each exchange, for each one hundred telephones thereafter installed and in operation, the local company will be required to make an additional issue of $140 in stocks and $70 in bonds against each telephone, twenty-five per cent. of which stock and $10 cash per 'phone is to be paid to the Parent and State Companies, and the remaining seventy-five per cent. of stock, with the money realized from the sale of the bonds, to be used by or held in the treasury of the local company as an additional construction and improvement fund, or subject to same conditions as an original organizatson of the plant.

PROPOSAL NO. 2.

When a bond issue of $100 per telephone is permitted, the minimum rental per long distance telephone will be $36 per annum, the conditions governing the issuance of the bonds being the same as where the issue of bonds is $70 per telephone.

In exchanges established under an issue of $100 in bonds per telephone, the annual fixed charges, cost of maintenance and operating will be as follows:

Interest on $100 in bonds at 6 per cent. per annum	$6.00
Cost of maintenance and operation	16.60
Total	$22.60

On this basis the net income of such exchanges will be as follows:

Gross annual income per telephone	$36.00
Fixed charges and operating expenses per annum	22.60
Net income per 'phone per annum	$13.40

The issue of bonds to the extent of $100 per telephone will be sanctioned only where extraordinary circumstances may warrant it, and only on the written authorization of the Parent and State Companies.

The same conditions covering the concession of territory and the issuing of license to local companies will be pursued in the establishment of both classes of exchanges, as well as in the provisions regulating the increased issue of stock and bonds to provide for the extension and enlarging of exchanges by the installation of additional telephones.

It will not cost $16.60 to operate a telephone in any exchange in America outside of New York and Brooklyn, and $16.60 is away above the cost in New York and Brooklyn, and on the above low costs of rental per 'phone there is 6 per cent. interest on the stock and bonds issued against a telephone and a surplus to retire the bonds when they mature.

Respectfully,
ALLEN T. NYE, General Manager.

There has been nothing in the career of this company to inspire confidence—except the names of eminent men connected with it. Names, however, are an insufficient basis to warrant any company in selling State rights for something which they cannot deliver, and unless all signs fail the courts will soon be called upon to decide whether or not those who have paid in $1,000 apiece in the organization of State companies have lost their money legally or otherwise. That it is lost there is little doubt.

In connection with this circular to the "Boys who are in the Pot," it is proper to reproduce the names of the officers and directors of the parent Standard Telephone Company. As given in a recent reading notice in the New York *World*, they are as follows:

THURLOW WEED BARNES, president.
MANNING C. PALMER, Syracuse, treasurer.
ALLEN T. NYE, New York, general manager.

DIRECTORS.

CARL F. BOKER, New York.
JOHN A. BRILL, Philadelphia.
HON. WILLIAM J. CAMPBELL, Chicago.
HON. JOHN W. CANDLER, Boston.
GEN. JAMES S. CLARKSON, Iowa.
GEORGE CROCKER, California.
A. L. CONGER, Ohio.
ALBERT M. DAY, Chicago.
SENATOR JOHN P. JONES, Nevada.
HENRY MERZ, New York.
FELIX RACKEMANN, Boston.
HON. JOHN S. RUNNELLS, Chicago.
COL. JACOB RUPPERT, New York.
CLARLES T. STRAUSS, New York.
LOUIS WINDMULLER, New York.

How would these gentlemen like to write their autographic signatures under the proposition of which we print a photographic fac-simile? None has done so, so far as we know, except one. Yet, is their position much better than it would be had each and everyone of them signed it? Corrupt promoters throughout the country are still trying to raise money for Standard Telephone rights, and the names printed above are their chief stock in trade. It is not the name of Allen T. Nye which has secured subscriptions of over $300,000 for these rights. It is the names of those whom he was shrewd enough to get into his scheme. And until every one of them denounces in positive language the methods so far followed by the Standard Company, and disclaims any knowledge of what has been going on on the inside, they can justly be held responsible for the conduct of the company's affairs. Indeed, if they are to save their reputations they must go further, and renounce all future connection with the enterprise or give personal guarantees that the representations made by the official promoters of the scheme will be made good. No other course is left open to them, and explanations are in order.

When the plans of the Standard Telephone Company were first made public, there was a capitalization of no less than $260,000,000 for the parent and district companies. Why was it that none of the honorable gentlemen who lent their names stopped to consider the inconsistency of this part of the plan? If this amount represented actual money, then no *new* company was needed. With $260,000,000 the entire capital stock and bonds of the Western Union Telegraph Company, the Postal Telegraph Company, and the Bell Telephone Company could have been purchased, and the most comprehensive and profitable monopoly the world has ever seen established at once.

But of course no such amount of money was ever dreamed of. There has been nothing but paper exposed to view, except the $300,000 or so of outsiders' money paid in in the organization of the district companies. And paper entered largely into this arrangement. In fact, the whole enterprise has been so exclusively on paper that we fail to see how the gentlemen who paid in $1,000 apiece for State or district rights can come in for much public sympathy in the loss of their money. The proposition laid before them by the original promoters lacked all the elements of sound business.

For the $1,000 paid in for an interest in the district companies, each one received from $25,000 to $50,000 of stock in the parent company. Does any business man know of a case where stock distributed in such a prodigal manner has ever had any real value? We do not.

In the *World* reading notice referred to the following appeared:

> An announcement of some of the purposes of the company, coupled with an alleged list of prominent gentlemen interested in it, that appeared in Chicago about six months ago, was not only unauthorized but was published against the wishes of the managers. While some of the statements that were then made

were substantially correct at the time, they were still very much exaggerated. . . . An investigation traced the disclosure to the person who gave out the information, and he was dismissed from the local branch. The information was sold to a stock-jobbing firm and was undoubtedly furnished for an illegitimate purpose. Attacks on the Standard Telephone Company which have appeared are said by its managers to have an equally illegitimate object.

We do not wonder that it was the intention to conduct this campaign with as much privacy as possible. It must have been well known to the original promoters that it would not stand publicity and dissection in the press of the country.

Officers of the Standard Company have lately charged that the exposures made in ELECTRICITY of its plans and methods are directly in the interest of the Bell Company. They are; but through no choice of ours. ELECTRICITY'S opinions of the Bell Telephone Company are on record, as are also our continued labors in behalf of a solid and legitimate independent telephone movement. No explanation of our course is necessary. It speaks for itself.

But every exhibition of rascality in independent telephone circles is welcomed in the Bell camp with as much joy as a patent decision in their favor. Nothing could have given them greater delight than our exposure of the Standard Company's methods. A few more episodes of a similar nature, and no telephone scheme, no matter how much merit it possesses, can command any capital whatever. This the Bell Company knows. Hence their satisfaction. ELECTRICITY is therefore compelled by a sense of duty to work temporarily in the interest of a company which it never endorsed, and whose methods it never approved of. But this work is only temporary.

The Standard Telephone Company will soon be disposed of, or the best opinion in the telephone world is all wrong. When this is done others will hesitate a long time, we think, before undertaking a similar project.

A scandal raised by any one company cannot kill so strong a movement as the independent telephone movement of 1895. And when the paper companies, the speculators and adventurers have all been driven out, the air will be clearer, capital will feel more confidence, and the legitimate companies in the field will go forward to solid successes.

As to the past record of the Standard Telephone Company it is a matter of history. There has been nothing but continued deceit and misrepresentation.

Long distance lines were promised first. Local capitalists were promised this as an inducement to go ahead and organize local exchanges. The method of organizing district companies has been explained. When it came to local exchanges the plan was practically the same—the promoters were again to receive the larger part of the money, and the exchange was actually to be built from the proceeds of the sale of bonds. Bonds on what? Prospective property, franchises and subscriptions for the service of the exchange secured in advance! Bonds of this nature are not easily disposed of, and as a consequence no local exchanges have been started.

The $1,000 men from various States who have expressed anxiety as to what they are getting for their money are told to wait. Wait for what? The best posted men in this city are unable to answer the question. Standard officials decline to explain what they mean. They look wise and say again, "Wait and see what we are going to give you."

The facts as we believe them to be are that the company has nothing to wait for except dissolution. There has been nothing of late to change our opinion. The reading notice in the *World* contained nothing but buncombe and false statements. Of the latter the following is a sample:

"About this Berliner question, the plain truth is that this patent was unjustly obtained by Emile Berliner for that which was in fact the invention of James W. McDonough, of Chicago, who was using reasonable diligence in adopting and perfecting the same; and all the McDonough patents are now owned and for some time have been under the control of the Standard Telephone Company, the president of the Standard being also president of the McDonough, and the other McDonough directors are either directors in the Standard or are clerks in the employment of the Standard Company. For this and for other reasons the Standard does not worry itself about the Berliner litigation."

The Standard Telephone Company does not own the McDonough patents.

A bill of sale of these patents is now and has been in the possession of another telephone company in this city.

Other patents claimed are those of A. W. Rose. Mr. Rose is a patient and industrious worker in the employ of the Standard Company. His patents are not mysterious at all. Copies of them all are now in our office. There is nothing in them to warrant the formation of any company to exploit them in competition with what is already in *practical use* in the field of telephony.

The only telephone man of any ability ever connected with the enterprise was H. H. Eldred, who long since ceased to work in harmony with the company.

Official claims as to the switchboard were printed by us last week. They are too silly to be worthy of comment, and are to be placed on a par with Mr. Allen T. Nye's claim, a few weeks ago, that he could put a diamond drill at work at the foot of Broad street and have a telephone subway fit to lay wires in to the Sub-Treasury building, at Broad and Wall streets, in twenty-four hours.

Over $300,000 of money has been paid into the Standard Telephone Company's treasury by presumably honest investors who supposed they would get something for their money. The money is nearly all now in possession of the company or of the four men who composed the original syndicate, Thurlow Weed Barnes, Allen T. Nye, Charles T. Strauss and J. O'Neill. Not one promise made by the promoters has been kept. Little wonder that a procession of the humbugged has besieged the offices of the company in the Postal Building since ELECTRICITY'S exposure was published.

We print, as of passing interest, some of the comments of investors in the district organizations—the $1,000 men.

Major Samuel Klotz, of the New Jersey company, says:

"If I were a councilman in any town I should certainly refuse to grant a franchise to any company that I knew to be the author of such a circular. It is infamous. The idea of a legitimate business concern suggesting the 'greasing of Common Councils' by the 'boys who are in the real pot.' . . .

"We have requested several times to be shown the patents which the Standard Company owns, but have always been put off with one excuse or another by Mr. Nye, the general manager. It has been claimed in certain quarters that no patents existed and that the Standard telephone was a reproduction of the Bell long-distance 'phone. What we want now is to see the patents, to have the parent company build trunk lines as agreed and to have them produce a telephone equal to the Bell and not a fac-simile of it. If we can't have this we want our money back.

"By the list of directors of our company you will see that we have some of the most prominent men in the State, among them Leon Abbett, Gen. William S. Stryker, Gottfried Krueger, P. Sanford Ross and Judge Garretson. We shall not act hastily, but we mean to know just where we stand without further delay."

The New Jersey people have determined to get what they paid for or get their money back—if they can. Judge Abraham Q. Garretson, of Jersey City, a Pennsylvania Railroad attorney, has been appointed a committee of one to investigate and report.

Mr. W. H. Truesdale, of Chicago, says of the circular and other matters:

"The circular is Greek to me. I never saw it before and did not know such a document was in existence. It has a bad look and I can scarcely comprehend its significance. I supposed the company was a legitimate enterprise, and this is the first intimation that I have had to the contrary. . . . . I am astonished at the issuance of such a document. If I had any information to give you I should be glad to give it. I should be glad if I could get some light on the matter myself."

Mr. Robert W. Hunt, of Chicago, is quoted as follows:

"I cannot believe that Mr. Clarkson or any of the leading spirits of the enterprise had anything to do with the issuance of the circular. The document, I say unqualifiedly, is to be denounced. If it was issued with the full knowledge and consent of the men at the head of the enterprise, I admit that it is to be taken as an evidence of dishonesty. I have had faith in the company, however, and still have. I believe the circular emanated from promoters who were bunglers in the art of writing. No business man would issue such a document, and hence I think that the men at the back of the company did not sanction its issuance."

We wonder if Mr. Hunt wants the public to suppose that the greasing of common councils is legitimate but that the plan to do so should not be announced in advance. Other comment from him is in order, and if he will write to us over his own signature he will certainly be correctly reported.

So far as ELECTRICITY has been able to ascertain, and its investigation has been thorough and its information is believed to be authentic, the only telephone exchange plant in the actual equipment of which the Standard Telephone Company has been even remotely interested is the plant of the Citizens' Standard Telephone Company at Kingston, N. Y. The representatives of the Standard Company have stated at Richmond, Va., and elsewhere, when seeking to secure franchises or to make stock sales, that the Kingston exchange is equipped with Standard apparatus and that the local Kingston company is a part of the comprehensive National system of the Standard Company, and that a controlling interest in it is owned by the parent company.

The Citizens' Standard Telephone Company of Kingston was organized in July with a capital stock of $150,000, to do business in the counties of Ulster, Orange, and Greene. The plant of the West Shore Telephone Company, operating at Kingston and adjacent points, was purchased by the Citizens' Company, which assumed all the indebtedness of the West Shore Company.

A large amount of money was spent by the Citizens' Company in rebuilding the lines and extending the service of the Kingston exchange. A contract was made with the Standard Telephone Company for 300 instruments. These instruments were made by the Phœnix Interior Telephone Company of New York, and fitted with "Rose" transmitters at the "electrical department" of the Standard Company, at No. 6 Murray street, New York. One hundred and twelve of these were delivered to the Citizens' Company and installed, payment being made in cash the same as for other supplies purchased elsewhere. The delay in completing the order, and other differences which arose, caused the Citizens' Company to give formal notice to the Standard Company, on October 19, of a cancellation of the order for instruments.

The above described is the only relation which has at any time existed between the Citizens' and Standard Companies. Mr. John H. Farrell, of Albany, one of the most prominent business men of the city, who is a director of the Citizens' Company, stated to a representative of ELECTRICITY a few days ago that—

"The Standard Telephone Company has not, nor has it ever had, one dollar's worth of interest in the Citizens' Standard Telephone Company of Kingston."

The Home Standard Telephone Company of Albany is another organization in which the owners of the Kingston plant are interested. A franchise has been secured and the construction of the plant will be commenced next spring. Like the Kingston Company, the Albany Company has no relation, except that of name, to the Standard Telephone Company of New York.

We demand of the Board of Directors of the Standard Telephone Company of New York an official statement, signed by every member thereof, showing, in clear language, the actual status of the company at present as regards the construction of lines and delivery of the service promised to investors.

This not speedily forthcoming, the entire scheme must be denounced as a fraud and a swindle, no matter whose names have been secured for use in connection therewith.

On whose individual shoulders this charge must rest we leave to the officers of the company themselves to make plain with the progress of events.

DEFECTS OF ELECTRICAL WIRING.

At the Convention of the National Association of Commissioners and Inspectors of Buildings, held in Baltimore, Md., on the 17th ult. Captain William Brophy, chief electrician of the Boston Wire Department, read a paper in which he pointed out many serious defects in the distribution of electrical energy for lighting and power purposes. Much of the paper was devoted to a description of the methods of supplying and distributing this energy. Speaking of the distribution by means of the low-tension underground system he said:

> When, by reason of an accidental reduction of the resistance of the conductors under the surface of the streets, this power, in the form of heat, is concentrated at one point, the copper compound and iron pipe are first reduced to a molten mass; then the paving stones are melted like lumps of fat in a frying pan. A sufficient amount of heat can be produced to cause granite or other stone, supporting posts and pillars to crumble, to heat and melt iron and steel columns, beams and girders, depriving them of all power to support the weight imposed on them, and to quickly ignite the wooden portion of any structure.

Of the alternating current system of distribution, Captain Brophy stated that the division of the energy into a great many small units limits the amount of energy that can be converted into heat in any building; but enough can be produced to cause serious damage if let loose in the right place. In view of the dangers ever present in either system of distribution, Captain Brophy asks:

> What is provided, or used, for keeping this subtle power or fluid, as it is sometimes called, within bounds? Plainly speaking, nothing more or less than cotton or rubber hose, plain or rubber lined, or impregnated with some preservative, non-combustible or insulating compound. The copper conductor in the center of the hose corresponds to the orifice, and the cotton or rubber to the walls of this hose pipe. What would be thought of a man who would propose to use such flexible pipes as this for the distribution of water, steam or gas in any of the buildings you are called on to inspect and approve? Surely you would not look with favor on such a proposition, especially if such pipes were to be placed in the space between floors, ceilings or partitions, where an inspection of their condition would be impossible. Yet hundreds of miles of electric wires are so placed, with nothing but this perishable covering to prevent this subtle fluid from escaping. A large number of these wires are laid on furring, laths and plaster, or are fastened on the side of floor joists and studding, under wooden cleats, the wires separated only 2½ inches from each other. Dry wood is a fairly good insulator, but let it become wet, by reason of the bursting of a water pipe, the overflowing of a sink, set bowl or water closet, and it becomes a conductor; and the same can be said of much of the insulating covering of the wires. Little by little the current finds its way from wire to wire across the surface of the wood, slowly carbonizing it until it bursts into flame. This is one of the cases where the element that is depended on to extinguish fires kindles them, when it is in connection with another element, in this instance, electricity.
>
> It might with propriety be asked why it is that such fragile substances are relied on to hold in check, and for a long term of years, this tremendous force that is capable of performing such great service or doing such an immense amount of damage. The simple answer must be, because nothing better has yet been discovered.

Captain Brophy then states that truth compels him to assert that very little wire can be credited with being reasonably safe when the insulating material has deteriorated. When the wires are laid in channels cut in the brick work, or laid under tiled floors, or imbedded in cement, notice is quickly given of the breaking down of insulation by the refusal of the lights to burn or motors to run. These wires can be removed and replaced by others only by tearing up floors and breaking down partitions and ceilings. The blame for this undesirable state of affairs is due, Captain Brophy thinks, to several causes and several classes of men. In dealing with the causes, he described the manner of wiring buildings for bells, etc., previous to the advent of electric light, and remarked that "improvements have been made in methods and materials since those days, and those engaged in electric construction are ready to provide the best of both when owners, architects and builders have learned that the very best is the cheapest."

> . . . . Those who erect buildings know little or nothing of the quality of electric light construction or material, and, if left to themselves would accept the lowest bid for such work, but when they employ an architect to plan and supervise the erection of buildings, and determine the cost and quality of work and material, they naturally suppose him to be not only competent to make plans and specifications, but to pass on the character of the work during its progress, and when completed as well. I venture to assert that but few of them think it necessary to make any provisions in their plans for electric wires or fixtures, and fewer still know what constitutes a first, second or third class electric plant or outfit.
>
> It is rarely that the contractor finds on his plan the location of the wires and their dimensions, location of lights, fixtures and electroliers, and specifications giving the quality of insulation and character of work, size and conductivity of the installation and the all-important percentage of loss in the wires, and the style and character of the necessary fixtures, number and candle power of lamps, etc., provided by the architect. If the architect has not acquired the practical and theoretical knowledge necessary to enable him to deal with this problem, he should employ some one competent to do so.
>
> In buildings where the wire must be concealed, but for which there are no convenient cavities, a system of conduits is imperatively necessary if the lighting system is to maintain a semblance of reliability, to say nothing of the question of safety. These conduits may be of iron or of other metal, insulated or not. They can be made also of glazed tile or slate that is free from iron or other mineral substances.
>
> The system of interior conduits or the method of fixing the wires to practically indestructible insulators may be adopted in buildings that are not considered fireproof, and ample provision should be made for the conduits when the plans are drawn, and each junction and fuse box located on them. . . . The practice of passing the wires that supply a lamp or a group of lamps through a hole made in the laths and plaster is one that should be discontinued.

Referring to the "reprehensible practices indulged in by those in electric light installations, and approved by architects and others," Captain Brophy said:

> Owing to the lack of faith of electric companies and their managers in their ability to maintain a continuous service, and to the fact that many of the smaller plants did not operate more than a small portion of the twenty-four hours of the day, as well as for other reasons, the combination fixture on which could be placed electric lights and gas burners was introduced. For good and sufficient causes, the continued use of such fixtures should no longer be encouraged. . . . They form a combination that should cause cold shivers to run down the backs of owners of buildings and the fire insurance underwriters, did they know with what ease and grace this twain can kindle the flame that converts the property of the one and the profits of the other into smoke.
>
> No class of men can do more to render this new and powerful servant, now enlisted in the service of man, safe and docile than the competent architects; and they will, no doubt, do their share in that direction when they see the great necessity that exists for their hearty co-operation with those who believe that the dangers attending the distribution of the electric current for all purposes can be entirely removed.
>
> Commissioners and inspectors of buildings should have a general knowledge of electricity, particularly when it is converted into light and re-converted into power. It would be better still if one of the corps of assistants were a practical electrical engineer, thoroughly conversant with the subject in all its phases, and whose judgment could be relied upon and respected.
>
> In cities that have recognized the great necessity of a strict supervision over electric construction, by establishing electrical bureaus or departments, such as those of Chicago, Pittsburg, Philadelphia and some other cities, or the admirably conducted wire department of the city of Boston, this addition to the bureau of inspection of buildings might not be necessary.
>
> I must once more express my firm belief that the transmission of electric energy and its conversion into light, heat, sound and articulate speech, or its re-conversion into motive power, can be accomplished with nearly perfect safety.

A good substitute for gutta-percha is said to be prepared as follows: Tar, one part; paraffin, 10 parts; dissolve together at 120°, and then add caoutchouc, two parts. Keep at this temperature until a homogeneous mass results.—*Electrical Engineer* (London).

ELECTRICITY ON STEAM RAILROADS.

At the twenty-fifth annual meeting of the American Society of Railroad Superintendents, held at the Hotel Brunswick, New York City, on the 14th of October, Col. H. G. Prout, editor of the *Railroad Gazette*, delivered a very interesting address on "The Use of Electricity as a Motive Power on Railroads Now Operated by Steam." The scheme of his talk was to lay down some of the governing principles which would determine where electricity could and where it could not be used; the deduction being that for main line work, as ordinarily understood, it is not to be used; for city work it must be used, while for suburban work and interurban work, it is yet debatable whether electricity or steam may be used. He then gave some idea of the seriousness of electrical competition as already developed, and the gravity of the situation which now confronts the railroad companies in the matter of suburban and interurban traffic, a large share of which must inevitably go to the electric railroads in spite of anything that the steam railroads can do.

It was suggested, however, that there are steps which can be taken by some of the railroads which may prevent the loss of business to competing electric roads. Some railroads, for instance, may be able to equip two tracks for electric operation within their suburban zones on which very frequent and light trains can be run, stopping often. Semi-express trains to serve the more distant suburban points could perhaps be interpolated on these tracks. There are other railroads which may be able to acquire new lines and equip them for electric operation. A great many others can hope to postpone for a little while loss of traffic by giving better suburban service and perhaps lower rates. On some roads accommodations could be made more comfortable for passengers by furnishing better lights, better heating, better cars generally, better facilities at terminal stations, more trains and a quicker schedule. One way of accelerating the speed of suburban trains which make frequent stops would be to insist on greater promptness on the part of trainmen and passengers in getting away from local stations. This is largely a matter of education on both sides—education of trainmen and education of passengers. But after all is done there is a considerable volume of suburban and interurban business that cannot be saved.

There is, however, a set of conditions at work which will change the situation of the present electric railroads a good deal before very long. Up to the present time it has been and still is easy to finance them, because rail mills and electrical manufacturers are glad to help float the bonds of new electric railroad projects; the public is credulous and investors look for great profits. We are, therefore, in the midst of the "kiting" epoch of electric railroads, when bonds which are sold to-day pay the interest on the bonds sold last month or last year. But, naturally, this situation must come to an end before long. It will be hastened by the realization, now at hand, of the fact that more substantial construction must be used than was common in the earlier tracks, that maintenance charges are heavier than has ever been anticipated, that the accident expenses are more than promoters and investors ever counted on, and finally, in some States, by the fact that right of way must be paid for. Furthermore, the States are beginning to exercise control over the building of new electrical railroads. All of these conditions are conspiring to put electrical railroad building on a rational basis and to approximate it more and more to the conditions of steam railroad building.

A gold medal or a premium of 150 florins is being offered by the Dutch Society of Science at Haarlem for a paper on the equilibrium phenomena of one or more alloys of two or three metals ranging from the melting point of the metal most difficult to fuse to the lowest temperature at which the alloy will continue to remain in a liquid state.

THE VARIATION IN THE ELECTRICAL RESISTANCE OF BISMUTH WHEN COOLED TO THE TEMPERATURE OF SOLID AIR.*

BY JAMES DEWAR, M. A., LL.D., F.R.S., AND J. A. FLEMING, M.A., D.SC., F.R.S.

In the course of investigations on the electrical resistance of pure metals and alloys at low temperatures made during the years 1892 and 1893, the results of which were communicated to the *Philosophical Magazine*,† extensive examination was made by us of the variation in specific electrical resistance exhibited by most of the ordinary metals when cooled to temperatures approaching the absolute zero. In the course of this research the abnormal behavior of bismuth with regard to its variation of specific resistance with temperature was noted and in a further research on the thermo-electric powers of metals and alloys at low temperatures, the results of which were communicated to the *Philosophical Magazine* recently,‡ it was noticed that the curves representing the thermo-electric power of bismuth, both for pure and for commercial specimens, presented a discontinuity at temperatures lying between about —70° and —100°. We were therefore recently led to make a more careful examination of the variation of electrical resistance of bismuth when cooled down to the temperature of solid air, some of the results of which are of sufficient interest to communicate, although the investigation is still in progress, and much remains to be done to complete it. A sample of very pure bismuth was kindly prepared for us by Mr. Geo. Matthey, by the reduction of the oxide, an analysis of which showed very small traces of iron as the only impurity. This bismuth, which was the same as that used by us in our thermo-electric experiments, was pressed into wire by a steel press. two sizes of wire being prepared, one having a diameter of about 0.067 centimeter, and the other a diameter of 0.049 centimeter. Lengths of these wires were mounted up in an appropriate form for taking the electrical resistance when measured in liquid or in solid air, or at any other temperature up to +100° C.

Amongst other specimens a wire was pressed from some commercial bismuth, supposed to be fairly pure, which will be distinguished by being called Griffin's bismuth; the diameter of this last wire was about .066 centimeter. The diameters of these wires were carefully measured with a microscope-micrometer in about twenty different places, the lengths of the wire used being about 30 or 60 centimeters. The sample of pure bismuth prepared for us by Mr. George Matthey will be distinguished by speaking of it as Matthey's bismuth, the thicker of the two wires being called A and the thinner B. The dimensions and mean diameters of the pressed wires, which were used just as they came from the press, were as follows:

Sample.	Length. centim.	Mean diameter. centim.
Matthey's bismuth (pure), A......	61.25	0.06713
Matthey's bismuth (pure), B......	32.70	0.04926
Griffin's bismuth.................	52.90	0.06625

In addition to these samples of pressed wires, other specimens were prepared by drawing melted bismuth up into fine glass tubes and making a suitable connection with the bismuth for the purpose of an electrical resistance measurement by means of tinned copper wires melted into the ends of the bismuth specimen. These samples of bismuth then had their electrical resistance measured with a Wheatstone bridge in the usual way, the temperature of the specimen being taken at the same time by means of a platinum thermometer, consisting of a platinum wire closely in contact with the specimen of bismuth. All the temperatures which are given in the following paragraphs have been converted into platinum temperatures, taken in terms of our standard platinum thermometer P_1, the electrical constants of which were given by us in the paper on the thermo-electric powers of metals (see *Phil. Mag.*, July, 1895). Temperatures so measured are distinguished by the letter P_1 placed after the number denoting the temperature. The electrical resistance of the bismuth specimens, all proper corrections being made for the resistance of the connecting wires, was taken at a large number of temperatures lying between the boiling-point of water (100° C.) down to the temperature of solid air, which, in terms of our standard platinum thermometer P_1 is about —233° P_1 to —235° P_1. From the known dimensions of the bismuth wires the volume specific resistance of the metal was calculated at these different temperatures, and the reduced observations for the three specimens above mentioned are given in the accompanying tables.

Commercial Bismuth (Griffin's).

Volume specific resistance in C.G.S. units.	Temperature in platinum degrees.	Volume specific resistance in C.G.S. units.	Temperature in platinum degrees
	°		°
190,700	+ 95.0	185,050	— 96.9
186,850	+ 84.6	188,450	— 107.9
180,350	+ 66.6	190,050	— 111.7
176,450	+ 47.0	193,800	— 123.5
176,200	+ 46.5	195,400	— 128.1
175,200	+ 41.2	199,700	— 140.0
173,650	+ 34.0	200,700	— 143.9
172,000	+ 21.3	205,400	— 157.0
172,300	+ 18.8	207,000	— 162.0
171,450	+ 5.2	211,450	— 180.0
171,050	— 2.2	211,750	— 184.0
171,100	— 6.8	212,800	— 196.6
171,650	— 25.0	212,800	— 196.8
172,050	— 32.7	212,050	— 213.2
173,400	— 43.0	212,100	— 215.5
173,700	— 47.3	211,700	— 217.1
176,050	— 59.6	211,500	— 220.1
176,700	— 63.3	210,900	— 222.5
179,050	— 75.1	209,700	— 228.5
180,100	— 79.1	208,900	— 232.8
184,400	— 92.9	208,950	— 233.2

Pure Bismuth (A) (Matthey's).

Volume specific resistance in C.G.S. units.	Temperature in platinum degrees.	Volume specific resistance in C.G.S. units.	Temperature in platinum degrees
	°		°
202,550	+ 96.4	183 350	— 135.0
185,100	+ 56.0	186,000	— 139.0
174,200	+ 17.8	188,850	— 145.9
171,100	+ 5.2	193,100	— 151.6
169,750	— 1.8	197,450	— 156.6
168,150	— 9.7	200,650	— 160.8
166,900	— 16.9	204,800	— 165.8
166,550	— 20.5	208,250	— 170.5
166,300	— 24.9	211,350	— 173.9
165,850	— 30.0	213,950	— 176.8
165,600	— 33.0	217,100	— 179.8
165,400	— 37.0	220,200	— 183.0
165,050	— 42.5	222,500	— 186.3
164,800	— 45.0	225,300	— 188.9
164,750	— 47.0	228,150	— 192.0
104,750	— 53.0	229,300	— 192.7
164,900	— 58.4	229,850	— 193.3
165,200	— 65.0	234,800	— 197.0
165,850	— 69.3	242,150	— 202.6
166,150	— 74.5	248,150	— 207.9
167,300	— 81.4	264,400	— 219.3
168,600	— 89.1	266,250	— 220.8
169,400	— 95.0	267,900	— 222.0
171,100	— 101.8	276,700	— 227.1
175,150	— 114.0	288,450	— 232.0
176,950	— 120.1	293,100	— 234.2
178,950	— 124.9	294,300	— 234.85
181,150	— 130.4	294,300	— 234.9

Pure Bismuth (B) (Matthey's).

Volume specific resistance in C.G.S. units.	Temperature in platinum degrees.	Volume specific resistance in C.G.S. units.	Temperature in platinum degrees
	°		°
175,100	+ 49.2	150,600	— 87.9
174,850	+ 48.0	151,300	— 100.5
165,100	+ 18.8	151,300	— 103.9
163,050	+ 11.3	152,000	— 114.8
161,550	+ 3.6	152,850	— 118.8
161,250	+ 1.3	154,950	— 132.2
158,400	— 11.5	155,900	— 136.1
157,900	— 18.3	159,450	— 148.1
153,750	— 36.5	161,200	— 152.2
153,300	— 40.0	166,300	— 168.0
152,350	— 51.6	169,850	— 174.9
152,050	— 55.3	179,550	— 193.4
151,000	— 66.8	181,000	— 196.2
150,850	— 71.0	181,000	— 196.8
150,500	— 83.3	......	......

The above numerical results are set out in the form of three curves (see Plate V). It will be seen that the specific electrical resistance of all the bismuth specimens taken from 100° C. downwards gradually diminishes to a point which in the case of the specimen of pure bismuth "A" was about 50° P_1, and in the case of the specimen "B" about —83° P_1. After these temperatures had been reached, further cooling *increased* instead of diminishing the electrical resistance of the A and B bismuth, until at the lowest temperature reached by the employment of large quantities of solid air, the electrical resistance of the specimen "A" had become increased by nearly 80 per cent. of its minimum resistance, and at the same time the mean temperature coefficient had become very large. and of course negative. It may be noted that the melting point of solid air as determined by our standard platinum thermometer. is —232°.2 P_1, liquefaction taking place under a pressure of 14 millim. of mercury. The boiling point of liquid air under a pressure of 746 millim. is —209°.75 P_1. The same general facts were observed in the case of the specimen of pure bismuth "B," only in this instance the temperature was not taken below about —200° P_1. As regards the commercial bismuth (Griffin's) the curves show that after reaching a minimum point, which for that specimen appears to occur at about 0° C., there is another point of inflection in the resistance curve in the neighborhood of —200° P_1 after which the resistance again diminishes. In the case of each of these specimens the resistance measurements were repeated many times, and in both directions, to obtain an assurance that the relation of resistance and temperature was perfectly definite, and that proof might be obtained that all the three specimens of pressed bismuth wire as well as the bismuth melted in the tubes, did not undergo any permanent change in their condition by the action of the low temperature, but that there was a definite relation between temperature and electrical resistance in the manner shown in the curves.

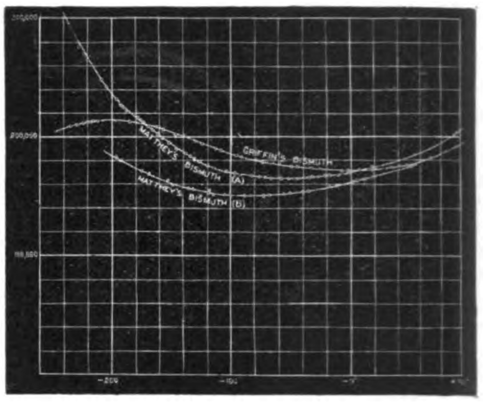


PLATE V.

(*To be continued.*)

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* From the *Philosophical Magazine* for September, 1895.

† Dewar and Fleming. *Phil. Mag.*, 1892, 5th series, Vol. XXXIV., p. 326. "On the Electrical Resistance of Pure Metals, Alloys and Non-metals at the Boiling-Point of Oxygen"; also *Phil. Mag.*, 1893, 5th series, Vol. XXXVI., p. 271, "The Electrical Resistance of Metals and Alloys at Temperatures Approaching Absolute Zero."

‡ Dewar and Fleming, *Phil Mag.*, July, 1895. "Thermo-Electric Powers of Metals and Alloys between the Temperatures of the Boiling-point of Water and the Boiling-point of Liquid Air."

PRESENT STATUS OF THE AIR-BRAKE.*

BY E. J. WESSELS.

Last October the speaker had the honor to lay before the members of the American Street Railway Association in Atlanta a paper on the subject of "Power-Brakes vs. Hand-Brakes." In that paper reference was made to the advantages of a good air-brake and the desirability of its adoption on roads with congested traffic. high speed or severe grades, and especially where trailers were used.

At that time the street railway air-brake was in swaddling clothes. Some, not positively indifferent on the subject, proved hostile. To contend against this opposition has not been easy.

In considering the present status of the air-brake it is pleasing to notice that the indifference which existed even in influential quarters has largely disappeared. Months ago a prominent railway president asserted that he would not put an air-brake on his road, because if he did there would be nothing for his motormen to do. Since then he changed his mind, and recently contracted to have every car on his road equipped with air-brakes.

Most managers now concede that the old form of hand-brake will no longer answer for heavy, double-truck, high-speed cars. There has been a remarkable change of views since we last met.

There are instances on record where certain roads have contracted for more reliable braking apparatus at a cost which a year ago they regarded prohibitory.

An air-brake which has merely been tested in the *shops* is of doubtful utility. It cannot be depended upon for the rough usage it will encounter in service. No air-brake is fit to be mounted on a car which has not gone through the most crucial tests based on records of similar brakes operated on cars for many months.

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*Abstract of paper read before the American Street Railway Association. Montreal, October 15, 1895.

To design an air-brake which shall be mechanical, *durable* and economical is one of the most difficult problems a manufacturer can face.

The street car air-brake has much to contend with.

Firstly—The unfamiliarity of the average motorman with the proper use of air is greatly against it.

Secondly—The compressor is begrudged space on the car axle. although generous space is freely given to electric motors irrespective of dimensions. This makes it difficult to have proper bearing surfaces.

Thirdly—The neglect of proper inspection is greatly against the air-brake. Even motors do not receive the attention they should, as many a scrap heap testifies. The air-brake hardly receives any.

Fourthly—Insufficient lubrication. The same man who lubricates his motors passes by the air-brake without using his oil can. Probably he might neglect to oil the motors, but knows that failure to do so would be speedily detected and render him liable to discipline. The air-brake has not reached that point in street railway operation where neglect to lubricate it produces like results. The most perfect apparatus ever designed if neglected cannot do its work properly, and no automatic oiling machinery or mechanism under a car can possibly replace human vigilance.

A year ago the air-brake was not found on many roads. On the few roads where it was being used satisfactory results were obtained, and in the "Street Railway Journal" for March last, in the article entitled "The Street Railway System of Buffalo, N. Y.," a report of the successful operation of air-brakes there will be found. It showed that by using air-brakes there had been a great saving in wheels. As a matter of fact, there should not be any flat-wheels if air-brakes are properly used, for by their aid pressure can be regulated to a nicety.

An examination of the Patent Office records discloses the fact that scores of patents have been granted for mechanical brakes for steam cars, but one would have to travel far to find a solitary mechanical brake in service on steam roads. If they have proved unfitted for steam practice, and the air-brake has been adopted, it is fair to assume that mechanical brakes may not be all that is required for braking electric and cable cars.

The street car air-brake has been adopted by the Australian Government; it has been specified by borough engineers in Great Britain; it is being installed in different places on the Continent. It is, therefore, somewhat discouraging to find that while the street car air-brake receives very careful attention abroad, it is denied that attention here. It is unfortunate that our managers entrust it to uninstructed men who have had no experience in its use.

The air-brake for steam roads has undergone an evolution beginning in 1869. Even its most ardent supporters will not claim that the system as applied to-day is absolutely perfect; but it is commercial and unquestionably has saved hundreds of lives in the past twenty-seven years.

If it has taken that long to bring the present steam car air-brake to a measurable degree of perfection, what may we not hope to see accomplished by the street railway air-brake in a very much shorter time.

The duties required of a street railway air-brake are more severe than those damanded of a steam car air-brake. Even the engineers of the Empire State Express do not face the risks to which the motorman of a fast suburban electric train is constantly exposed. There being no definite time when the train passes crossroads, the motorman of the electric train is menaced by farm wagons and other vehicles, deaf people, bicycle riders and others, who would not attempt to cross the track if the Empire State or other express was due.

The air-brake is the only brake which has an emergency stop that can be instantly applied by the easy turning of a handle. In order to have even an approach to an emergency stop, it is generally necessary with hand-brakes to gear them to a point which they would never reach were the semblance of such a stop not required. This excessive gearing means rapid wearing of parts and needless tiring of muscles.

It is not claimed that the street railway air-brake has reached perfection. It is believed it never will reach that point unless through the co-operation of the railway managers. But even though it is not claimed that the present street railway air-brake is all that it should be, we must admit it has made remarkable strides, that satisfactory results have been produced, and that it is commercial. It will not be possible to overcome all the objections to an air-brake unless managers rally around the men who are striving to reach perfection.

The cry about the trolley slaughter has subsided. Six months ago it had reached large proportions, but the riding public is beginning to realize that even if managers are anxious to minimize accidents they cannot reach the safety point unless a superior class of apparatus is within their reach.

Since we last met, fenders have been made compulsory in several cities. Those who believe most in fenders will not deny that a reliable brake is an absolute necessity. It may be advisable to have both. That is for you to determine. It is probable that air-brakes would have been made compulsory on street railways long ago had the manufacturers of commercial air-brakes devoted their energies to influencing legislation, instead of concentrating them wholly upon the perfecting of an air-brake. It is, however, extremely probable that before long the air-brake also will be made compulsory, and this is a good argument in favor of testing it in actual service *now*, so that if it becomes compulsory managers will be familiar with its advantages.

The claims of the air-brake over other forms of brakes were fully defined in the Atlanta paper referred to and need not be repeated. At that time the electric brake was actively opposed to the air-brake. The opposition has since faded away. There has not been, nor is there, an electric trailer brake. If we are to have a reliable electric motor-car brake, the brake must apply equally well to trailers. Until the advent of an electric trailer brake, the air-brake must certainly be regarded as its superior for *train* service, especially as the air-brake dispenses entirely with brakemen and gives the motorman absolute control of his train.

The street railway air-brake is in a transition state and is going through some of the processes that characterized electric motors. We would not have the superb motors in service to-day had not manufacturers been able to learn the defects of the pioneer motor through the reports and suggestions of their railway friends.

Fenders, car heaters, lighting systems and other things are now going through these same processes. Hence it is not singular that the air-brake shares the common lot.

The questions to be considered are:

Firstly—Are better brakes than hand-brakes necessary?

Secondly—Will not the demand for better brakes grow even more imperative day by day?

Thirdly—Will not some form of power-brake become compulsory ere long?

Fourthly—How can the valve of any brake (mechanical or otherwise) be judged except by tests in everyday service?

Fifthly—How can anything (brake or otherwise) undergo a fair test unless the men who use it are compelled to observe ordinary diligence?

Sixthly—How can any movable machinery or apparatus be expected to work satisfactorily unless the moving parts are kept properly lubricated?

Lastly—Can you afford to operate without having a reliable braking system for checking speed or making service and emergency stops?

If you desire to test an air-brake it will not be difficult for you to secure one, and if perchance it fails to do all you expect of it, it will be an unwise manufacturer who will not avail himself of any suggestions you may make in the light of your own experience. Let us not forget that your interests and the air-brake manufacturer's are and will always be identical.

STORAGE BATTERIES FOR RAILWAYS.

BY MAURICE BARNETT.

In these days when it is the practice of not a few eminent electrical engineers to damn the storage battery in the field of traction, either by too vehement denunciation or by too "faint praise," the announcement in the *Kolnische Zeitung* that the trolley system which has been in use in Hanover for some time has been discarded, and that the twenty-eight cars operated on that system are to be remodelled and equipped with storage batteries, while not conveying solace to the electrical engineers referred to, will prove very gratifying to those who, even in view of some discouraging failures in accumulator traction, have always had a firm conviction that traction work was a legitimate field for accumulators, and that the test of time would prove that storage batteries would be able to hold their own with other representative electric traction systems.

Since the announcement in the *Kolnische Zeitung*, news has been received here that the "Dresden Tramway Company" and the "Hague Tramway Maatschappy" have likewise decided in favor of accumulator traction. Inasmuch as no less important a company than the Tudor Storage Battery Company is making the installation, it is not at all too optimistic to believe in the ultimate success of the storage battery cars about to be operated in the above named places.

Up to the present time, the engineers of the overhead system have had matters pretty much their own way. Occasionally a statement of results (coming in all probability from interested sources) bearing upon the success obtained with the open conduit has caused a commotion in the trolley ranks; but, save for that, the erection of poles has gone merrily on and the manufacturers of trolley machinery have had no complaints to offer on the ground of lack of orders. The past two months, however, have seen the beginning of a mighty change. To-day the trolley is considered to have been merely coincident with the evolution of the modern passenger railway, and that its usefulness in the future, at least in cities, is not likely to be greatly overestimated. E. H. Johnson, who, with Lieut. F. J. Sprague, was the pioneer in working out the trolley method of electric transportation, writing in the *Electrical Engineer* under date of October 9th, sounds the doom of the overhead line at least in cities and towns. The reason for this belief is to be found in the objection to overhead construction, and secondly in the fact that greater economies are possible in the newly projected closed conduit system by reason of the fact that higher voltage may be maintained than is practicable in trolley systems. This criticism, emanating from one of the parents of the overhead wire system, may be considered to have some weight. Mr. Johnson also proceeds to pay his respects to the open conduit system anent the great ado made by the Metropolitan Traction Company of New York "over the practical success of their $150,000 per mile open conduit system," by saying "it was neither scientific nor business like to place the electrical conductors in a sewer and then expend hundreds of thousands of dollars to secure drainage." This represents the view that is at present held respecting the open conduit electric system. Surely the friends of the electric accumulator can take hope in the discomfiture of their rivals!

Looking impartially at this question, it would seem as if the contest for supremacy in the field of transportation would in the future be between the storage battery and the closed conduit systems. Which side will win cannot be conjectured at the present time. Neither system is in the final form it will assume when the contest for supremacy takes place, and one is therefore precluded from indulging in prognostications regarding the outcome.

The above remarks have been called forth by statements appearing from time to time in some of the newer electrical journals, reflecting upon the judgment of those who are instituting the test with storage battery cars on the Madison Avenue line in New York City. The remarks have all been characterized by a sneering incredulity as to the value of accumulators for traction work. Before the next six months are passed, the critics of the storage battery system may have to reverse their conclusions.

The object of the present paper is to emphasize the great value possessed by storage batteries—not in furnishing direct motive power, but when used in connection with railway power plants.

The first accumulators used in connection with a railway power station were, so far as the writer can ascertain, those employed in the power plant of the railway lying between Zurich and Hirslanden, Switzerland, an account of which was published in the *Elek. Zeitung* of June 28, 1894. According to report, the dynamo delivers current under a constant load, the accumulators being charged or discharged as the load on the line is less or greater than the output of the dynamo. In this plant there were automatic means for cutting in and out of end cells to keep the voltage constant. Results showed that by means of the accumulators a saving was effected of 2.2 pounds of coal per H. P. hour, amounting to nearly a ton per day, or $2,500 a year. The cost of accumulators, installed complete with necessary apparatus, was $7,400. Allowing for interest and depreciation, the battery paid for itself in four years by saving in coal bills alone. The saving was effected by reason of there being no necessity to keep a second boiler and steam engine in reserve, and that by this arrangement the power plant ran at its highest efficiency. It was furthermore developed that the first cost of combined steam power and battery plant was less than cost of total steam power plant would have been for the same work.

How important this installation proved may be judged from the fact that a single type of storage battery is now found in Germany and Austria in 80 per cent. of all central stations, besides being installed in fifteen railway power plants and 5,000 isolated lighting plants.

Two railways in the United Kingdom have recently attracted a great deal of attention; and inasmuch as the batteries used in connection with generators are of the Chloride Accumulator type, manufactured by the Chloride Electrical Storage Syndicate, Limited, the installations have a special interest for American railway managers. These two railways are known as the "Douglas-Laxey Line" and the "Snaefell Mountain Electric Tramway," both in the Isle of Man.

The Douglas-Laxey line was established about a year ago. From the September 19, 1895, issue of *Lightning*, London, it is gathered that when the battery was connected to the line the cars immediately began to run with exceptional smoothness, the accumulators keeping the voltage steady and eliminating all sudden variations due to starting of other cars. How variations will otherwise arise will be understood when it is considered that it requires 150 amperes at 500 volts to carry a loaded car up the 8½ per cent. grade at a nine mile rate.

Encouraged by the success attained by the Douglas-Laxey electric tramway, which after a year of service "had fulfilled in every way the expectation of its promoters," it was not difficult to secure capital to construct an extension of this road up to the summit of Mount Snaefell. The electric equipment of the Snaefell road resembles that of the Douglas-Laxey line, both being designed by no less eminent an engineer than Dr. Edward Hopkinson. The battery consisted of 246 special cells. At 550 volts, the battery furnished 176 amperes for three hours, 112 amperes for six hours, 84 amperes for nine hours and 72 amperes for twelve hours.

By evening up the load on the generators, the battery enabled the plant to work at a high efficiency and rendered the service extremely satisfactory.

A large economy is made possible by a special use of battery at seasons of the year when there is comparatively little traffic. Under the agreement with the authorities, these lines bound themselves to run two cars a day each way every day of the year. Obviously, it would not have paid to keep the power house in operation just for this load. This is where the battery proves so valuable during the winter months. The battery being charged once a week can carry the load for the other six days without necessitating the running of the power plant.

In the United States there are two installations of storage batteries in connection with railway power plants which are of special interest. The first is at Merrill, Wis., where a battery of chloride accumulators was installed to effect a solution of the problem so constantly occurring in the railway world, i.e., how to bring up the capacity of the power plant to meet the requirements of a constantly increasing demand. It was decided to use a battery not alone for increasing the light capacity, but for regulating the voltage on the railway circuit, which—according to the engineer who installed the plant—"was far from satisfactory owing to the great fluctuations in railway demand." As the lighting machine and railway generator were connected to the same shaft, it can be understood that the light furnished was far from satisfactory. Records kept before the battery was installed showed a fluctuation as high as nine volts on each side of the three-wire system. Mr. Herbert Condict, in a paper descriptive of this plant read before the Northwest Association of Electrical Engineers at their last Convention, spoke of the performance of this battery as follows: "The great improvement in running of cars was immediately noticed by all, but it was at night that the contrast was most apparent. The two water wheels were connected together as usual, but the railway generator charged the battery at almost a steady rate instead of with its ever varying demand of from 0 to 120 amperes per car. . . . Instead of a succession of sharp peaks the voltage curve of the lighting circuit became practically a straight line; instead of nine volts variation, there was practically no variation, demonstrating most clearly the capability of the battery to respond to all demands of the railway, no matter how severe."

The second plant mentioned is now being installed at Anaconda, Montana, for the Electric Railway, Light and Power Company of that place. The battery consists of 270 special cells of central station type, of 600 ampere hours capacity, but admitting of very heavy discharges. The object of the battery is to even up the load on generators and maintain constant E.M.F. When the battery goes into operation it will be found to give results no less satisfactory than those obtained with the Merrill plant.

To sum up, it may be said that the storage battery is destined to play a very important part in the future in light, heat and power stations. The reason for this statement is to be found in the ability of a good storage battery to act—

First—As a "reservoir" in which may be stored up the energy representing the difference between the average and the maximum demand on a generating plant.

Second—As a regulator of pressure on circuits subject to fluctuating demands, increasing the efficiency of the service and diminishing the wear and tear on apparatus, and

Third—As a "transformer," to utilize high voltage charging currents and to discharge, when disconnected from generator, at any lower voltage desired.

One fact that has been demonstrated, and which has the most important bearing on the construction of electric railway power plants, or for that matter of most electric light and power stations, is that in any station which has to meet a fluctuating demand for power a plant consisting of part steam power and part storage battery is cheaper in first cost than total steam power plant would be for the same work. The high efficiency and satisfactory performance of such a plant has already been referred to.

Edison Is Out.

Finally Dropped from the Pay Roll of the G. E. Company.

About two weeks ago Mr. Edison was notified by Mr. C. A. Coffin, president of the General Electric Company, that his retainer fee of $400 a week would be discontinued at once, but that if he (Edison) was in need of money, the same sum would be advanced to him every week and charged to his account.

Mr. Edison did not accept the situation cheerfully, but at once called on J. P. Morgan & Co. and expressed himself with some emphasis. It was finally decided, we believe, to place him upon the pay roll of the Edison Illuminating Company of New York for an equivalent amount, for services rendered in years past.

Brooklyn Electrical Society.

The latest appliances for the measurement of electrical resistance was the subject of an interesting lecture delivered by Mr. Otto T. Louis, of the Queen Company, before the Brooklyn Electrical Society on Tuesday evening, October 29, in the Edison Assembly Rooms, Brooklyn.

Mr. Louis described at length all the more important resistance testing instruments in their process of manufacture, also a new form of American standard, which is an improvement on the British Association unit. The lecturer also described and exhibited a new bridge capable of measuring resistances as low as that of ¾" bar copper. At the close of the lecture Mr. Louis made several donations to the Society.

The Henry Electrical Club.

At the weekly meeting of the Henry Electrical Club, held at the American Institute, New York City, on the evening of the 1st inst., Dr. M. I. Pupin, of Columbia College, gave a lecture on "The Alternator." The history of the development of this type of dynamo-electric machine, the theory of its design and its characteristics were considered at some length. The lecture was illustrated by diagrams and was appreciatively received by a larger number of persons than usually attend the meetings of the Club.

General Electric's Financing Policy.

Northwest General Electric—The Scheme, the Companies Financed, the Facts and Figures from the Official Record.

How Bonds are Manufactured for New England Investors.

CHAPTER XVI.

The Austin Electric Company.—II.

The official records of the Austin Electric Company, published in our last issue, it will be remembered, showed a deficit for the year ending March 31, 1893 of $4,733.15, which was constantly increasing up to December 1, 1894, the date of the last report. The plant was under the direct control of the Northwest General Electric Company, was for the most of the time in the hands of an admirable central station manager, and it is certain that the best possible record was made.

It is sufficiently proved, therefore, that there was no earning capacity on which to base a capitalization as was planned by Mr. Byllesby, of $100,000. The debt to the Northwest General Electric Company had increased from $401.30 on March 31, 1893, to $7,586.16 on March 31, 1894.

Now let us see what basis there was in actual plant for the capitalization. We present herewith the official inventory of the company's property, with the most liberal valuation to be placed upon it:

AUSTIN ELECTRIC COMPANY, AUSTIN, MINN.

SCHEDULE OF PROPERTY: APRIL 1, 1893.

(Photographs and Plans on File.)

REAL ESTATE.	
Lot 1, block 33. Brick station, including engine and dynamo room, 39 ft. 2 in. x 46 ft.; boiler room, 39 ft. x 36 ft. 4 in. Frame building (former station), 50 ft. x 20 ft. Frame building, coal shed, 40 ft. x 12 ft. 6 in., 7 ft. x 10 ft. high.	$2,500.00
STEAM PLANT.	
One Ball single cylinder engine, 12 x 12. One Ball tandem compound engine, 9 x 16 x 12. Two H.T. boilers, 60 in. x 17 ft. 3 in., 64 4-in. tubes. One Globe injector. One 100 H.P. heater, Wainwright imp. cop. tubes. One Reynolds heater, 100 H. P. (old). Piping, valves, etc.	$5,235.00
BELTS.	
Two leather belts, 39 ft. long x 7½ in. wide. One " " 51 ft. " x 7½ in. " One " " (old). Two " " "	$236.80
ELECTRIC PLANT.	
One K. 12 arc dynamo, No. 2,289; capacity 30 1,200 C. P. lamps. One L. D. arc dynamo, No. 3,932; capacity 50 1,200 C. P. lamps. One A. 35 alternating dynamo, No. 591, 110 volts; capacity 650 16 C. P. One A. 35 alternating dynamo, No. 500, 100 volts; capacity 650 16 C. P. One D.S. exciter dynamo, No. 2,447, 110 volts, 20 amperes. One D 1½ S exciter dynamo, No. 3,678, 110 volts, 10 amperes. One oak switchboard, 6 ft. 6 in. x 8 ft. 6 in.	$4,982.50
INSTRUMENTS.	
Four Type A lightning arresters. Four Type F lightning arresters. Four feeder blocks, No. 8,170. Two current indicators. Two potential indicators. Two station transformers. Two rheostats, Type 148, No. 12,598 and 13,004. One " " 165, No. 15,912. One " " 141, No. 14,766. One one-circuit ground detector. One Thomson-Rice ammeter. One buckle switch. Two 75 ampere station switches, D.P. D.B. D.T. Six 10 " " " D.P. D.B. D.T. One two-circuit arc plug switchboard.	$790.50
ARC LAMPS.	
52 K. 12 arc lamps. 4 hoods for arc lamps. 82 clear arc globes. 19 opal arc globes.	$1,086.60
POLE LINES (ERECTED).	
139 30 foot poles; 2 50 foot poles; 154 4 pin cross arms; 22 2 pin cross arms; 156 brackets; 589 D. G. insulators; 186 porcelain knobs; 383 1½ in. oak pins; 8,130 ft. No. 4, 6,180 ft. No. 6 and 9,388 ft. No. 8 B. & S. weatherproof wire; 9,210 ft. No. 8 Underwriters' wire; 1,720 ft. No. 12 B. & S. weatherproof wire; 670 ft. No. 10 and 1,280 ft. No. 14 K. K. wire	$1,985.10
TRANSFORMERS (ERECTED).	
23 B 15 (one burned out); 5 B 25; 3 Class A; 4 E 1; 6 E 2; 2 E 8; 1 E 8; 1 F 4,500 watts; 1 F 1,250 watts; 5 F 1,000 watts; 4 F 600 watts; 8 F 300 watts.	[illegible]
Total	$20,122.50

Brought forward	$20,112.30
METERS.	
Sixty 10, twenty-four 15, seven 25 and one 50 ampere wattmeters; one 40 and three 20 ampere, Westinghouse.	$1,096.00
TOOLS AND FIXTURES.	
One 8 in. square; 2 pair pliers; 1 pair splicing clamps; 3 screwdrivers; 2 compass saws; 1 *hand* saw; 1 hand axe; 1 pair climbers; 1 gasoline torch; one long handle spoon; 2 long handle shovels; 1 digging bar; 1 pinch bar; 2 raising forks; 1 tree trimmer; 1 chain *tongs;* 150 ft. manilla rope; 1 set double 2 in. pulley blocks; 100 ft. ½ in. rope with come-alongs; 2 sets double 2 in. pulley blocks; 1 set triple pulley blocks; 150 ft. ¾ in. rope; 1 *10-foot* step ladder; 1 8-foot step ladder; 1 pair extension ladders; 1 coal pick; 1 pick-axe; 1 iron wheelbarrow; 3 scoop shovels; 1 flue cleaner; 2 hoes; 1 splice bar; 2 bellows; 1 speed indicator; 4 oilers; 2 ½ gal. measures; 1 oil filter; 10 drip pans; 2 oil cans, 1 and 3 gallons; 1 clock; 1 10-in. grindstone; 1 magneto; 1 stove; 1 75-foot tape line; 4 iron pulleys, 3 12-in. diam., 10-in. face, 1 16-in. diam., 8-in. face; 10 engine wrenches; 25 ft. canvas hose; 1 12-in. combination wrench; 3 monkey wrenches; 1 pipe vise; 1 bench vise; 1 ratchet brace; 2 expansive bitts; 1 reamer (for tapping oil barrels); 1 machinist hammer; 1 20-in. Stillson wrench; 1 adz-eye hammer; 3 files; 2 cold chisels; 1 office desk; 2 office chairs; 1 office stool; 2 common chairs; 1 slate; 1 wardrobe; 1 set shelves; 1 counter scale; 1 platform scale; 1 water meter; 2 piston wrenches.	$326.60
INSIDE WIRING MATERIAL.	
52 K. W. porcelain rosette cut-outs; 45 keyless T.-H. sockets; 31 key T.-H. sockets; 6 keyless wall sockets; 36 D. P. D. B. 20 amp. porcelain cut-outs; 4 D. P. D. B. 10 amp. porcelain cut-outs; 17 S. P. 5 amp. porcelain cut-outs; 1 40 amp. D. P. snap switch; 1 30 amp. lever switch; 11 10 amp. Paiste switches, porcelain base; 5 5 amp. Paiste switches, porcelain base; 5 25 amp. Paiste switches, porcelain base; 1 10 amp. S. P. switch, T.-H., porcelain base; 8 30 amp. D. P. M. L. porcelain cut-outs; 2 lbs. black Grimshaw tape; 1 lb. white Grimshaw tape; 2 lbs. Okonite tape; 21 Ball cord adjusters; 4 8-in., 7 5-in. and 2 7-in. opal shades; 6 snowball opal shades; 7 ruby shades; 31 2¼-in. and 34 3¼-in. shade rings; 28 arc lamp clutches; 4 gross 1½ in. x 8 in., 5 gross 1 in. x 8 in., 2 gross 1¼ in. x 8 in., 1 gross 2½ in. x 16 in., and 4 gross 3 in. x 14 in. flathead brass screws; ½ gross 1 in. x 10 in. R. H. blued screws; 186 small porcelain knobs; 17 attachment plugs; 25 peanut cord shorteners; 108 rubber bushings; 45 break knobs; 45 D. G. insulators; 20 large porcelain knobs; 60 medium porcelain knobs; 177 ceiling buttons; 100 ⅛ in. and 50 ¼ in. patent cleats; 2¼ lbs. wire solder; 12 hard tubing; 58 lbs. No. 14, 4 lbs. No. 12 and 27 lbs. No. 10 K. K. wire; 49 lbs. No. 8 and 82 lbs. No. 6 weatherproof wire; 53 lbs. No. 10, 50 lbs. No. 12 and 61 lbs. No. 14 Underwriters' wire; 124 lbs. old wire; 106 16 c. p. lamps; 24 32 c. p. lamps; 57 lbs. galvanized iron wire, No. 8; 30 1½ in. oak pins; 20 brackets; 45 D. G. insulators; 20 large porcelain knobs	$124.20
STATION SUPPLIES.	
27 gals. kerosene oil; 16 gals. engine oil; 12 gals. cylinder oil; 24 lbs. cup grease; 25 tons Wilmington coal; 4 tons unscreened nut; 42 lbs. colored cotton waste; 26 lbs. white cotton waste; 2,250 carbons.	$147.00
Total	$22.106.10

Again, we submit, we have presented undeniable proof, as in the case of all other Northwest properties analyzed. of the truth of the charges so often made in these columns, that the entire career of the Northwest Thomson-Houston and General Electric Companies, as directed by Mr. C. A. Coffin, and carried into execution by Gilman and Byllesby, was little less than a confidence game—a studied and elaborate attempt to manufacture worthless securities to sell to savings banks, trust companies, and directly to small and comparatively poor investors in the East.

Mr. Coffin's direct connection with all these evil schemes has not been denied. . It cannot be. In the case of the Austin plant no proof is lacking. With the records all before him, with a full knowledge of the disastrous career of the plant from the start, with the official inventory in his own desk showing the total possible cost of the equipment to be not over $23,000, he stated, over his own signature, only a a few months ago, that the plant had cost $53,595.58. Perhaps it did cost the Northwest General Electric Company this amount. If so, at least $30,000 was stolen by those who had in charge the manipulation of the Austin Company's accounts.

General Electric.

(From the Boston News-Bureau.)

General Electric business is now said to be at the rate of about one and a quarter millions per month, though some months have been as high as a million and a half. It is not expected, however, that the General Electric gross business will be over $15,000,000 this year. The company will this year endeavor to write off its entire patent account, and not more than 3 per cent. need be expected as the exhibit of earnings on the common stock.

It is understood that the Northwest General Electric Company, whose preferred stock sold at from $90 to above $100 per share in this market a few years ago, has been closed out and wound up, and the preferred stockholders got from the guarantee of the General Electric Company about $10 per share. The other 90 per cent. they can charge off to profit and loss.

Some of the most sagacious investors in Boston failed to foresee the overturn that has taken place in the great Northwest territory. Electric railways in this district whose bonds were bought by New England investors at about par have not only failed, but the rails have been taken up and sold for scrap iron, returning the bondholders a small percentage on the dollar.

BOOK REVIEWS.

COMPRESSED AIR. Practical Information upon Air Compression and the Transmission and Application of Compressed Air. By FRANK RICHARDS, Mem. A. S. M. E. 8vo, cloth. 195 pages. New York: John Wiley & Sons.

The matter contained in this book, or at least the most of it, appeared from time to time in the columns of the *American Machinist*, and has been gathered together here to meet a supposed want for a condensed and handy statement of the case of compressed air. The want is certainly existent, for the literature of compressed air is almost wholly confined to scattered articles in periodical publications, to a few chapters in the larger works treating of tunneling and mining and to the circulars of manufacturers of air-compressing machinery. The last is perhaps the fullest of all, but, as the author suggests, is open to the implication of partisanship.

In opening this book we were elated with the hope that at last there had been presented a treatise that was full and from a non-partisan standpoint. We also hoped to find the subject handled in an able manner. Our hopes were founded on the interested basis that as compressed air transmission has been the last to give way to the electrical—and in many applications has not yet given way—we wished to see clearly stated its points of vantage so that the discrepancies of the electrical method might become more manifest. We confess that we were sorely disappointed in the first chapter. The author seems to take the stand that economy is not one of the essentials and that convenience alone is the recommendation of the medium about which he writes. It is certainly true that convenience will often overbalance a considerable lack of economy, but we were unprepared for such a candid acknowledgment of the greater cost of compressed air over other methods as the author makes. He says (p. 6): "The application of the air is not mechanically economical, only *ten per cent.* of the power employed being applied to the work of moving the carriers, while ninety per cent. is 'wasted' in accelerating the air, and in its friction." This in regard to pneumatic tube transmission. This means, if we assume an efficiency from the fuel to the engine piston of 10 per cent. an ultimate efficiency of but 1 per cent., and the argument is used to show that actual power economy has little to do with the employment of compressed air. We think that the illustration is an unfortunate one for his audience, who are evidently laymen, for they will conceive that "power economy," as he expresses it, is a secondary consideration, whereas nowadays it is in most applications a prime requisite.

He says: "Compressed air is *unique* [italics ours] among all power transmitters—at least among *long-distance power transmitters* [italics again ours]—in that it is always and instantly ready to do its work to its full capacity, and yet it charges nothing for its services except when it is actually employed." This is a rank misstatement of fact, for any means of storage of energy fulfils equally well this specification. A compressed spring, water pumped up to an elevated reservoir, or any other weight raised against gravity, thermal storage, gas storage, many forms of chemical reactions, etc., etc., which absorb energy in their initial stages are capable of being reversed quite as well as the compression of air. Unfortunately electrical energy is not capable of storage of this kind, and when the so-called storage of electrical energy takes place, it does involve a charge for its services, but this charge is by no means as great as the author seems willing to admit for compressed air in the way of inefficiency. As a further argument for the use of compressed air he says: "These uses of compressed air . . . continually increase, not because the air is more adapted to . . . use than any other, but because the *air* is *there*." If that argument is good, and we don't think it is, the argument for electricity would be better, viz., that the ether which pervades all space and upon which alone it is dependent, is more universally "there" than air.

His heresy, however, is that mere convenience overbalances all other considerations. In speaking of a plan adopted by a master mechanic of a certain railway company for whitewashing by means of compressed air, he concludes thus: "There can be no doubt of the success of this scheme; but if it pays to use a locomotive, a freight car, three brake pumps, two reservoirs, and all the rest of it (system of piping into the building and men to hold the nozzles), for such a job, compressed air surely must be cheap at any price."

In the first place, we think it would be difficult to prove that the method outlined above would be more economical than hand labor, and the author does not attempt to prove it, but says that *if* it pays to employ that method, then "compressed air surely must be cheap at any price." It would be a great concession to admit that such a method would pay, but admitting for the moment that it would pay it is a *non sequitur* that compressed air would be cheap at *any price*.

We are led into this somewhat lengthy review of this book chiefly because of the publishers' name, which usually stands for merit. In this instance we think they have been sadly mistaken, for however able the author in everyday affairs of life, he seems to have mistaken his calling when he felt called upon to write a book in defence of compressed air.

The ill impression which we formed on reading the first chapter followed us throughout the work. In justice to the author, however, we must say that he has collected much information of a valuable character and presented it oftentimes in a very attractive form for the novice. His exposition is entirely elementary and usually diffuse, but that is not a fault (unless carried too far) when catering to the layman. His fault lies chiefly in the doctrine that efficiency is not an essential in present day engineering.

GAS, OIL AND AIR ENGINES; OR INTERNAL COMBUSTION MOTORS WITHOUT BOILER. By BRYAN DONKIN, JR. Cloth, 8vo. 409 pages, 136 illustrations. London: Charles Griffin & Co.

The gas engine, while it has come into considerable use abroad, is but little known in this country, chiefly because of the business stupidity of those into whose hands its manufacture has so unfortunately fallen. The merits of internal combustion engines, however, deserve to be more widely known, and every well conceived effort to place this knowledge before the public is welcome and appreciated.

The present work is, we believe, the fullest treatise yet published, and coming as it does from one who is regarded as an authority on such subjects, is particularly welcome.

We are sorry to see, however, that in many particulars the author has not brought his book up to recent times. For instance, in his description of the Daimler motor, which is now so interesting on account of its recent successful application to automobile vehicles, he is away behind the times. He is evidently not familiar with the present mechanism and has not taken the trouble to obtain recent data. This criticism applies also to many other portions of the book, and we are surprised that a man of Mr. Doukin's standing would be willing to come before the public so illy prepared on so many subjects to do them justice.

The book is divided into three parts, treating respectively of Gas, Air and Oil Engines. Part 1, Gas Engines, is divided into two sections, the first dealing with the early history of these motors, and the second with modern gas engines. The theory of the gas engine is discussed in four chapters. The chemical composition of gas is given one chapter. An appendix is added in five sections in which much valuable data not otherwise readily accessible have been incorporated, and tests on gas, oil and air engines, showing the results accomplished to date, will be found valuable for reference.

Short descriptions, often illustrated, of the various makes of English, French and German engines are given, making this undoubtedly the most complete exposition of the art yet offered.

The various methods of producing fuel gas are also briefly described. We would like to have seen this portion of the work largely amplified, and consider that its brevity in this direction is a great mistake.

The author, however, has been very painstaking, and the merit of what he has given us is what especially emphasizes the want of that which he has omitted or slighted.

LEGAL NOTES.

In the case of the electric railway companies of Harrisburg, Pa., versus the city, in which the companies resisted the payment of taxes on cars not in general use, Judge McPherson has decided that the act of 1889 makes no exception of this kind, and holds that the city is authorized by its provisions to impose the tax of $55 on any car that has been used in the city during the year.

Argument in the case of the New Britain, Conn., electric road was concluded in the Supreme Court on the 25th ult., and the decision of the court is awaited with interest as it involves the question of the right of a town to take a certain per cent. of the receipts of street railroads for the privileges granted. The matter has never been passed on in Connecticut.

The Montreal (Can.) *Gazette* states that the Superior Court has issued an order for the winding up of the affairs of the St. Jean Baptiste Electric Company. Charles Desmarteau has been appointed provisional liquidator and Judge Ouimet will hear further proceedings on the 7th of November.

The General Electric Company has begun suit in Tacoma against Receivers Bird and Mitchell of the Tacoma Railway and Motor Company, to restrain them from paying interest coupons on first mortgage bonds of the company issued April 1, 1890. The Farmers' Loan and Trust Company, Miles C. Moore, the Baker-Boyer National Bank of Walla Walla and the Pacific National Bank of Tacoma are made defendants.

Married.

On Wednesday afternoon, October 30, at Delmonico's, Mr. Joseph Wetzler, editor of the *Electrical Engineer*, and Miss Pauline, daughter of Mr. Jacob Gerson, were married by the Rev. Mr. Silverman. Mr. Wetzler and bride are at present on an extended tour of the various Southern resorts.

Mr. L. J. Montgomery, secretary of Electricity Newspaper Company, and Miss Mary Helen Watt, youngest daughter of Dr. Thomas Watt, of Kintore, New Brunswick, Canada, were married on Thursday, October 31, at the residence of Mr. John Nicol, Jersey City, N. J.

Personal.

Among out-of-town visitors to the metropolis last week were Henry Cram of the Bernstein Company, Boston; B. E. Sunny of Chicago, Dr. Addison of San Francisco, Charles King of the Ohio Brass Company, Mansfield, O., and H. E. T. Pringle of Montreal.

Mr. and Mrs. W. S. Key, of Boston, were guests of friends in Brooklyn last week, stopping off on their return from a Southern trip.

Mr. Eugene McQuat has succeeded Mr. E. E. Cary as superintendent of the Beacon Lamp Company's factory, Boston.

GENERAL NEWS.

What is Going on in the Electrical World.

Park Rapids, Minn.—An electric light plant will be put in here in the spring.

Arcadia, Wis.—The Arcadia Milling Company will put in an electric light plant.

Atlanta, Ind.—It is proposed to organize a local company to light the town with electricity.

Tunkhannock, Pa.—It is planned to construct an electric railroad from Scranton to Tunkhannock.

Allegheny, Pa.—The new electric light plant installed by the Western Electric Company has been completed and the lights turned on.

Little Valley, N. Y.—The taxpayers of the village have voted in favor of an issue of $7,000 bonds for the purpose of putting in electric lights.

Reading, Mass.—The selectmen have decided to grant a franchise to the Woburn & Reading Street Railway Company for an electric road to Woburn.

Preston, Minn.—An election has been held here to ascertain whether an electric light plant and waterworks should be put in. The vote stood 151 in favor to 58 against.

Topeka, Kan.—The council has passed a resolution instructing the city clerk to advertise for bids for machinery to increase the capacity of the city electric light plant.

Bloomfield, N. J.—Work has just been begun on the extensions to the Sprague Electric Elevator Works in Bloomfield, one of which will be 125 x 100 and the other 200 x 64.

Tarrytown, N. Y.—A. J. McKee, of Tarrytown, has filed an application with the board of trustees for the right to construct and maintain an electric railway in the village.

Cincinnati.—The Cincinnati Street Railway Company intends to equip its "owl cars" with electricity and run them at shorter intervals; the cars are at present drawn by horses.

Peterboro, Can.—The first three-phase electric plant erected in Canada is being put in in the town of Trenton. It is proposed to run electric wires to Belleville, Can., twelve miles distant.

Philadelphia.—At the Baldwin Locomotive Works three electric freight engines are being constructed, two of which are to be used for switching purposes and the other is to be placed on exhibition.

Corunna, Mich.—At a special election held here on the 24th ult. the proposition to bond the city in the sum of $30,000 for waterworks and an electric light plant was carried by a large majority.

Jamestown, N. Y.—The council having decided to furnish electricity for commercial lighting, have accepted the estimates of the Standard Electric Company of Chicago for additional machinery for the city plant.

Davenport, Ia.—The gas and light committee of council and the board of public works have been ordered to advertise for proposals for lighting the city by electricity for a term of five years, commencing June, 1896.

Norwalk, Conn.—The Tramway Company of Norwalk, whose charter gives it the privilege of building a trolley line from Norwalk to New Canaan, has made a preliminary survey over the main road between the two points.

Aberdeen, Wash.—The electric light plant has been leased to the firm of Benn & Green of this city for a period of one year with the option of two years. The purchasers promise to extend the lines and give an all-night service.

Albany, N. Y.—The Buffalo Traction Company, whose incorporation papers have been filed here, intends to construct a surface electric railroad sixty-six miles in length, crossing the city and extending into various suburbs of Buffalo.

Rutherford, N. J.—The borough council has revoked the franchise giving the Union Traction Company permission to build an electric road through this town on the ground that the company had not begun construction within six months as required.

Winnipeg, Man.—The Neepawa Electric Light and Power Company, Limited, is applying for a charter of incorporation. The capital stock is $20,000. Directors: J. J. McFadden, J. H. Hamilton, J. H. Dandson, J. H. Howden, G. A. Davidson, all of Neepawa.

Springfield, O.—The county commissioners have granted to the Dayton, Springfield & Urbana Railway Company a franchise to construct an electric line over the National and Valley pikes from the west corporation line of Springfield to the west county line near Medway.

Lansdale, Pa.—The "Republican" says: "There are rumors afloat to the effect that another electric light and power company is about to be formed in Lansdale, with a view of furnishing electric power to operate a trolley line from Lansdale to Doylestown and Norristown."

Mankato, Minn.—C. L. Alleman, manager of the Standard Oil Company's business here, and S. R. Snow, proprietor of the Saulpaugh Hotel, are considering the advisability of operating an electric street railway and lighting system here, and will ask the council for a franchise.

South Haven, Mich.—The business men and fruit growers of this vicinity are agitating the building of an electric road from Saugatuck to Benton Harbor. Many of the fruit growers between here and Saugatuck are anxious for the construction of such a road, and will give the right of way.

New London, Conn.—Interest is revived in the projected electric railway between this city and Norwich, and indications are favorable to the carrying out of the scheme. The selectmen of Waterford and Montville have designated a route for the railway over the highways of their respective towns.

Shaefferstown, Pa.—Local moneyed men have subscribed nearly $45,000 for the extension of the Reading & Womelsdorf Electric Railway to this place. The estimated cost is $80,000, which would include the necessary equipment. The line is in operation to Womelsdorf, fourteen miles west of Reading.

Niagara Falls, N. Y.—W. W. Gibbs, president of the Electric Storage Battery Company of Philadelphia, has been here making investigations with a view, it is stated, to establishing a great factory for storage batteries in this locality. He said the prospects of the company locating here were very favorable.

Wabash, Ind.—The county commissioners have granted the recently organized Huntington, Columbia City and Ligonier Electric Railway Company a franchise for the construction of its line through Huntington County. The road is to be forty miles long and taps the finest summer resort region in Indiana.

Danville, Va.—The charter of the Dan River Power and Manufacturing Company has been amended by action of the Hustings Court so as to make the limit of capital stock $1,000,000. It was originally $750,000. This company is developing the water power in Dan River, four miles above here. One of the first enterprises to be inaugurated will be an electric plant.

Wilkinsburg, Pa.—Sealed proposals will be received until the 16th inst., by James G. Stover, borough clerk, for the furnishing and lighting by electricity of 65 arc lamps, more or less, of 2,000 c. p., on the streets of the borough, to be located as council may direct. Proposals must be accompanied by a certified check for $1,000 as surety that if the proposal be accepted a contract will be entered into.

Washington, D. C.—Among the improvements lately made at the Capitol was the installing of a complete electric lighting plant capable of furnishing illumination for the whole building. The odors of escaping gas had rendered the atmosphere of the halls and chambers almost unbearable, and it was decided to abolish the deleterious illuminant and give the nation's legislators better air and better light.

Boston, Mass.—The common council has adopted an order looking to the presentation of a petition to the Legislature for the passage of an act enabling this city to adopt a municipal lighting system. The council was asked for a hearing on the subject by the Boston Electric Light Company and the Edison Electric Light Company, and a date for a public hearing was set for November 14 at 2 P. M.

Terre Haute, Ind.—The stockholders of the proposed Terre Haute & Brazil Electric Railway have elected the following board of directors: Christian Miller, James N. Halstead, Major Collins, Max Joseph, Frank E. Benjamin, R. J. Smith and J. N. Hickman. The directors elected Max Joseph president, W. H. White treasurer and R. J. Smith secretary. The directors ordered an extra assessment called at once.

Harrisburg, Pa.—The Harrisburg & Mechanicsburg Electric Railway Company, having failed to obtain consent of all the municipalities through which the line was projected prior to the recent decision of the Supreme Court requiring such consent, has determined to change its route. The parts of the route abandoned are the extensions to Oyster's Point, Shiremanstown, Mechanicsburg and Riverton. The line will be operated to West Fairview and New Cumberland.

Fond du Lac, Wis.—The General Electric Company has taken its dynamos and other machinery out of the local electric light plant on an execution rendered in June last. It is reported that the owner of the plant, Elihu Colman, has closed a deal whereby the entire property of his company—the Fond du Lac Light, Power & Railway Company—has been transferred to other parties who will reorganize the company and put in the best electric machinery to be found in the market.

Lynn, Mass.—It seems probable that the General Electric Company will have to shut down its works here owing to the strike of the moulders. A careful estimate of the number of employees of the works who have been suspended because of lack of work pending the settlement of the strike is placed as high as 150, and it may possibly reach the 200 mark. This would make the total number rendered idle by the strike about 300, and in many departments of the works the operatives are working but three days a week.

Petersburg, Va.—It is understood here that operations will be commenced shortly on the electric road connecting Manchester with Petersburg, for which J. C. Robertson, of Manchester, has obtained a franchise. Mr. Robertson says that he intends to have motors on the cars of sufficient power to carry several extra cars whenever it is necessary to attach them as trailers. In addition to passenger coaches provision will be made for carrying freight and express.

St. Louis.—The Laclede Power Company, St. Louis, has increased its capital from $75,000 to $400,000. As the new capital was contributed by men in the company there will be no change in officers or directors. President Henry C. Scott of the company said to a reporter lately: "We have about 1,000 miles of wire, but most of it is in the heart of the city and we want to extend our lines. We will endeavor to convince manufacturers and others that it would be economical for them to dispense with their steam plants and to get their power from our central station."

Danbury, Conn.—A company to be known as the International Electric Company has been formed here to control the electric railway system invented by J. M. Murphy and Albert F. Pierce, of this city. The following are the officers agreed upon: President, Samuel H. Rundle; vice-president, J. H. Hawkins; second vice-president, G. V. P. Lansing; treasurer, G. Mortimer Rundle; secretary, Albert F. Pierce; general superintendent, J. M. Murphy; directors: Samuel H. Rundle and G. Mortimer Rundle, of Danbury; J. H. Hawkins and G. S. Hawkins, of Steubenville, Ohio; G. V. P. Lansing, of Seattle, Wash.: George A. Shepard, of Bethel; Albert F. Pierce and J. M. Murphy, of Danbury; W. J. Dickson, of Canada, and Alfred Adams, of Cleveland.

Brooklyn, N. Y.—Chief Engineer C. C. Martin has been instructed by the Bridge trustees to advertise for proposals for an electric system for switching the Bridge cars. The bids will be opened at the regular meeting of the trustees on the 11th inst.—William E. Roller, of the electrical department at the Brooklyn Navy Yard, has devised an electrical arrangement for signaling at sea which will shortly be tested and if found practicable and efficient will be adopted on all the ships of the United States Navy. The system consists in electrically illuminated letters formed on a frame by an arrangement of parts calculated to facilitate their successive production. The keyboard is built after the fashion of a typewriter and can be operated from the cabin or any convenient part of the ship.—The common council has passed a new franchise to take the place of the one already granted to the State Electric Light & Power Company, some of the provisions of which were either unconstitutional or could not be carried out by the company. The new grant provides for a forfeiture of all moneys paid into the city treasury by the company.

Chicago.—The Suburban Electric Railway Company has secured a franchise from the trustees of the town of Riverside, thus completing the right of way of this company. The Suburban will connect a number of the small towns between Chicago and La Grange.—In view of the opposition of the property owners to the proposed overhead trolley railway in Indiana avenue, the General Electric Railway Company offers to maintain the underground system in operation in the avenue for one year, when, if satisfactory, it can be purchased by the City Railway Company (the projector of the trolley line) at a figure not to exceed $19,000 per mile.—Tests of a new automatic electric signaling service have been made on a section of the Chicago and Eastern Illinois Railroad which appear to have been quite successful. It was shown that the system will give timely alarm to the engineer of a moving train when approaching a standing or moving car or locomotive on the same track, and of an occupied grade crossing, an open switch or drawbridge, or a car projecting from a side track over the main track. As the signal given is the ringing of a bell in the cab of the locomotive, which will continue to ring until stopped, the system is certain to be as effective in darkness as in daylight. The device is the invention of E. B. Cornell, formerly with the Cramps in Philadelphia.

TELEPHONE AND TELEGRAPH.

Will Not Give Franchises Away.

The Duluth correspondent of the Minneapolis *Journal* says: "It is not a sure thing—this trying for a telephone franchise in Duluth. The people have come to regard the giving of franchises in an unfavorable light, even when strong inducements are held out. Only a short time since the council refused to give a telephone franchise to a new company on the ground that they didn't want two systems in conflict, as the service would be unsatisfactory to the public, and also because they wanted to be able to reap a decided advantage for the city when the present company's franchise expires, which date is not far distant Later the council refused to give the present company an extension although it offered some return in a financial way. When the franchise expires the privilege will probably be sold to the highest bidder."

Willing to Sue in Massachusetts.

It will be remembered that some time ago the Manhattan Electrical Supply Company of New York published a card offering to pay $100 for the privilege of defending a suit on the Berliner patent brought by the Bell Company against any user of the Manhattan Company's telephones. Some days ago an agent of the Bell Company visited the Manhattan Company's office to inquire if the $100 reward would be paid in case a suit were instituted in Massachusetts. He was advised that it would not, but the amount would be increased to $500 if New York be selected as the battle ground.

Telephone Kiosks.

The extension of the telephone booth idea is to be made in Copenhagen. A company of leading Danes has been formed to erect in all the public squares of the city telephone kiosks, which will be capacious and elegantly fitted up. Here, besides the telephone, the citizen will have access to the daily papers, be able to write letters, receive messages, have their shoes polished and generally to make themselves comfortable.

To Use Rails As Wires.

It is proposed to connect Aberdeen and Tacoma Park, South Dakota, by running a telephone wire to a rail of the Great Northern Railroad, at Tacoma, and making a similar connection at the Aberdeen end of the line. The idea of using the railroad in lieu of wires for telephoning has already been successfully tested, and the South Dakota farmers are expecting to derive great benefit from the new service, especially in the matter of information of coming storms.

Wedded by Wire.

Miss Lydia Klutte, of Oshkosh, Wis., was married to Duncan Edwards, of St. Cloud, Minn., on the 28th ult., by wire. The usual questions were asked of the groom, and his answers, made before witnesses, were returned by wire. The bride replied in person to the minister. After the ceremony was performed, the bride took the first train for the home of her husband, which was her wedding trip.

Telephones for Life-Saving Stations.

A survey has been completed for a telephone line from South Atlantic to Cape May Point, N. J., connecting all the life-saving stations. The building of this line will connect by telephone all the life-saving stations on the Atlantic coast from south of Cape Hatteras to Maine.

Latest Move in the Berliner Case.

A motion to dismiss the appeal of the United States from the judgment of the Court of Appeals of the First Circuit of Massachusetts in the Berliner Telephone patent case was submitted in the Supreme Court of the United States last week by the Bell Telephone Company. No action has yet been taken by the court.

"It is a Live Paper."

To the Editor of ELECTRICITY.

SIR: We like ELECTRICITY very much. It is a live paper. Yours truly,

FARR TELEPHONE AND CONSTRUCTION SUPPLY COMPANY.
Chicago, Ill., October 25, 1895.

Bell May Buy a Rival.

The *Tribune* of Detroit, Mich., is the authority for the statement that negotiations are pending in England for the purchase by the Bell Telephone Company of a telephone receiver owned by the Brown Loud-Speaking Telephone Company of Detroit.

Not the Western "Standard."

Some people have confused the Standard Telephone Company of New York with the Standard Telephone and Electric Company of Madison, Wis. There is no relation whatever between the two companies.

Will Be Sure to Control the News.

The cable between Havana and Santiago de Cuba, which is practically under the control of the Spanish Government, will be completed by November 10, and it is said will be of great value to Spain in the prosecution of the war in Cuba.

A stock company has been organized at Muncie, Ind., to establish an electrical call and messenger service in that city. Boxes will be placed in all localities where there is not an accessible telephone service, and at points where the interests of the public can best be served. At the central office a corps of messenger boys, provided with bicycles and a delivery wagon will be kept ready to attend to all calls day or night. Roy Coffeen will have the management of the business.

The citizens of Springfield, Ill., and the Central Union Telephone Company are having almost daily passages at arms over the pole question. The company was directed to remove certain poles, which it refused to do. A committee of citizens removed the poles with axes and the company has now instituted trespass and damage proceedings against the property owners. An injunction has been secured restraining the company from taking further steps until the case can be disposed of in the Circuit Court.

The Wisconsin Telephone Company is discovering how hard the people of Milwaukee can kick. Some time ago the company established a rule limiting the number of the calls of each subscriber to three a day or 1,000 a year and fixing a rate of two cents for each call. An indignation meeting, in which the leading attorneys and business men of the city participated, was held recently to protest against the "extortionate, unreasonable and unjust" rates of the company.

The Bell Telephone Company of St. Louis has decided to extend its system over the eastern half of St. Louis County, reaching Ferguson, Shrewsbury, Fenton, Old Orchard, Maplewood, Kirkwood and Webster Groves. The system will be operating within sixty days. Rates have not been decided upon, but will be considerably less than the present charges for suburban service.

The exchange of the Greencastle Local Telephone Company, Greencastle, Ind., has been attached by local parties who have claims against the Phœnix Telephone Company, of Indianapolis. The system was built by the Phœnix company for the Greencastle company, but owing to some hitch in the proceedings the local company has not accepted the plant.

A temporary injunction has been secured by the city council of Sheboygan, Wis., restraining the Wisconsin Telephone Company from setting additional poles until the formality of securing a franchise has been complied with.

The Board of Supervisors of Mason, Mich., has directed the Co-operative Telephone Company of that city to place its instruments in the city and county offices. The Bell instruments are to be thrown out.

John Goodnow, a prominent capitalist of Minneapolis, and a director of the Northwestern Standard Telephone Company, has been in Duluth, Minn., arranging to secure a telephone franchise.

The Baldwin Electrical and Manufacturing Company of Watertown, N. Y., is constructing the telephones to be used in the new local exchange now being erected in that place.

The Finance Committee of the Board of Works of Newark, N. J., has in preparation an ordinance granting street rights to the Newark Telephone Company.

The Board of Trade of Laramie, Wyo., is interested in the movement to establish a telegraph and telephone line between Laramie and Walden Park.

The St. Louis *Star Sayings* declares that the Bell telephone service in that city has become almost worthless. The management lays the blame on the Municipal Assembly which refuses to give the company right to construct underground metallic circuits.

W. R. Simmons of Seven Springs, N. C., contemplates building a telephone line to connect La Grange and Seven Springs.

The Painesville Telephone Company, Painesville, O., is now ready to receive bids for the construction of an exchange.

Texas Siftings is of the opinion that "the telephone complication just now is an example of 'sweet Bells jangled.'"

The Home Telephone Company has at last secured permission to enter Red Bud, Ill., with its lines.

The Wisconsin Telephone Company will extend its lines to and establish an exchange in Antigo, Wis.

The Phœnix Telephone Company of Altoona, Pa., has been granted street rights at Tyrone, Pa.

E. H. Brainard is interested in forming a new telephone company at Springfield, Ill.

New Companies Incorporated.

The North Creek, Newcomb and Long Lake Telephone Company, limited, has been incorporated to build and operate a telephone line from North Creek, by way of Olmstedville, to Minerva, thence by way of Aiden Lair to Newcomb and Long Lake, connecting North Creek, Olmstedville, Minerva, Aiden Lair, Newcomb and Long Lake, N. Y. The capital stock is $3,000, and the directors are John Anderson, jr., Dennis Moynehan, jr., and Edward Anderson of Newcomb; P. Moynehan of Glens Falls; David Hunter of Tahawus; John Donelly of Olmstedville, and T. D. Sullivan of Long Lake.

The Troy Telegraph and Stock Company—to maintain a line of telegraph or telephone from Troy to New York and the principal cities and towns of Westchester and Kings Counties, and the State of New Jersey; also to Chicago, Louisville, Lexington, and Covington, Ky.; Nashville and Memphis, Tenn.; New Orleans, St. Louis, Baltimore, Washington, and Montreal. Capital stock, $2,000. Directors: Thomas Hogan of New York City, Peter J. Turner, Patrick E. Purcell, Patrick J. Delaney, and William Miller of Troy; Eli Galaise, Jr., of Cohoes, and Charles G. Teeling of Green Island.

The Smith-Vassar Telephone Company, New York—to manufacture and operate a signal call station for telephone and telegraph purposes and to acquire and hold stock in other corporations engaged in a similar line of business. Capital stock, $1,000,000. The directors of the company are Frank S. Pusey of Council Bluffs, Iowa; Wm. L Beardsley, Frederick J. Winston, Joseph F. Barling, Augustus W. Hand, Charles W. Durland, and Edward Schmidt of New York.

A meeting of persons interested in the Berliner Gramophone was held in Philadelphia last week for the purpose of forming a company to engage in the manufacture of the 'phones. A permanent organization was effected by the election of the following officers: Thomas S. Parvin, president; W. C. Jones, vice-president and general manager; Max Biernbaum, secretary, and W. J. Armstrong, treasurer. The organization will be known as the Berliner Gramophone Company.

The articles of association of the Bridgeport Mutual Telephone Company have been filed at Bridgeport, Conn. The officers of the new company are Frederick W. Tracy, president, and William E. Bowers, secretary. The company proposes to establish a local telephone service. Membership will cost $100 and the expenses will be divided pro rata among the members. For communication with the outside world, special toll rates will be charged.

The Beaver Hill Telephone Company of Beaver Hill, N. Y.—to connect Rockland Station and Lewbeach in Sullivan County, and to connect such line with points in Sullivan, Ulster and Delaware counties, New York. Capital, $1,500. Directors: Jefferson Campbell of Roscoe, J. W. Johnston of Rockland, Jay Davidson of Beaver Hill, and others.

The Home Telephone Company, Richmond, Va. Capital stock, $200,000. Incorporators: J. N. Cullingworth, J. D. Patton, S. W. Travers and others. James Russell, Baltimore, Md., is president of the company.

The Willamette Valley Telephone Company, Portland, Ore. Capital stock, $5,000. Incorporators: John Bradley, Alexander Smeek and John W. Shafford.

The Norfolk Mutual Telephone Company has been organized at Norfolk, Conn., as a corporation without capital. George M. Coy, of Milford, is secretary.

The People's Telephone and Telegraph Company of South Dakota, with headquarters at Hot Springs, has been organized with a capital stock of $50,000.

The Oconto Telephone Company, Oconto, Wis. Capital stock, $7,500. Incorporators: Judge D. G. Classon, Dr. C. W. Stoelting and A. H. Lukenbach.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and articles required in the electrical equipment of public and private buildings.]

Brooklyn, N. Y.—Walter Silsby, restaurateur, 460 Fulton st., has leased the entire corner, Fulton street and Hanover Place, which will be at once rebuilt and thoroughly furnished for restaurant purposes . August Woodbury has prepared for Mrs. Emily A. Patterson, 191 Franklin ave., plans for a five story brick improved apartment house, to be erected at the southeast corner of Harrison ave. and Cooper st . . E. Johnson & Co. has prepared for Moller Bros. & Co., South 9th st , plans for two four story stone front houses that it is proposed to erect on South 9th st.

Buffalo, N. Y.—Architect W. H. Archer has prepared plans for a store and apartment building to be erected at 397 Woodlawn ave . . . . James W. Chase will erect a four story brick block for stores and flats corner Grant and Ferguson sts., to cost $50,000.

Detroit, Mich.—Gilbert Wilkes, the consulting electrical engineer, has advised the Board of Education that it will be more economical to have a separate lighting plant for the new high school building than to light the building from the city's lighting plant.

Doylestown, Pa.—Architects Baker & Dallert, of Philadelphia, are now engaged in drawing plans for a handsome new building which the First National Bank of Doylestown intends erecting.

Kansas City, Mo.—The Karnival Krewe committee on lighting propose to expend $15,000 for lighting the city during the carnival week; the committee on street illumination consists of John Sullivan, W. W. Cowan and George P. Gloss.

Lewiston, N. Y.—Messrs. Carrell & Fleming, of Lewiston, have purchased the Piper mansion from Dr. T. W. Bartlett, of Buffalo, and will at once convert the structure into a first-class hotel with all modern improvements.

Miami, Fla.—It is rumored that H. M. Flagler will erect here a 1,500 room hotel.

New Britain, Conn.—A movement is likely to be started soon by a number of our prominent citizens towards the erection of a new city and town building.

New York City.—Edward Kilpatrick, 50 West 67th st., will erect a ten story hotel at 94th st. and Central Park West, to cost $175,000; Architect Frederick Jacobson.... Walker & Lawson have purchased a plot of about four lots on southeast corner of Riverside Drive and 84th st., with the purpose of erecting high class dwellings thereon... Richard S. Barnes, of Washington, Conn, will build a five story brick dwelling north side of 75th st., east of Riverside Drive, to cost $60,000 ... Frederick Brandt, 538 East 84th st., will erect 2 five story flats south side of 105th st., west of Park ave.; Architect John Brandt Andrew J. Kerwin & Son, 316 West 88th st., will build 2 five story flats on north side of 99th st., east of Amsterdam ave.; Architects A. B. Ogden & Son, 1031 Madison ave.... Architects Schneider & Herter, 48 Bible House, have prepared plans for a six story store and flat to be erected at southwest corner of Allen and Rivington sts ... Abraham and Harris Cohen, 232 Henry st., will erect a five story store and flat at 138 East Broadway .. James Livingston has purchased four lots, 420–426 West 20th st., and will improve the property at once by the erection of 3 five story flats.

Peoria, Ill.—The State Board of Commissioners have decided to locate the Asylum for the Incurable Insane at Peoria; the asylum will be the largest of the State institutions and will accommodate 5,000 people; the estimated cost is $2,000,000; work will be begun on the new buildings this winter.

Philadelphia, Pa.—Chester H. Kirk is preparing plans for a handsome residence to be erected for Wm. F. Harrity on lot recently purchased by him at Overbrook; bids will soon be asked for.

Stafford Springs, Conn.—A syndicate of local business men have caused work to be started on a hotel building to be called the Spring House, which is to be ready for occupancy about January 1st.

INCORPORATIONS.

The Clear Lake Electric Power Company, Lakeport, Cal.—to construct and operate irrigation works, construct electric power producing works and manufacture electricity. Capital stock, $2,000,000. Promoters: E. P. Clendenin, D. C. Rumsey, Lakeport; J. K. Fraser, Kelseyville, Cal.; C. E. Moore, San Francisco; Richard Wylie, Napa, Cal.

The Key West Electric Light and Power Company, Key West, Fla.—to operate and maintain electric lights and power for public use. Capital stock, $25,000. Promoters: Chas. Curry, M. L. Kellings, M. W. Curry, Jos. Y. Porter, Key West.

The Barrie and Allendale Electric Street Railway Company, Barrie, Ont., Can.—to construct and operate an electric railway in Barrie and suburbs. Promoters: J. H. McKeggie, J. Vair, G. Reedy, S. J. Sanford and J. Dickinson, all of Barrie.

The Monroe City Electric Light Company, Monroe, Mo. Capital stock, $10,000. Promoters: Wm. Wood, E. P. Nelson and W. T. Ragland.

The Logan County Electric Light Company, at Lincoln, Ind. Capital stock, $10,000. Incorporators: John W. Lutz Charles C. Reed, John St. Cerny, T. A. Reynolds, Adam Denger, D. H. Harts, R. H. Gains and John A. Lutz.

The Schuylkill Traction Company has filed its charter at Doylestown, Pa. The company proposes to build and operate trolley roads in that part of Pennsylvania, and in adjoining States the waters of which drain into the Delaware and Schuylkill rivers. Capital stock, $50,000. Incorporators: Wm. Jenks Fell, Francis Fennimore, Marshall S. Lynch, Robert C. Fulton and Samuel Hamilton.

The Essington and Chester Railroad Company—to build an electric line from Essington to Chester, Pa., a distance of four miles. Capital stock, $50,000. Directors: William Simpson, Jr., Joseph B. Townsend, Jr., Overbrook, Pa.; Charles C. Townsend, Philadelphia; William H. Badger, Jr., Wayne, Penn.

The Hafemeister Electric and Machine Company, Cleveland, O. Capital stock, $5,000.

The Hollister Company, Hollister, Cal.—to furnish water for domestic use, irrigation and power, and to generate electricity for light and heat. Capital stock, $100,000. Promoters: T. S. Hawkins, N. C. Briggs, John T. Lowe, E. A. Crepin, A. S. Jones, Hollister.

The Akron and Cuyahoga Falls Rapid Transit Company has increased its capital stock from $300,000 to $600,000.

The Philadelphia Electric Storage Renting Company, with a capital stock of $300,000, of which $1,000 has been paid in, has filed articles of incorporation with the County Clerk at Camden, N. J.

The Buffalo Traction Company, Buffalo, N. Y.—to construct a street surface railroad sixty-six miles long, in, through and to points in the neighborhood of Buffalo. Capital stock, $3,000,000. Directors: E. G. S. Miller, Joseph B. Mayer, Leonard B. Crocker, Washington Bullard and Herbert P. Bissell, of Buffalo; Tom L. Johnson, of Cleveland, Ohio; Richard Ladenburg, John K. Page and Louis Kahn, of New York.

The Marysville Electric Light and Water Company, Marysville, Mont.—to manufacture and generate electricity and deal in same, etc. Capital stock, $50,000. Promoters: Geo. Berg, Chas. C. Wenstrom, John Edgerton.

The Smith-Vassar Telephone Company, New York City—to make and sell electrical devices, etc. Capital stock, $1,000,000. Promoters: W. L. Beardsley, F. T. Winston, J. T. Darling, A. N. Hand, New York City.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

NOVEMBER, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	3.30 A. M.	1	5.30 A. M.
2	No light.	2	No light.
3	"	3	"
4	"	4	"
5	5.20 P. M.	5	7.40 P. M.
6	5.20 "	6	8.40 "
7	5.20 "	7	9.50 "
8	5.20 "	8	11.10 "
9	5.20 "	10	12.20 A. M.
10	5.20 "	11	1.00 "
11	5.20 "	12	1.30 "
12	5.10 "	13	2.50 "
13	5.10 "	14	4.00 "
14	5.10 "	15	5.20 "
15	5.10 "	16	6.00 "
16	5.10 "	17	6.00 "
17	5.10 "	18	6.00 "
18	5.10 "	19	6.00 "
19	5.10 "	20	6.00 "
20	5.10 "	21	6.00 "
21	7.30 "	22	6.10 "
22	9.00 "	23	6.10 "
23	10.20 "	24	6.10 "
24	11.00 "	25	6.10 "
25	11.20 "	26	6.10 "
26	...... "	..	....
27	12.20 A.M.	27	6.10 "
28	1.20 "	28	6.10 "
29	2.20 "	29	6.10 "
30	3.20 "	30	6.10 "

Card's Improved Fuse Box for Street Railways.

In street railway service the fuse box is a necessary part of each car equipment and should receive the careful attention of every street railway company. The success of any system depends largely on the completeness of minor parts and the readiness with which they perform their share of the work.

The accompanying cuts show Card's Improved Fuse Box for street railways, manufactured by the Card Electric Company, Mansfield, O. Fig. 1 shows the slate box without metal case and is well adapted for use on cars when placed under the seat or in some other protected place. It is made up with a slate bottom and sides and has brass binding blocks at each end for securing the connecting wires. At one end is a small spool, on which is wound a length of the fuse wire selected. The wire passes from the spool under a clamping piece on the binding block, through a slot in the slate partition and under another clamp on the opposite binding block, completing the circuit. Fig. 2 shows the slate box in a metal case, for use on the outside of cars. The lid closes tightly and the box has a projection along the top, making it water and snow proof. A folded piece of asbestos slips inside the box along the sides, over the fuse, insulating the lid. Fig. 3 shows the box with the front open, exposing the fuse. The spring on the outside of the lid acts to hold it either closed or open.

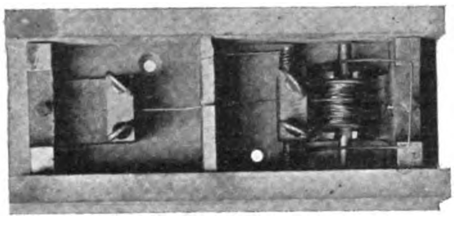

FIG. 1.

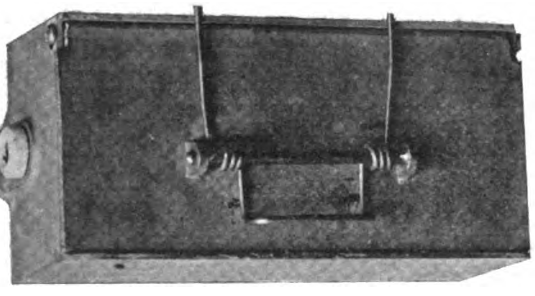

FIG. 2.

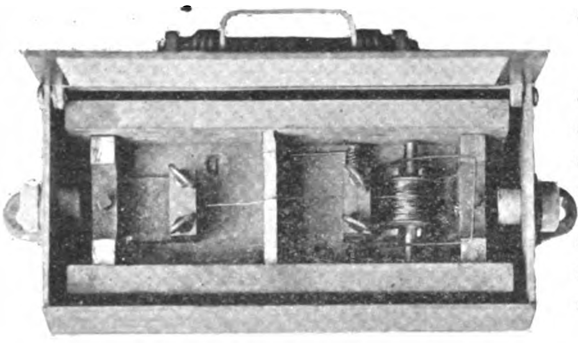

FIG. 3.

When a fuse blows, all that is necessary to do is loosen the thumb screws, pull through more wire and clamp it down. No hunting for wire never found and no time lost. Each spool will hold 35 feet of No. 21 copper wire, enough for 100 50-ampere fuses. When the wire is used up the empty spool can be taken out and a full one put in without loss of time.

As the proper size of wire to use depends largely on the grades, service and the motors, it should be determined by the superintendent and then adhered to. This method will save burn-outs, time and money. It is not safe to permit motormen or conductors to select their own fuse wire, since the temptation is great to put in a large one and save themselves the trouble of frequent renewals.

The value of this improved fuse box can be better appreciated by street railway managers by ordering one from the Card Company for trial. The price complete is very low.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCTOBER 29, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

548,704. Trolley-Wheel. Ferdinand J. Feldt, Peoria, Ill., assignor of one-half to Arthur Hoklas, same place. Filed April 20, 1895.

548,786. Underground Electric Railway. Henry B. Nichols and Frederick H. Lincoln, Philadelphia, Pa. Filed March 11, 1895.

548,976. Closed-Conduit Electric Railway. Michael F. Flynn, Stamford, Conn. Filed Nov. 27, 1894.

548,997. Electric-Motor-Car Trolley. James M. Kennedy, Hollidaysburg, Pa., assignor of three-fourths to Thomas F. Johnston, same place, and William F. Gable and Galen Hemperly, Altoona, Pa. Filed May 31, 1895.

549,091. Trolley for Electric Railways. Jacob Hess, Scranton, Pa. Filed May 13, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

548,682. Electric-Arc Lamp. Malone Wheless, Washington, D. C. Filed May 2, 1895.

548,683. Electric-Arc Lamp. Malone Wheless, Washington, D. C. Filed June 8, 1895.

548,899. Adjustable Incandescent-Lamp Holder. Edward Wade, Lawrence, Mass. Filed April 1, 1895.

549,074. Electric-Arc Lamp. Regina Niewerth and Hermann Niewerth, Berlin, Germany, assignors to Niewerth & Co., same place. Filed April 25, 1895.

549,075. Electric-Arc Lamp. Regina Niewerth and Hermann Niewerth, Berlin, Germany, assignors to Niewerth & Co., same place. Filed April 30, 1895.

549,083. Electric-Arc Lamp. Malone Wheless, Washington, D. C., assignor to Edward W. Creecy. Filed March 6, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

548,684. Dynamo-Electric Machine. Norman Whichello, Chicago, Ill. Filed July 18, 1895.

548,709. Polyphase Alternating-Current Motor. Fred S. Hunting, Fort Wayne, Ind. Filed March 14, 1893.

548,789. Distribution System for Alternating Currents. Alva L. Searles, Brooklyn, N. Y. Filed April 18, 1895.

548,829. Device for Regulating Current Admitted to Electric Motors. Frank E. Herdman, Winnetka, Ill. Filed March 22, 1895.

548,830. Automatically Controlling Electric Motors. Frank E. Herdman, Winnetka, Ill. Filed June 29, 1895.

548,930. Turbine Electric Generator. Charles E. Sargent, Chicago, Ill. Filed Sept. 19, 1894.

549,061. Indirect Control of Motors. Gano S. Dunn, New York, N. Y., assignor to the Crocker-Wheeler Electric Company, of New Jersey. Filed Aug. 12, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

548,623. Sound-Record and Method of Making Same. Emile Berliner, Washington, D. C. Filed March 18, 1893.

548,729. Telautograph. George S. Tiffany, Highland Park, Ill., assignor to the Gray National Telautograph Company, Richmond, Va. Filed March 16, 1894. Renewed April 23, 1895.

548,748. Microphone. Lars M. Ericsson, Stockholm, Sweden. Filed July 6, 1895.

548,897. Telephone-Switch. John E. Thomas, Cleveland Ohio, assignor to the Union Electric Company, same place. Filed April 17, 1895.

548,969. Telegraph-Instrument. Orville A. Dickinson, Arverne, N. Y. Filed July 13, 1895.

549,053. Telegraph-Pole. Albert A. Blow, Denver, Colo Filed Jan. 26, 1895.

BATTERIES.

548,730. Dry Battery. John T. Todd, Tuscola, Ill. Filed Feb. 6, 1895.

549,023. Secondary-Battery Plate and Method of Preparing It. John J. Rooney, Brooklyn, N. Y. Filed Apr. 1, 1895.

549,079. Secondary-Battery Grid and Plate and Method of Preparing Grids. John J. Rooney, Brooklyn, N. Y. Filed July 22, 1895.

MISCELLANEOUS.

548,669. Insulator-Pin. Charles W. Stephens, Camden, N. J. Filed Feb. 9, 1895.

548,700. Electrical Recording Apparatus. Albert C. Crehore, Hanover, N. H. Filed April 8, 1895.

548,701. Indicator for Electric Currents. Albert C. Crehore, Hanover, N. H. Filed May 25, 1895.

548,743. Non-Conducting Covering and Process of Constructing Same. Philip Carey, Cincinnati, Ohio. Filed March 1, 1894.

548,744. Electric Switch. John C. Cassidy, East Orange, N. J. Filed July 19, 1895.

548,755. Electric Meter. Ralph O. Hood, Danvers, Mass. Filed March 9, 1895.

548,777. Electrode for Applying Electric Currents. Edwin F. Davis, West Caton, assignor of one-half to Quincy W. Wellington, Corning, N. Y. Filed June 10, 1895.

548,819. Electric Switch. Hiram Ross, Providence, R. I. Filed July 17, 1895.

548,867. Rheostat Element. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 28, 1894.

548,904. Automatic Time Cut-Out. Francis B. Badt, Chicago, Ill. Filed Sept. 24, 1894.

548,924. Electric Train-Signal. Myron W. Parrish, Detroit, Mich., assignor of three-tenths to Stephen K. Stanton, J. H. Carstens, and Frederick T. Sibley, same place. Filed Dec. 24, 1894.

548,949. Safety and Limit Switch for Electric Motors. Geo. F. Card, Mansfield, Ohio. Filed Aug. 21, 1895.

548,952. Electric Brake. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed June 29, 1894.

548,968. Automatic Circuit-Breaker Alarm. John H. Devine, Johnstown, Pa. Filed Nov. 13, 1894.

ELECTRICITY.

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EDITORIAL NOTES.

Promoters or Pirates? At the first annual meeting of the Ohio Electric Light Association there was considerable informal discussion of one of the evil features of the policy which has been practised by some of the leading electrical manufacturing companies since the early eighties. The following resolutions passed:

> Whereas, Certain manufacturers of electrical apparatus have in the past, and are at this time, attempting to secure franchises for the installation of electric lighting plants in certain cities of this State; and
>
> Whereas, These franchises are not sought for the purpose of making a legitimate investment, inasmuch as the demand for electric service in these towns is not sufficient to support an additional company, but is rather for the purpose of compelling the existing companies to become customers of these manufacturing companies;
>
> Resolved, That this association now puts itself on record as condemning such business methods as being neither more nor less than blackmail, and that such methods justify the association in requesting each of its members to refuse to purchase of such companies any apparatus whatsoever if they thus continue their piratical attacks upon the invested capital which this association represents.

ELECTRICITY has been perhaps the only paper in the field with courage enough to handle the manufacturers who have been guilty of this species of blackmail without gloves. Its application has been the direct cause of an endless amount of trouble, of the loss of large amounts of honestly invested capital, the enrichment of a few of the pirates and the discrediting of this class of investments.

The Ohio association has done well to face the problem so early in its life, and we trust the National Electric Light Association at the next annual meeting may take even a more radical position. It should have done so long ago.

The kind of business morality which has been exemplified in the application of this method of blackmail is well illustrated by the following, which appeared in ELECTRICITY of January 2:

At the time of the G. E. consolidation the Denver Consolidated Company was buying everything from the G. E. Company, its purchases amounting to several thousand dollars monthly. The company was prosperous and had declined several overtures to mix itself up in financial deals with the Eastern people. Soon after coming to New York, Mr. Coffin called one of his agents into his private office and said to him:

> "You are pretty well acquainted at Denver, and we want some special work done there. You remember a few years ago we decided to start a small opposition company there, and they finally bought us out. We made a handsome profit. Now the Denver Consolidated Company has a capital of $1,000,000 and we must have some of it; it is good stock and pays 10 per cent. annually. We think you ought to go to your friends there and organize a new company. The Consolidated people would probably prefer not to be hostile to us and might give us about $250,000 of that stock. You see, I know all of Mr. Rawlins's (president of the Denver Company) financial friends in the East, and might have some influence on them in future deals of his if he chose to be unreasonable. Now, you go out to Denver and scorch them at that end and I will burn them up at this end."

* * *

Why Not Standard Prices? The complaint is commonly heard that there exists no standard of prices or discounts for the staple articles of the electrical supply trade. The complaint is well founded, as every well-posted buyer and dealer knows. Just why the electrical supply trade has been so long conducted upon the principle of "business at any price" is not susceptible of explanation, but certain it is that the continuance of variable and various prices and discounts has not added to the volume of trade; it has not increased profits, nor has it tended to inspire mutual confidence between buyer and seller.

The electrical supply business is no longer an "infant industry." It is no longer in the hands of people who know comparatively little about it—differing in this respect from a period in its history which is not so remote as to have been entirely forgotten. Nearly or quite all of the goods which now go to make up the stock of a well-equipped establishment have practically become standardized. A 3-inch bell, made by reliable manufacturers, is much the same everywhere. So also are insulated wires, battery cells, lamp sockets and a hundred other articles constantly required by electrical contractors; but the prices differ as widely as do the temperaments of the individual dealers. A may sell a 3-inch bell for 30 cents, B for 28 and D for 27. D may sell other articles at higher prices than A or B, and B may have some goods for which he may ask higher prices than A. And so on ad infinitum.

There is just as much need for standard prices and standard discounts in the electrical supply trade as there is in the hardware or any other established trade. A building contractor knows to a certainty that he can buy nails as cheaply from Jones & Company as he can from Smith & Company, but an electrical contractor is confronted with a multiplicity of prices and discounts on all the various articles he needs to complete a contract. Being the largest buyers, contractors naturally feel the need of standard prices the most. Oftentimes it happens that a contractor is perplexed to know why his bid on a contract exceeds that of a competitor. He has secured from his supply dealer what he believes, or has reason to believe, are the lowest prices. He has figured on the usual per cent of profit. His competitor, paying the same for labor. figures the same way and obtains the contract because he had secured lower prices on perhaps one class of goods used in the work. It is not in this particular that the contractors have suffered the most. It has been, and still is, the practice of some dealers to sell goods in dozen lots to amateur electricians and small contractors at almost as low prices as they do to the buyers of hundred or thousand lots.

Happily this rule of business is becoming obsolete, but there are many of the reputable contracting houses in the smaller cities and larger towns which have suffered the loss of much trade on account of it. More than that, the whole electrical industry has suffered. An amateur with perhaps a $25.00 stock of goods, and who estimates his profit on a contract upon the basis of obtaining fair wages for the time occupied with the work, has always been able to underbid all competitors, unless they are of his own class. In all such cases the customer sooner or later discovers that he has secured just what he paid for, and no more. He finds that cheap electrical apparatus, installed by a cheap contractor, operates for a time, then does not. He becomes disgusted with the much vaunted superiority and reliability of electrical appliances and throws out the bargain-counter material. A neighbor hears of it and postpones, if not abandons, the purchase of a contemplated installation. As a consequence the dealer and contractor both lose, but the responsibility rests with the dealer who sells to large and small buyers at the same price.

The supply dealers have long felt the need of an agreement as to prices and discounts, but no systematic effort has ever been made to bring it about. The movement inaugurated in Philadelphia some time ago, looking to the formation of a local association, may, and it is hoped it will, lead to good results.

The leading dealers in New York have already had several informal meetings at which the question has been discussed. Thus far no definite action has been taken in either city, but the indications are favorable to a mutual understanding and agreement upon the all-important matter of prices, and possibly the organization of associations on the lines of those of kindred commercial bodies. The sooner it is brought about the better it will be for the whole industry.

* * *

John Jacob Astor and The Spiro-Vortex.

Mrs. Bloomfield Moore, scientist, physicist, Keelyist, magazine writer and pamphleteer, is reported to have sold to John Jacob Astor all her right, title and interest in the Keely motor, the Keely Motor Company and the inventions of John W. Keely, whose alleged discoveries in physics now threaten, it is said, to more nearly eclipse the achievements of electricity than ever before. Mr. Astor neither affirms nor denies the truthfulness of the report. It is well known that he is interested in scientific pursuits, and it is also known that he was but recently a visitor to Keely's laboratory. It was upon the occasion of this visit, no doubt, that Mr. Astor was convinced Keely "has grasped the greatest hidden secret—the power of the will—and now offers the key of the door that leads from the realm of matter to the realm of mind to all who are ready to pursue their researches in the new fields." Probably at the same time it was made plain to him that Keely's "latest discovery—that of the spiro-vortex action of currents of force—is so overwhelming in its simplicity of demonstration that it needs but to be witnessed to convince physicists that vibratory physics will place science on an height never before attained."

Some time ago Keely made the rather frank admission that the force he discovered twenty-two years ago, and the inventions connected with it, are "practically valueless," because he "was unable to harness or control the force for commercial purposes by any of the devices constructed for its use." This does not signify that Keely is either disheartened or dismayed, but merely prefaces his plan "for the organization of an entirely new company, capitalized in such a manner as to enable me to prosecute experiments for the further applications of the new force to my heart's content." Part of the capital of the new company is to be set aside for the cancellation of the "speculative obligations" incurred by Keely when he was "yet groping after light." Another portion is to be used as working capital, and the balance, the inventor modestly announces, he "will retain for my own use."

With the working capital of the new company, the inventor asserts, he will be able "to produce a thoroughly practical commercial engine" for the use of his newly discovered force on all railroads. To the New York *Herald*, which publication divides with the *New Science Review* the honors if not emoluments of press agent for the Keely Motor Company, we are indebted for the following graphic description of the successor of the locomotive and street car motor:

> The most wonderful use to be made of this new force is in the push engine, or machine intended to propel street cars or vehicles of any kind on earth or in water. This is described as being a cylinder, 18 x 8 inches approximately, boxed up in portable form. This box is to be fastened to the front platform of the vehicle, and, without any gearing or wire connection or connection of any kind between the box and the wheels, the energy generated in the box is to turn the wheels and push the vehicle along. Some time next year it is expected that the people will be able to get light, heat and power in their homes and factories at trifling cost.

In such a company, organized for such a purpose, and capitalized after the manner proposed by Keely, John Jacob Astor will be a useful man to have as director. So also would Rothschild, or even Barney Barnato.

The electrical, scientific and commercial worlds await the confirmation of the above rumor with scarcely less interest than they await the appearance of the spiro-vortex "push engine," or the "cylinder, 18 x 8 inches approximately, boxed up in portable form."

Under the Searchlight.

Views and Opinions on Timely Topics.

THE EIGHTH DUKE OF MARLBOROUGH.

Important Services Rendered in Behalf of the Electrical Trades.

The marriage of the ninth Duke of Marlborough to Miss Vanderbilt recalls the services rendered by his father in behalf of various lines of electrical development in England.

When his magnificent ancestral estate of Blenheim had become impoverished, and his banking account seriously depleted, he resolved to visit the United States in quest of knowledge, and incidentally a rich wife too if one could be found. The Duke was successful in every respect and married the millionaire widow, Mrs. Hamersley.

He was particularly impressed with the marvelous achievements of our electrical inventors, and studied closely what was being done in that particular department of our American business life. On his return to England he applied well and usefully the knowledge thus gained.

Before stating just how he availed himself of his American experience and knowledge, it will be well to enumerate a few facts that may be of interest to our readers because of their bearing on electrical development throughout Great Britain.

In 1880 Edison's announcements created a great scare throughout England as well as elsewhere. The gas industry was very prosperous, gas stocks were regarded as among the safest and most profitable of securities. Many members of the English Parliament—both Lords and Commoners—held large blocks of gas stock which were paying good dividends. Edison's startling claims portended ruin, and the "deadly electric fluid" must be switched off or grounded. If it found favor with the English people, down would tumble the values of gas stocks and substantial dividends would become things of the past. Such a condition of things could not be tolerated, and soon every attempt at introducing electric lighting into England on a commercial scale was so harassed and threatened by absurd and unreasonable conditions, so many obstructive enactments became law for the benefit of gas stock holders, that in time the promoters of electrical enterprises became weary of opposition and practically abandoned the business.

Thus matters remained for something like ten years, very little progress being made in the adoption of electricity for either lighting or power purposes. No sooner had the late Duke returned from America than he took his seat in the House of Lords. He had now ample means at his command and a fund of practical knowledge and experience to aid him in wisely investing his newly acquired wealth. He talked about the marvelous achievements of electrical science in the United States, and won the attention of wealthy friends and acquaintances. He set forth the advantages of electrical illumination for London and the provincial towns and cities of England. He became an active promoter of an electric light company. His enthusiasm became contagious. Englishmen were convinced that they were behind the times. As the Board of Trade began to be again and again appealed to for what we in America call franchises or charters, by newly organized companies desirous of going into the electrical business, that exalted and conservative body found that it was imperative that they should grant concessions; and they did, the speedy result being that the gas companies no longer enjoyed monopolies, and such an impetus was thereby given to electrical development that it has even up to the present time lost none of its momentum.

"Honor to whom honor is due" is a trite saying, yet the writer cannot but think that the electrical fraternity in England, as well as many others over there who are interested in the advantages and benefits accruing from the increasing use of electricity, will willingly concede the full meed of praise and credit due the memory of one who, though a blue-blooded English aristocrat, did much in his latter years for the commercial supremacy of his native land.

If the youthful scion of the noble house of Churchill, who is about to return to the magnificent palace of Blenheim, makes as good use of his wife's substantial dowry as did his late father, then we as Americans shall have slight cause for criticism or complaint.

* * *

The Burton Smelting Process.

(From the Pacific Electrician.)

Mr. George D. Burton, who recently astonished the local mining men on this coast by performing some variations of the electrical forge experiments, and who formed a company here, is now in the East organizing corporations right and left.

Like the tin-type man, he will finish your corporation while you wait.

Recently he got his picture published in the *Electrical Engineer*, with an article telling of his wonderful discoveries.

An engineer who looked into Mr. Burton's claims when he was in San Francisco reported to us that he had no patents of any value, and that any attempt to operate his electric forge for smelting on a large scale would be absurd.

* * *

Electric Sand Man Redivivus.

The Elmira *Advertiser* says that a company has been organized which may establish a factory in that place to manufacture a new electric bicycle and carriage lamp which "is a decided novelty," as the following description certainly shows:

"The new lamp is composed of a secret composition which is similar to asbestos, and is pressed out in a hydraulic press with a force of about 200 tons. It is indestructible and cannot break. A small incandescent lamp is placed in the reflector and is connected with two zincs and a small cell battery in the interior of the lamp. The battery is charged with the contents of a small box of sand which is chemically prepared and is dissolved in water. The lamp is then ready for use. No switches or other mechanism is used on the lamp, the light being shut off by simply inverting the lamp, which carries the chemical solution away from the zincs in the battery.

"The lamp has proved a decided success and will burn about four hours continuously without recharging. The light is very strong and white, and small objects are readily distinguished fifty feet ahead the dark. The chemical sand can be obtained at a wholesale rate of about one and one-half cents per box, which makes the cost for operating it nominal."

* * *

The Dead Game Sport.

(From the Pacific Electrician).

The *Electrical Engineer*, under the heading "Engineers as International Yachtsmen," states that Mr. C. J. Field, the electrical engineer, is the owner of the "Ethelwynn," the yacht that won the recent international race for half raters. Mr. Field is also the man who got frightened at the waves and threw up the race, as well as his dinner. He is hardly a person to take very much pride in.

* * *

The Svengali Buncophone Company.

At the last monthly meeting of the Board of Directors of the Svengali Buncophone Company, A. F. Akir, secretary and treasurer, presented the following statement:

Number State companies organized	48
Capital stock of same	$480,000,000
Number State sub-companies organized	480
Capital stock of same	$960,000,000
Number Telephone rights sold	998,789
Number Telephones installed (in exhibition room, general offices)	2

It was voted to increase the stock bonus to local organizers to $250,000 each, and to increase the commission for sale of rights to 90 per cent., to be paid in stock.

The name of Barney Barnato was added to the directorate of the parent company. The secretary was directed to notify this gentleman of his election and to request him to name a good man to sell telephone rights in the Kaffir country.

* * *

THE Nye who was frescoed with stale eggs at Paterson, N. J., a few nights ago, was not the Allen T. Nye of Standard Telephone fame.

* * *

THE letter printed below was referred to in ELECTRICITY last week. The circular mentioned is the one which has become familiar, designed to awaken enthusiasm among "the boys who are in the real pot," and providing for the greasing of Common Councils:

ALBANY, N. Y., Oct. 25, 1895.

EDITOR ELECTRICAL DEP'T N. Y. HERALD,
New York City.

DEAR SIR: To correct statements made by Mr. Clarkson as stated in clipping from *Herald* of Monday last, I send you herewith circular which came direct from the Standard Telephone Company's office on July 27th last. No paper can expose the inside work of this promotion company as well as the *Herald*, and it should be done to prevent innocent parties being placed in false colors to the public. Ask them what telephone patents they own or control. I am told the Phœnix Interior Telephone Company, 131 Liberty street, has made what few instruments the Standard Company have put out. They may be able to give you some information.

Yours truly, W. V. D.

* * *

IT is not true that the Pennsylvania Light, Heat and Power Company has leased the Philadelphia Edison Company or absorbed it. The plan is proposed and awaits action by the stockholders at the next annual meeting. ELECTRICITY'S guess is hereby on record that a majority of the stockholders will refuse to tie up to a shadow.

* * *

THE *Railway Age* exhibits the saving grace of common sense when it says: "But it is well to remember that enthusiastic claims made for new appliances are not always sustained by experience, and that the canal trolley is as yet little more than a theory. After it has been put into practical service under varying conditions over a long line, in place of the 1¼-mile course on which the test was made, there will be a basis for determining the cost of operation and maintenance."

'Twas Ever Thus.

As fast as the Electric Storage Battery Company absorbs one company, four or five others are formed with capital ranging from $1,000,000 to $10,000,000. 'Twas ever thus with Trusts. It is a fair proposition that when a Trust succeeds in making, say 50 per cent. profit, sandbaggers step in and take 30 or 40 per cent. of it, leaving just about the old-fashioned manufacturer's profit. Of course the Electric Storage Battery Company has as yet made no money, but they have sold stock and have a well-filled treasury which answers the same purpose; and there are a great many men in this field who have learned to strike while the iron is hot, or, as it were, to pull the leg before it is broken. By the way, a little of the water has been squeezed out of Electric Storage, which has dropped from 75 to 30 recently. If Philadelphia investors had read ELECTRICITY carefully they could have saved themselves a few millions of dollars. We wonder if it has ever occurred to these people to investigate what the capitalization of $13,500,000 means. It does not represent property, business or achievement. The best definition which we can give is that it represents a possible, though long and vainly sought, discovery.

* * *

IN a recent interview Mr. Charles R. Huntley is quoted as follows:

"I have no doubt whatever that the problem of transmitting the power from Niagara to Buffalo without serious loss will be successfully met. It certainly can be no more difficult to transmit the electrical current in Western New York than in other parts of the world, and it is a matter of general knowledge among electricians that power has been successfully transmitted by electricity in many cases over as great distances as from Niagara here. It is done in Switzerland, in Germany and in several places in the West. The heavy transmission of power for the Telluride mines of Idaho are famous. I believe that the time is not far distant when the manufacturers of Buffalo will use all the Niagara power they can get."

This is what Mr. Huntley says when his hat is full of holes. But what does he really think?

* * *

A GREAT deal of rubbish is floating about in regard to the late Eugene Field. Among other things there has been printed the statement that he spent an inheritance of $70,000 in one year in the city of Paris. Mr. Field never inherited $70,000 and never spent that amount in one year. What he did spend abroad was not spent without judgment either, as any visitor to his home could testify. Money spent for rare books cannot be wasted, and Mr. Field's "When I was Broke in London," written not long after his return, shows pretty clearly the chief subject on his mind at that time.

* * *

MR. DE LANCEY NICOLL, who was District Attorney of New York County when the publisher of ELECTRICITY was indicted for libel on the complaint of Mr. C. A. Coffin, said at a recent dinner party in this city: "The only thing in my career as District Attorney that I regret is that the publisher of ELECTRICITY was indicted during my term. However, I was in Chicago at the time, and when I returned I had the pleasure of telling some of the G. E. officials what I thought of the trick then."

* * *

MR. WALTER K. FREEMAN bobs up in San Francisco with a charge of attempted fraud against the Westinghouse Company's attorney, and it is encouraging to know that Warren P. Freeman denies every charge made. Mr. Walter K. Freeman ought to be squelched. His career of perjury and blackmail, not to mention other crimes, has been too long extended.

* * *

LOUIS C. DIEKMANN, of St. Louis, in a recent interview on the telephone situation, is reported by the St. Louis *Chronicle* to have said: "Don't ask me about this so-called Standard Telephone Company. I think it must be what Ingalls calls the Monroe Doctrine—'a vague sentiment.'"

The Explanation.

(From the Boston News Bureau.)

The General Electric people expect that the company will show for the present fiscal year about 3 per cent. earned upon the common capital shares. The cash on hand is as it has been for some time past about $500,000.

As the company is now doing business upon a cash basis, the only explanation which is given as to why the company's cash does not increase faster is that the expansion of business has required an increased investment in tools, machinery and raw materials.

* * *

THE United Electric Securities Company has made a renewed attack upon Messrs. McDonald and Hart and the Louisiana Electric Light Company, and again asks for a receiver. If persistence is proof of right, the Securities Company ought to win.

* * *

It Is.

(From the Atlanta Journal).

ELECTRICITY is the power of the world.

* * *

"It is not likely that enough power will ever be obtained from Niagara, over and above that which will be taken by nearby consumers, to operate boats along the entire length of the canal. But the charter of the Cataract General Electric Company gives it permission to use the power of any cataract or waterfall."—*New York Press.*

WHEN the power of Niagara is exhausted, the cableway can be supplied from the falls of the Yellowstone or the Zambesi.

* * *

General Electric.

(From the Wall Street News.)

A Boston newspaper says that the greater part of the decline in General Electric this week came on the return of Pennsylvania Railroad officials and New England capitalists from a view of the Westinghouse works in Pittsburg. It is said on the best authority that the negotiations between the General Electric and the Westinghouse for exchange of patent rights, which promised harmony in the electrical field, were broken off in an hour after they were ready for signature. The reason for breaking these negotiations never has been made public, but has been making trouble in the General Electric camp ever since.

* * *

AT the recent election in this State an appropriation of $9,000,000 was authorized for the improvement of the canals, and $4,000,000 will be ready to draw on in 90 days. State Engineer Adams has already prepared elaborate plans, and we fail to see any reference therein to Mr. Hawley's aerial towing scheme.

* * *

And Clean Hands Too.

(Miss Frances Willard, Pres. W. C. T. U.)

Steam and ELECTRICITY, machinery and invention, have put level heads at a premium.

* * *

WE are glad to know that Mr. Charles L. Ackerman, having fully recovered his health, has begun active work in the San Francisco office of the Westinghouse Company. Mr. Ackerman's training on ELECTRICITY fits him to occupy any position with credit to himself and profit to his employer.

Among the technical novelties introduced in Germany the new electric suspension railroad between Leipsic and Halle deserves mention. The system is a recent invention of Eugene Langen of Cologne, and its distinctive feature is the suspension of the cars. The only place where this new system has so far been tested for a short time is on a special line between Cologne and Deutz, a suburb, but there it has been found eminently successful. By the new system the running time between Leipsic and Halle, 22 miles, is to be reduced from 35 minutes, as at present, to 15 or 20 minutes. The Berlin municipal authorities are very anxious to see this new line in operation, as in the event of all the promises made being carried out, it is the intention to build several electric suspension roads for intramural traffic at Berlin.

The Standard Telephone Co.

Its Long "Roll of Honor."

The following list of eminent names is a copy of a document issued by the Standard Telephone Company of New York, for the purpose of inspiring confidence in its scheme for the sale of stock and rights :

THE STANDARD TELEPHONE COMPANY.

BOARD OF DIRECTORS OF PARENT COMPANY.

Capital, $10,000,000.

THURLOW WEED BARNES, Capitalist; President Standard Telephone Company, 253 Broadway, New York.

JOHN A. BRILL, President of J. G. Brill Company, Car Builders, Philadelphia, Pa.

CARL F. BOKER, senior partner Hardware, Steel and Iron House of H. Boker & Co., New York.

JOHN W. CANDLER, Merchant; ex-President Boston Board of Trade; R. R. President; ex-Member Congress, etc., Boston, Mass.

GEORGE CROCKER, Capitalist, San Francisco and New York.

JOHN P. JONES, United States Senator, Nevada.

HENRY MERZ, President Heller-Merz Co., Manufacturers of Colors; President Color Manufacturers and Druggists' Association, etc., New York.

ALLEN T. NYE, General Manager Standard Telephone Company, formerly General Manager Overland Telephone Co., New York.

MANNING C. PALMER, President Syracuse National Bank, Electric Light Co., etc., Syracuse, N. Y.

FELIX RAKEMANN, of the firm of Balch & Rakemann, Boston, Mass.

JOHN E. SEARLES, Secretary and Treasurer of the American Sugar Ref. Co., New York.

CHARLES T. STRAUSS, Charles T. Strauss & Brother, 468 Broadway, New York, and St. Gall, Switzerland.

LOUIS WINDMUELLER, senior partner L. Windmueller & Roelker, prominent member of the Chamber of Commerce, etc., New York.

NEW YORK STANDARD TELEPHONE COMPANY.

BOARD OF DIRECTORS.

JOHN E. SEARLES (President), President R. R. Co.; Director and Treasurer American Sugar Refining Co ; President and Director of many other corporations, manufacturing companies, etc., New York City.

WINTHROP MURRAY TUTTLE, Vice-President, Secretary and Treasurer B. C. P. R. R. Co., and President A. K. W. Co. and various other corporations, New York City.

CHARLES T. ARMSTRONG, Sugar Importer; Ship Owner; Capitalist, New York City.

LOWELL M. PALMER, President Brooklyn Cooperage Co., Manufacturers Barrels for Sugar Trust, Brooklyn, N. Y.

WM. DICK, Capitalist; Director American Sugar Refining Co.; Dick, Meyer & Co., Brooklyn, N. Y.

JOHN DUNN, JR., President Syracuse National Bank; President Dunn Manufacturing Co., Boots and Shoes, Auburn, N. Y., and Syracuse, N. Y.

ALVA W. PALMER, Wholesale Clothing, Syracuse, N. Y.

GUSTAVUS E. STRAUSS, Lace Importer, New York City.

GEORGE HUTCHINS, Standard Oil Company ; Capitalist, New York City.

ANTHONY N. BRADY, Capitalist ; Director Central Trust Co., Municipal Gas Co., Westchester Electric R. R. Co., etc., Albany, N. Y.

HENRY SIEBERT, Capitalist; Director in many corporations, New York City.

GUSTAVUS E. JAHN, President Rice Mills, Molasses Mills, Sugar Importer, etc., New Orleans and New York City.

HENRY D. McCORD, Capitalist; Merchant; Grain and Flour Exporter, etc., New York City.

EASTERN STANDARD TELEPHONE CO.

BOARD OF DIRECTORS.

JOHN W. CANDLER (President), Merchant; ex-President Boston Board of Trade; R. R. President; ex-Congressman, etc., Boston, Mass.

WM. GREEN ROELKER, Attorney; Electric Railway Owner, etc., Providence, R. I.

GEORGE P. WESCOTT, Bank President; President R. R., Portland, Me.

GEORGE W. HUNT, President Bank ; President Sugar Refining Co., Portland, Me.

J. M. W. HALL, Banker; Merchant; ex-Mayor, Cambridge, Mass.

FRANKLIN FAIRBANKS, ex-Governor Vermont; owner Fairbanks Scale Works, St. Johnsbury, Vt.

H. E. WELMAN, President Electric Light Co., and Merchant, Providence, R. I.

R. R. ARMSTRONG, Capitalist; Sugar Importer, New Haven, Conn., and New York.

J. A. STURSBURG, Controller; Buyer of American Sugar Refining Co., New York and Boston.

F. C. HEWITT, Banker; Sugar Importer, etc., New York.

STILLMAN F. KELLY, Sugar Importer; Molasses Manufacturer, etc., Boston, Mass.

JOSEPH B. BARTRAM, Banker; Merchant, New Haven, Conn.

THURLOW WEED BARNES, Capitalist; President parent Standard Telephone Co.; represents other parties on this Board; home, Nantucket and New York.

NEW JERSEY STANDARD TELEPHONE CO.

BOARD OF DIRECTORS.

NATHANIEL TOOKER, Capitalist; President National Sugar Refining Co.; home, New York and Orange, N. J.

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F. D. MOLLINHAUER, President Mollinhauer Sugar Refinery; home, New Jersey and New York.

AUGUST LUEDER, Capitalist; Sugar Importer; home, New York.

ELISHA B. GADDIS, Wholesale Grocer and Capitalist, etc.; home, Newark, N. J.

FRANK A. MAGOWAN, ex-Mayor Trenton, N. J.; Manufacturer, Capitalist, etc.; home, Trenton, N. J.

JAMES A. SILVEY, President Insurance Club of New York; Vice-President German-American Insurance Co.; home, New Jersey and New York.

SAMUEL KLOTZ, Capitalist; Manufacturer, etc.; home, Newark, N. J.

A. Q. GARRETTSON, Attorney; ex-Judge; Capitalist, etc.; home, Jersey City, N. J.

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OTTO THEURKAUF, F. A. Marsily & Co., New York.

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JOHN STOREY JENKS, of Randolph & Jenks, Cotton, Philadelphia.

NICHOLAS LENNIG, President Tacony Chemical Works, Philadelphia.

CRAIGE LIPPINCOTT, President J. B. Lippincott Co., Philadelphia.

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GOTTLIEB HARTWEG, Capitalist; Steamboats; Coal, etc., Cincinnati, Ohio.

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JARED DUNBAR, Attorney; Capitalist; Pittsburg, Cincinnati & St. Louis R. R., Steubenville, Ohio.

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F. G. SMITH, JR., Treasurer F. G. Smith Co., Detroit. Mich.

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J. H. McFARLAN, of J. H. McFarlan & Co., Electrical Manufacturers, Flint, Mich.

GEORGE W. MOORE, General Counsel Standard Telephone Co., Detroit, Mich.

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J. F. R. FOSS, Cashier Nicollet Nat'l Bank, Minneapolis, Minn.

T. B. JANNEY, Wholesale Hardware; Director N. W. Nat'l Bank, Minneapolis, Minn.

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THOMAS B. SCOTT, Director Mer. Nat'l Bank, St. Paul, Minn.

CAVOUR S. LANGDON, Director City Bank ; Messrs. Linton & Co.; Geo. R. Newell & Co., Minneapolis, Minn

MAURICE AUERBACH, President St. Paul Title, Ins & Trust Co.; President Union Bank, St. Paul, Minn.

WILLIAM HAMM, Brewer; Vice-President Commercial Bank, St. Paul, Minn.

CHARLES J. TRYON, Counsel Minnesota Title, Ins & Trust Co., etc., Minneapolis, Minn.

E. W. WINTER, Gen. Manager Chi., St. P., M. & O. R. R.; Director First Nat'l Bank, St. Paul, Minn.

DR. CHAS. A. WHEATON, St. Paul, Minn.

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L. F. JONES (Treasurer), Warren, Jones & Gratz.

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ROBT. S. BROOKINGS, Vice-President Cupples Wooden Ware Co.

JOHN S. CULLEN, President Wiggins Ferry Co., Union Depot Railway.

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GEORGE T CRAM, President Third Nat'l Bank and American Central Insurance Co.

CLAUS VIETHS, Allen & Vieths, Contractors.

EDWARD MALLINCKRODT, President Mallinckrodt Chemical Works.

WM. H. THOMPSON, President The National Bank of Commerce.

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B. B GRAHAM, President The Graham Paper Co.
All of St. Louis, Mo.

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JOHN S. RUNNELLS, " "

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WM. P. KETCHUM, President Lumber Association, Chicago.

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JOHN S. HANNAH, Grain and Elevator Merchant, Chicago, Ill.

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G. H. HIGBEE, Pres. Murray Iron Wks., Burlington, Ia

N. S. MURPHY, Attorney Goodrich Steamship Line, Milwaukee, Wis.

HENRY D. SMITH, President First National Bank, Appleton, Wis.

W. W. TRACY, Vice-President First National Bank, Springfield, Ill.; Tracy, McDonald & Co. Chicago.

JOHN GOODNOW, represents A. T. Nye.

G. G. PABST, Pabst Brewing Co., Milwaukee, Wis

E. H. BOTTUM, Attorney, Milwaukee, Wis.

ALBERT M. DAY, Counselman & Day, Milwaukee, Wis

THE RATING AND BEHAVIOR OF FUSE WIRES.*

BY W. M. STINE, H. E. GAYTES AND C. E. FREEMAN.

The thermal cut-out is still one of the most unreliable of the many devices employed on electric circuits. Its use is universal, but beyond a few practical details the device is but little understood. The blocks in which they are used show some slow improvement, but most of this has been due to the vigilance of insurance boards, and they are still far from perfect. As a source of vexation and uncertainty, the fuse is probably unrivaled.

An analysis of the literature of the subject shows that the theory of the thermal cut-out has been thoroughly investigated. The elements entering into its action have been carefully studied and incorporated into fairly satisfactory equations. Yet all tests and treatments have shown the thermal cut-out to be subject to such variations and modifying influences that but little of practical value can be deduced from analytical investigations. These considerations led the writers to attempt further investigations. The fuse was dealt with as an auxiliary to electrical circuits, and its behavior under such conditions was carefully studied.

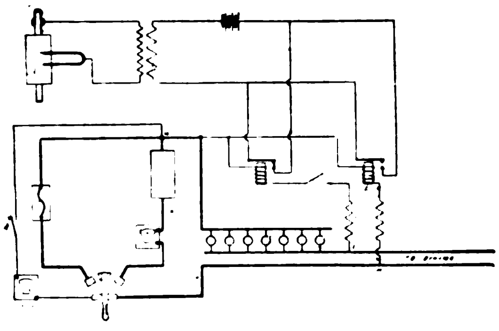

FIG. 1.

Figure 1 is a plan of the main and auxiliary apparatus, with all connections indicated. One of the dynamo leads was brought to the switch S. The carbon rheostat, C R, was built up of carbon plates, whose contact resistance was readily varied by screw pressure. The fuse was tested in a large box lined with asbestos, and open at the top, permitting of inspection and access, while at the same time protecting the fuse from draughts. The lamp rack, P, held 100 16-C. P. 110-volt incandescent lamps. These were connected in groups to switches, which enabled any combination from 1 to 100 to be used. A step-by-step rheostat in multiple with this rack was used to adjust the current through the interval of one lamp. By its use the current could be accurately adjusted within the limits of .4 and 60 amperes. For higher currents several similar racks were placed in multiple: L_1 and L_2 were small "pony" relays of 20 ohms resistance, having in series with each five 16 C. P. 110-volt lamps (R_1 and R_2). These relays worked on a current of about 10 milliamperes each, and were wired to close the circuit through the primary of the induction coil I. Two storage cells furnished the current for these relay circuits. T was an electro-magnetic tuning-fork driven by an independent storage-cell; C an iron chronograph drum which was turned by hand. The secondary or spark circuit of the induction coil was connected to the tuning-fork and the chronograph drum respectively.

The current to which the fuse was subjected during the test was first measured accurately by throwing the switch on contact O, and passing it through the Weston ammeter, A. Both the circuits passing from the jaws O and N of the switch to the point of conjunction Q were short, and of No. 4 A. W. G. wire. It was thought best to take the resistance of the fuse into account, and adjust the resistance of the ammeter circuit to exactly equal that of the fuse circuit. To accomplish this a current smaller than the known fusing current was sent through the fuse, and the fall of potential from S to Q noted on a Weston milli-voltmeter. The current was next switched on the ammeter circuit and the fall over this from S to Q was made exactly that over the fuse circuit by adjusting the compensating carbon rheostat. The fusing current being accurately measured was switched over on the fuse. The fusing time was thus accurately ascertained. The lamp rack being a non-inductive resistance, the time interval for the current to rise to its full value on the fuse is negligible for all but the very shortest periods. The resistance of the bank of incandescent lamps could not materially alter during the quick throw of the switch. To render the point more certain, the time interval between the break and make of the switch was accurately determined chronographically, and found to vary between $\frac{1}{700}$ and $\frac{1}{1500}$ of a second. The fusing times were noted on a stop watch for all periods exceeding one second. For shorter periods the chronograph arrangement was used. The tracings of the electromagnetically driven tuning-fork T were made on smoked paper fastened over the drum C. This fork was always rated before each set of experiments by switching it in circuit with a standard-second clock. Its rate was about 67 double vibrations per second. By frequent timing, all changes in rate due to temperature, etc., were noted and allowed for. The amplitude of the fork was large enough to allow periods of less than $\frac{1}{1500}$ second to be accurately measured. The records on the drum were made by sparks from the induction coil upon the breaking of one of the relay circuits.

The action of the relays was as follows: When the switch was on O, L_1 was closed and L_2 open; when the contact was broken at O, L_1 opened, throwing a spark on the drum, and L_2 closed; the switch making contact at N, L_1 closed and L_2 opened, making the second spark record; when the fuse blew, L_1 opened, causing the third spark record. Though both relays acted synchronously, there was an interval during which the current through coil I was completely broken. Two distinct records were made in every case. The interval between the first and second sparks gave the period of open circuit for the switch, while the interval for the second and third sparks gave the fusing times.

As our experiments were designed to exhibit the behavior and characteristics of the fuse used for protecting electrical circuits, it was considered best to adopt not more than two brands of wire for all the tests, rather than employ a large number of varieties. Other investigations have shown that the various makes of fuse wire closely resemble each other in behavior, and the conclusions obtained with one wire would be general for all. The first make of wire was purchased from supply houses, the second was furnished by manufacturers.

The first series of tests was made under conditions which we shall call commercial, or those which obtain in practice. In all cases the fuse wire was carefully inserted, so as to obtain a uniform pressure of the wire under the screw head without unduly crushing it. The same block was used repeatedly, and little care taken to keep the terminals clean. This was done to more nearly imitate practical conditions. In only two or three cases out of hundreds of fuses blown did the rupture occur at the contact. Two classes of porcelain cut-outs were employed; one was the open porcelain base "Main Line" style, the other the closed porcelain "K. W." variety. In the latter, the 10-ampere size has a space of only ½ inch between its terminals, though the fuse is suspended out of contact with the porcelain base. This style of block has recently been condemned by the underwriters, and very properly. Nearly all types of porcelain fuse-blocks merit severe criticism on several points. The terminals are too close together in small sizes, the fuse often resting on the top or base; and their mechanical construction is very poor. Too little attention seems to be given to the proper function of a fuse-block in its design.

Table I needs but little comment. It clearly shows the unreliability of the porcelain fuse blocks used, and also the imperfect commercial rating of the fuse wire, A. The limit of fusing time was 60 seconds. Fuses larger than five amperes will often blow in from one to three minutes on a current somewhat less than stated, but this correction is so slight for these results that it need not be seriously considered.

TABLE I.

FUSING CURRENTS IN AMPERES—LIMITING TIME ONE MINUTE.

	A ½ ampere.	A 1 ampere..	A 2 ampere..	A 3 ampere..	A 5 ampere..	A 10 ampere.	A 15 ampere.	B 4 ampere..	B 8 ampere..	B 12 ampere.
Covered block, ½ inch......	2.5	5	10	14	20	35	..	13	..	..
Open block, ⅞ inch.........	3	5	9	10	15	25	..	..	..	..
Open block, 1 7-16 inches...	..	..	..	..	..	..	30	..	..	..
Open block, 8 inches, vert..	1.5	3	5	6	9	14	20	..	7.5	10
Open block, 8 inches, hor..	2	4	6	7	11	..	20	..	..	..

In the second series of tests the open 8 inch block was adopted to avoid all cooling effects from the terminals. When used horizontally, the fuse rested on a number of thin asbestos supports let into grooves one inch apart, the fuse being elevated one inch above the base of block. In those tests in which the block was placed vertically hydrostatic pressure lowered the fusing point, but when used horizontally the data may be regarded as the normal fusing points for these various wires.

The data of Table II will be clearly understood from the accompanying legends. One of our objects was to accurately measure the fusing time for abnormal currents. It is characteristic of all electro-thermal devices that they are sluggish in action. Cases may arise in practice where the insulation of wires is forced to become a fuse competing with the metal supposed to protect the circuit. In all such cases it is only a question as to which shall yield the sooner. There is sufficient evidence in this table to explain why a fuse does not always protect an armature from burning out. The table becomes the more significant in this light when it is noticed that the data has been obtained by the use of an abnormally long fuse block. With the commercial block the fusing times were increased many fold.

TABLE II.

FUSING TIMES IN SECONDS.

Ampere.	I.	II.	III.	IV.	V.
15	84	75.8	..	..	..
20	• 36.6	35	..	..	..
25	19	17	60	45	195
30	12.8	10.8	33	26	41.6
35	9	7.6	20	16.4	30
40	7	5.8	15	12.6	25
45	5	4.8	10.4	9	17
50	4	4	9	7.4	13
55	3.6	3	6.6	5.8	..
60	3	2.6	5	5	8
65	2.8	2 2	4	4.6	..
70	2.8	1.8	3.6	3.6	5.4
75	2	1.6	3	3	..
80	1.8	..	..	2.6	4.8
85	..	..	..	2.2	..
90	..	..	..	2	3.6
95	..	..	..	1.8	..
100	..	..	..	1.6	3.2
105	..	..	..	1.4	..
110	..	..	..	1.2	2.8

I.—20 amp. B.	Horizontal 8 in. mica supports each inch.
II.—20 amp. B.	Vertical 8 inches.
III.—20 amp. A.	Horizontal 8 in. asbestos supports each in.
IV.—20 amp. A.	Vertical 8 inches.
V.—25 amp. A.	Vertical 3 inches.

The curve obtained from three-ampere fuses indicates that a fuse is more sensitive in a covered than in an open block.

The blowing of the fuse is not immediately an electrical act. The current fuses the metal, the cross-section is reduced at some point due to gravity, unequal expansion, or "sweating"; the heat in consequence intensifies at this point, and a globule falls, breaking the circuit and establishing an arc, which soon burns out a length of the fuse. This accounts for the sluggish action of such thermal cut-outs. An ideal fuse would be one that would act at approximately a constant time interval for all currents in excess of its normal. It would in this respect closely resemble the action of an electro-magnetic cut-out. Its curve would be a straight line extending from its normal point and slightly approaching the vertical axis for all abnormal currents, being thus identical with the curve of the electro-magnetic cut-outs. In practice the curves of all thermal cut-outs must be more or less modified hyperbolas. The ideal curve could only be attained were it possible to eliminate conduction and radiation losses. This is evidently the line to follow in designing a sensitive fusing block.

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* Abstract of a paper read at the 100th Meeting of the American Institute of Electrical Engineers, New York and Chicago, October 23, 1895.

The smaller diameters of fuse wire approach more nearly the ideal condition. This is of great practical interest in guarding against excessive currents of short duration, such as motors are subject to when operated from street railway and power circuits. In such cases a multiple fuse of four pieces of five-ampere wire would prove from two to three times as sensitive as one piece of twenty-ampere size. Such multiple fuses have been found by the writer to effectually prevent the belt slipping off the pulley of small dynamos under short circuits. The sluggishness of large fuse wires may be due to the cooling of the outer layers which, with the oxide coating, prevent the fuse from breaking. It is evident that this effect would be less in small wires. For this reason a thin ribbon should prove more sensitive than a round wire.

These tests with long lengths of wire reveal some actions which may account for the lowering of the fusing point by use. In the A wires, with a current just below the fusing value, the wires were found to "sweat;" the oxide film broke in places and allowed the molten interior to ooze out. When the current was shut off the globules were drawn in, leaving the wire pitted. With the B fuses the metal was found to be remarkably plastic and free from the oxide film. These fuses sagged badly and twisted, showing a high coefficient of expansion. As a result they were drawn out and the cross-section reduced.

When used vertically the metal flowed until a large globule formed, the rupture occurring just above this. In the case of the german-silver fuses the sweating resulted in partially breaking up the alloy, the zinc seeming to melt out from the nickel and fusing with the copper formed globules of brass. This was so marked that it would render such fuses too uncertain for use in all but the smallest diameters of wire.

The blowing current for 15 seconds of 6.3 amperes in the case of the short fuse in the open porcelain block was raised to 10 amperes. Excepting the higher fusing points, the curve of the long fuse is the same as that for the shorter length. The results obtained by shortening the fuse make it evident that the usual rating of fuse wires in ampere carrying capacity is practically valueless and should be discontinued. The proper designation for such wires would be a table of carrying capacities for the lengths ordinarily employed. The 10-ampere wire fused in 30 seconds at 15 amperes in an eight-inch length; in a length of one-half inch in a covered block at 35 amperes, and in the open block, length seven-eighth inch, at 25 amperes. Accompanying each spool of the B wire was a stated carrying capacity for a given length, but this is not sufficient since it furnishes no guide for other lengths.

Copper fuses have frequently been stated to be more prompt in action than the alloys usually employed. The copper fuses reached red and even white heat in these tests, while the other fuse wires scarcely reached a perceptible glow. This has a practical significance in selecting metals for fuse wires. Metals in general, which can be worked at or near a white heat will prove most sensitive, since a slight increase of heat will make them highly fluid, and rupture will promptly occur. The practice of using copper in street railway circuits for limit fuses seems justifiable. Whether the oxide film of copper fuses would prove progressive in formation is a question which has not been definitely settled. A 3-mil copper wire which fused at 2.2 amperes in 13 seconds was fatigued at a red heat for eight minutes; cooled and tested under the first condition, it fused at 2.2 amperes in 14 seconds.

A great deal has been said about the influence of grease films on lead fuses. This point was also investigated. The grease was removed from the wires by immersion in KOH and NaOH with subsequent washing. In other cases the wire was cleaned by the use of fine sand-paper. The oxide film was also removed by immersion in nitric acid. Measurements showed that this treatment did not sensibly reduce the cross-section. When the oxide film was removed by either mechanical or chemical means it was noticed that a thicker coating formed at once, raising the fusing point. In short, these tests showed that nothing was gained by cleaning the wires, but that the thin film of grease deposited during the drawing of the wire was rather an advantage. The wires were also coated with shellac, but without encouraging results. Some coating, not affected by heat, and which would reduce the radiation, would doubtless increase the stability and sensibility of fuse wires.

We may now summarize some of the practical conclusions deduced :

1. Covered fuses are more sensitive than open ones.

2. Fuse wire should be rated for its carrying capacity for the ordinary lengths employed.

2. (*a*) When fusing a circuit, the distance between the terminals should be considered.

3. On important circuits, fuses should be frequently renewed.

4. The inertia of a fuse for high currents must be considered when protecting special devices.

5. Fuses should be operated under normal conditions to insure certainty of results.

6. Fuses up to five amperes should be at least 1½ inches long, one-half inch to be added for each increment of five amperes capacity.

7. Round fuse wire should not be employed in excess of 30 amperes capacity. For higher currents flat ribbons exceeding four inches in length should be employed.

Breaking a Strike With a Searchlight.

A novel use has been found for the electric searchlight in connection with a strike and riot in Lancashire, England. The manufacturer whose men had struck was determined to keep his mill going, and he promptly secured new hands and set them to work. At the same time he wired to a firm in Manchester to fix a searchlight on a prominent part of the factory building, with the idea of preventing the strikers from maliciously setting fire to the temporary sheds erected for the protection of the new hands. An hour after the receipt of the order the plant was running on the top of the works, and during the continuance of the strike it was used nightly, in conjunction with the police force established in the works, to scour the surrounding country and to illuminate the various parts where pickets were placed. It was found so effective that a large number of temporary police were dispensed with.

Low Temperature and Magnetism.

The experiments made by Prof. Dewar before the British Royal Institution with low temperatures have established some interesting facts. The tensile strength of iron at 400 degrees below zero is just twice what it is at 60 degrees above. It will take a strain of 60 instead of 30 tons to the square inch, and equally curious results have come out as to the elongation of metals under these conditions.

It was an idea of Faraday, says *Cassier's Magazine*, that the magnetism in a permanent magnet would be increased at very low temperatures; and experiments with comparatively low temperatures had rather negatived Faraday's suggestion, but Prof. Dewar has completely verified the opinion of the famous savant, having shown that a magnet at the extremely low temperature made possible by the liquid air had its power increased by about 50 per cent.

NO SEAT, NO FARE, IN EUROPE.*

LONDON.

In London the intramural transportation business is done by about thirty different companies and private individuals, who operate respectively from one to one thousand vehicles. The largest of the London companies in 1894 carried 133,131,902 passengers. London has a graded system of fares, which is a very expensive system for the company. The lowest fare is a halfpenny, or one cent, and is increased according to distance, so that the passenger pays about one cent for each mile of ride. The average fare received by the company referred to during 1894 was three and one-fifth cents, or equal to six rides for twenty cents. Each vehicle requires a driver and conductor, and its capacity is generally limited to twenty-six passengers, fourteen on top and twelve inside. The Commissioner of Police is authorized to make regulations in respect to the route to be taken by each vehicle. No pictures or advertisements are permitted, unless approved by the Police Department, and they must be so placed as not to obstruct ventilation. Before each vehicle is licensed it must be brought to the police station, where it is examined by an Inspector of Public Carriages. If he is satisfied that the vehicle is "fit for public use," he gives the vehicle its number. The license specifies the number of passengers permitted to be carried, and the police regulations provide that an additional person shall not remain when warned by the conductor that the vehicle is full. The conductor is required not to permit such additional person to remain. This additional person and the conductor are each subject to a fine of not exceeding forty shillings in case of violation. Under these conditions, the company last year paid eight per cent. dividend on its stock, and also carried an amount to its surplus account. In London the cab fare for a two wheeled vehicle is one shilling—twenty-five cents—and the charges are the same for one, two or three persons, which makes serious competition for all the street railway companies. The metropolitan police district of London contains considerably over five million people, and every person who rides is furnished with a seat.

BERLIN.

In Berlin the franchise of the principal street railway company expires in 1911. During the life of this franchise the company will pay into the city treasury two times its capital stock. At 1911 all the street construction becomes the property of the city, and the horses, cars, stables, etc., may be purchased by the city at its option. All street repairs are done by the city, at the expense of the company, but, unlike American customs, the repairs are carefully and economically made. The police control the traffic in the streets in every respect. Berlin has a graded system of fares. In 1894, 131,800,000 passengers were carried by this company, for which it received an average of a trifle more than eleven pfennigs, or two and three-quarter cents per passenger, or six rides for seventeen cents. With this rate of fare, sufficient surplus is being accumulated to retire all bonds before 1911 and leave two hundred (200) per cent. for the stockholders. The stock of the company is now quoted at three hundred (300). This street car company is subject to effective competition of an omnibus company. Tickets are not sold in advance, but are given to each passenger as they pay their fare, and the police regulations require the passenger to retain and to produce such ticket on demand of the conductor or inspector. Every passenger is provided with a seat.

A COMPARISON FOR 1894.

London Company seated	133,131,902
Berlin Company seated	131,800,000
West Chicago Company freighted	85,287,302
Chicago City Company freighted	84,794,987
North Chicago Company freighted	49,571,463

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* Report made to the Mayor and City Council of Chicago by C. L. Bonney of the Chicago General Railway.

PARIS.

In Paris the rate of fare is high, inside the vehicle being thirty centimes (which includes a transfer ticket) or six cents. The fare on top, which does not include a transfer, is however three cents. *Special* 'buses also run between the railway stations at a charge of five cents, but are not permitted to take on or let off passengers between the terminals. The competition from the hack service is a very effective one, two or three people being carried for thirty (30) cents.

In St. Petersburg and Moscow the fare is uniform; inside the cars it is two cents and a half, and on top one cent and a half. The competition of the cab service is carried on at the rate of twelve and a half cents for one or two persons.

In Christiania and Stockholm the uniform fare of ten ore—two and a half cents—is charged.

In Vienna the graded fare is from four cents up, according to distance.

In Brussels the graded fare is from two cents up, according to distance.

In all of these cities, and I believe in every other city in Europe, every passenger is provided with a seat, and the regulation is so well understood that it does not produce any disorder or complaint. In fact, the overcrowding practised in American cities would not be tolerated at all.

JOINT USE OF TRACKS.

In pioneer days the American street car privileges were declared to be legal contracts which could not be subsequently altered without consent of the street railway company, but with the progress of civilization the courts have discovered that, although the municipal body may contract or sell the property of which it is proprietor, it cannot either contract or sell the rights held by it as trustee for the whole people. The American street railway privileges are not construed to be exclusive, except when so expressly stated, and even then the rule of construction limits the exclusive rights of the railway company, as much as possible, in favor of the people. The principle that the people own the fee of the streets, and that the municipal body may grant to a new railway company the right to use the tracks of the old company upon paying compensation, has been developed in Ohio and Massachusetts to a praiseworthy extent. The Supreme Court of Illinois now holds that the ordinances of the city council granting street railway privileges are not franchises but mere licenses. In nearly all of the American cities some old railway company has occupied the principal streets with tracks, and in many cases has not operated the same until some new company offered competition, then the agents of the old company would preach to the signers of frontage that as the new-born company was neither big nor rich it should not be allowed to live. If the new ordinance was secured, the new company would be notified that its franchise would be "smashed," and bogus injunctions would then be brought to sink the new-born in a mire of lawyers' fees and court costs, and every struggle of the new-born to exist would be branded as blackmail to force the old company to buy out the new. This condition of affairs naturally led to the new law of Ohio and Massachusetts. The above data indicate that in the European cities competition is fostered and monopoly discouraged, but it is not so in the American cities, except in theory.

GENERAL LAWS, NOT INDIVIDUAL PRIVILEGES.

I have to petition your honorable body that the general ordinances relating to street railway licenses be revised by the City Law Department, and in which it shall be declared to be the public policy of the city not to renew or extend any street railway "contracts" after the original terms of the same shall expire, but that "licenses" may thereafter be issued under the general law by the City Clerk, and subject to such general laws, to any person, firm or corporation who may apply for the same to operate a street car, as is done with hacks and other vehicles used by common carriers; the movement of such cars on the public street to be under the control and regulation of the Superintendent of Police. That a license fee of .... dollars be charged for each car, which license shall be posted in the car for which it is issued, and that one-half of all license fees collected may be used by the Commissioner of Public Works in keeping the tracks now laid, or to be laid, in proper repair. The Police Department should also have authority to require vestibule cars for the protection of smokers and employees.

MUNICIPAL OWNERSHIP.

The proposed general ordinance should distinguish between municipal ownership and municipal regulation; the former should include everything attached to the public highway—track, poles, wires and everything which the Police Department may desire to change or remove at any time. The latter should relate to the movable private property of the street car company, as the same may be engaged in public service on the public street. I do not think the city should attempt to own or operate the vehicles in which the business of the common carrier is conducted. I am informed that such a system is now in operation in Toronto and with great success. In case a new company also desired to use the cable or trolley power of an old company, the running arrangements should be made by the Superintendent of Police, and the old company should receive compensation from the new company on a mileage basis. This complication will not long exist, however, as several independent motors are nearly ready for the market, which will do away with both cable and trolley.

In this general ordinance the construction of tracks can be declared to be a local improvement, which, under our constitution can be constructed like water and sewer mains, by special assessment on the property benefited. If the majority of the owners of the land fronting on the street where said tracks are proposed to be constructed petition for the construction of such tracks, the ordinances for the same may be passed as in other special assessment cases. Such a system would not only encourage competition and discourage monopoly, but would remove the scandal which sometimes attaches to the railroad company when it receives an individual street railway franchise. Such a system would also give double protection to the majority of abutting land owners about whose right to enjoin the old companies of this city are now much worried.

1. Tracks will not be constructed on any street unless the majority ask for it.

2. If the majority ask for the tracks, it is not probable that the old companies would influence the suppression of the improvement, as it and every other company, individual or real estate speculator, would be entitled to run independent cars on such tracks under the general license ordinances above proposed.

In the European cities roads are built for the profits of regular operation, but in the American cities the profits of construction are the first consideration. Watered stocks, windy debentures and mortgage securities are issued to so large an amount that many American companies cannot pay expenses and fixed charges, much less make money, even with a five-cent fare. The company with which I am connected has, for more than two years, carried passengers, under unfavorable circumstances, for six rides for twenty-five cents, or a nominal four-cent fare, and has paid all its operating expenses and fixed charges.

The so-called sale of franchises to the highest bidder should not be established, as in so doing none but the very rich could buy. The principle of paying the cities a gross sum for a "supposed franchise" is also bad, as it perpetuates the idea of a privileged monopoly as against the license theory. Why should not the people themselves, through whose territory the road runs, be entitled to some of the direct benefits, as by a reduction of fare, improved service, or other advantages which would naturally come out of fostered competition?

G. E. EXPLOITING WORK.

OBJECT LESSONS—THE CHARACTER OF ESTABLISHED STATIONS.

Samples of the Facilities Afforded to Local Enterprises.

[The Edison Company, to a small extent, and the T.-H. Company (the organization of which was mainly adopted by your company), to a greater extent, had been in the habit of doing more or less exploiting work, resulting in the acquisition of stocks and bonds of local lighting and railway companies. By the facilities which it had thus been able to afford to local enterprises it was enabled to expand its business.—*G. E. Company's Annual Report, 1894.*]

CHAPTER I.

In a series of articles running through the past three months, ELECTRICITY has been able to show, from the official records, the character of the local enterprises to which Mr. Coffin's agents devoted their attention and the financial results thereof.

This week we lay before our readers proof of a different kind, fully as conclusive and vastly more entertaining than the plain figures which we have printed. This is in the shape of letters from the successive managers of the Austin, Minn., station to the home office, making up a brilliant word picture of the condition of this plant, on which Mr. Coffin and Mr. Byllesby planned to float $100,000 of securities, and various other documents relating to the affairs of the company. This correspondence begins a few months after Mr. Byllesby bought the plant of Pierce Bros., and will be continued down to the time of the Northwest G. E. Co.'s collapse.

During the first few months the Northwest G. E. Co. was successful in floating a good many bonds. Money was plenty, and the local companies received all assistance necessary. Later, as money became scarce, all the local properties established by Mr. Coffin's exploiters went through the same experience. They went from bad to worse, and were sold out at any price offered—with few exceptions. One of the exceptions was the Austin plant, which Mr. Coffin has been unable to sell, and which he still owns.

The correspondence is all worthy of careful perusal. The first few letters are found written on the old stationery of Pierce Bros.

Austin Electric Light and Power Company.
Pierce Brothers, Proprietors.
Austin, Minn., May 14th, 1892.

Mr. W. H. Moore,
405 Sibley St., St. Paul, Minn.

Dear Sir: Some one in Austin is circulating the report that two dollars per light for wiring complete is extortionate, so that four names on the list have declined to let me wire their houses at that rate. One man asked for the privilege of having his house wired by some one else. I told him he could, but that we would not light his house unless the work was satisfactory to us. They have made inquiry as to prices in the neighboring towns and say that work is done for a dollar and a quarter a light. I have argued with them but to no effect. There is a rumor that the city will buy some second-hand arc machinery and run their own lights in connection with the water works. Hoping to hear from you soon in regard to the above information, I am yours truly,

GLOVER F. PERIN, Manager.

C. L. Dering, Coal, 175 Dearborn St.,
Chicago, June 7th, 1892.

Austin Electric Light and Power Company.

Gentlemen: Yours under date of the 4th is received and noted. The regular terms of coal shipments are as stated in our circulars and in our invoices, payments due the 10th of the month following shipments. We are obliged to have our money in approximately at this time, in order to meet our mine pay-roll which is due the 15th of the month.

We will not make sight draft on you, but would request that you conform as closely as possible to our date; sometimes you will find that it gives you more than thirty days and sometimes less.

Yours very truly,
C. L. DERING.

Austin Electric Light and Power Company.
Pierce Bros., Proprietors.
Austin, Minn., June 25th, 1892.

W. H. Moore, Esq.

Dear Sir: Will you send check to B. Farrington, $60, and Fred Rettig, $40, for wages, or should pay here. Their pay is due to-day. It is collection time for June. Shall I deposit in bank to acc't of N. W. T. H. Elec. Co., or will you have account changed to "Austin Elec. Co.?" Must know so I can deposit. Alchon Bros. have two arc lamps. The past two or three months, at least once in each month the lamps have been out on account of broken circuit. They have always paid full bills—but they want some incandescents put in to use only when arcs are out. This is no more than fair. Shall I have them put in? Will send you the first of the week memorandum of items, as requested; could not do so to-day. Please advise me on above points immediately and oblige yours truly,

Wm. M. Howe.

Austin, Minn., July 1st, 1892.

W. H. Moore, Esq.

Dear Sir: Enclosed find freight bill for one car of coal. This should be paid at once. I also enclose you blank check on Austin Nat'l Bank—as I suppose you will wish to draw on this bank. I also suppose the bank will require your signature. Do you want a check book? If so will send you one at once by mail. Yours truly,

Wm. M. Howe.

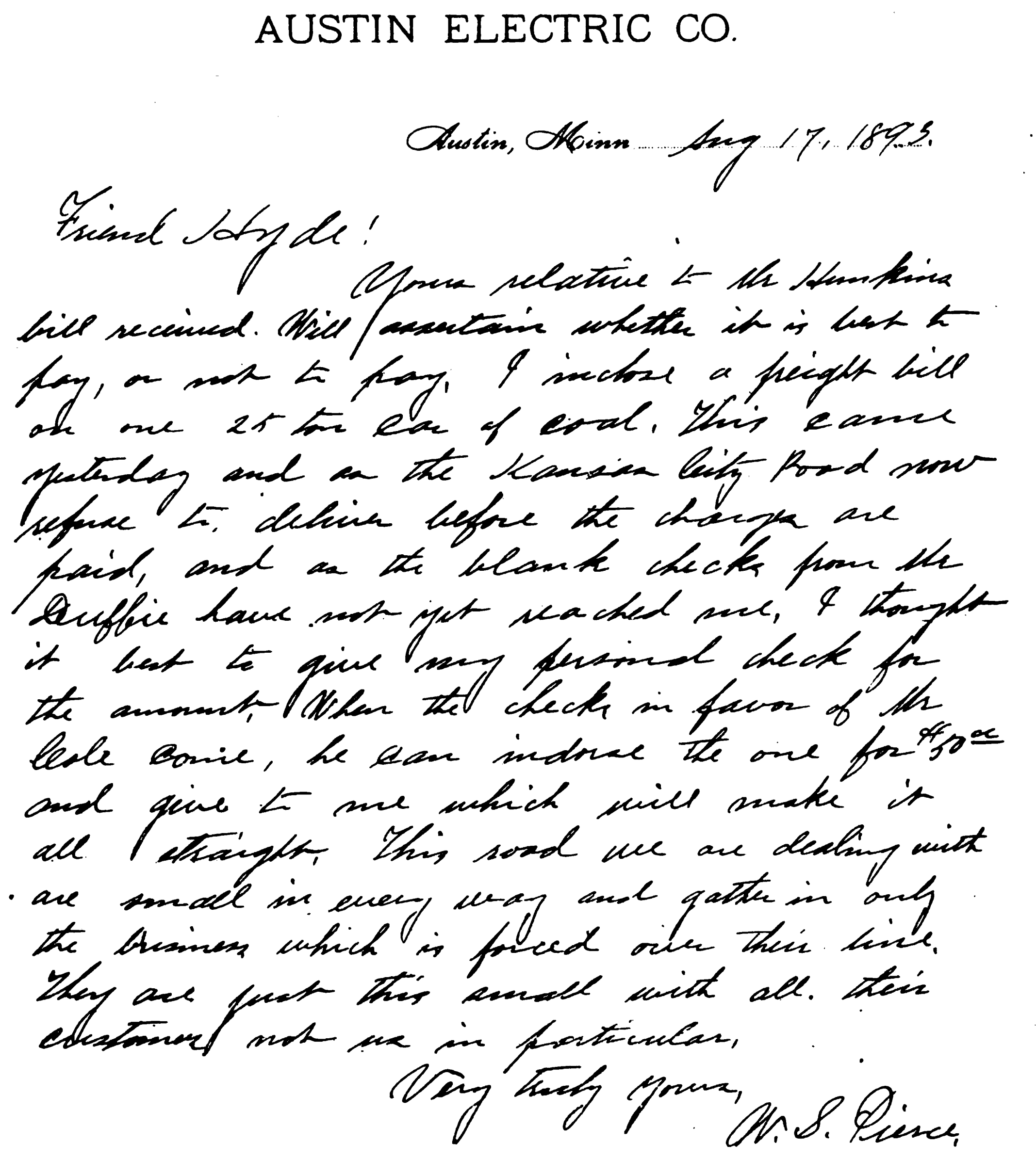
Austin, Minn., July 9th, 1892.

W. H. Moore, Esq.

Dear Sir: I herewith enclose memorandum showing part collections and all expenses as far as I have them to July 1st, 1892. The bills taken by and sent to you are not included as I keep no account of them. When I get through June collections as far as can be will send you memorandum showing amounts received for arcs and incandescents. I also return you voucher for freight on one car of coal and also statement of Robinson & Cary Co., which bill you took to pay from St. Paul, 6—4, 1892. Please send checks for bills sent you, as parties are not very well satisfied to wait. The account in bank has been changed to Austin Electric Company.

Yours truly,

Wm. M. Howe.



AUSTIN ELECTRIC CO.

Austin, Minn Aug 17, 1893.

Friend Hyde!

Yours relative to Mr Hunkins bill received. Will ascertain whether it is best to pay, or not to pay. I inclose a freight bill on one 25 ton car of coal. This came yesterday and as the Kansas City Road now refuse to deliver before the charges are paid, and as the blank checks from Mr Duffie have not yet reached me, I thought it best to give my personal check for the amount. When the checks in favor of Mr Cole come, he can indorse the one for $50.00 and give to me which will make it all straight. This road we are dealing with are small in every way and gather in only the business which is forced over their line. They are just this small with all their customers not us in particular,

Very truly yours,

W. S. Pierce,

Austin Electric Co.,
Austin, Minn., Aug. 30th, 1892.

W. H. Moore, Esq.,
403 Sibley Street., St. Paul, Minn.

Dear Sir: Your letter of the 29th inst. received The following is the pay-roll for August:

G. F. Perin,	$75.00.
B. Farrington,	60.00.
F. Rettig,	40.00.
S. A. Johnson,	35.00.

Yours very truly,

G. F. Perin.

Austin, Minn., Sept. 13th, 1892.

W. H. Moore, Esq.,
403 Sibley St., St. Paul, Minn.

Dear Sir: I received your letter of the 9th inst., also check for Rettig the voucher for which I return by this mail. If you have any idea of putting in a compound engine I should think it advisable to put in two new boilers 100 h. p. each, built to carry 125 lbs. of steam; the Ball engine would be more efficient working under that pressure by cutting off earlier in the stroke. Johnson is back at work. I have put him in the station and he bids fair to be a good man in that capacity; he and Farrington get along very nicely. Neither the poles or the coal have come yet. Will you please write Linges, Conwells & Co., and hurry them up about those fire door arches you ordered. I met Mr. Claussen to-day and assisted him as much as I could. Mr. Robertson came down Monday night and I showed him around.

I have made a canvass of the third ward and got the promise of thirty odd lights.

The station agent of the Milwaukee, Mr. Wenham, said if I would get a written proposition from you to wire 40 lights to run all night on meter basis in R.R. Hotel, station and freight houses he would endorse it and send it in to the proper authority; he expects a close figure on the wiring. I learned from Mr. Glenn, attorney for the man who owns the Missoula Electric Co., that the N. W. Gen. Co. were negotiating for purchase of that plant. I know a good many people in Missoula and would like to go out there if the deal is made. Please keep me in mind when you want to send a man out there.

Yours very truly,

G. F. Perin

Austin Electric Co.,
Austin, Minn., Oct. 4th, 1892.

W. H. Moore, Esq.,
403 Sibley St., St. Paul, Minn.

Dear Sir: Your letter of the 29th inst. received. No dynamo has come here by mistake. Nor have the poles come yet. In answer to Mr. Pratt's note about Johnson's time, the construction work mentioned was on inside wiring, and 21 days were in the capacity of a fireman and lamp trimmer. Enclosed you will find collection list amounting to $475.99, also five duplicate deposit slips, also receipted bills amounting to $1,292. Yours very truly,

G. F. Perin.

Lyman D. Baird, Attorney at Law.
Austin, Minn., Jan. 21st, 1893.

W. H. Moore, Esq.,
403 Sibley St., St. Paul, Minn.

Dear Sir: The old management of Pierce & Howe did not charge me enough at my house or else the new management are charging me too much, for while using less light the bills are double what they were in '91, and this with the same meter.

Matters are ripe here for a general shut-off, but I do not care to lead in any such movement and ask you for an explanation. You know that lights were put into the dwellings here on my recommendation as to the expense, etc., and it now looks as though I had been made a tool of. Resp'y yours,

Lyman D. Baird.

Austin Electric Co.,
Austin, Minn., March 22, 1893.

UNCOLLECTED LIGHTING ACCOUNTS.

Names.	Service.	Month.	Am'nt.	
Colos Fenton........	Incand.	Oct.	$2.30	Dead beat.
S. H. Harrison.......	"	"	2.00	"
J. H. Williams........	"	"	1.00	"
W. H. Butler...	"	"	2.60	O. K.
Hotel Robinson......	"	Nov.	15.00	Dead beat.
Geo. Finn...........	Arc.	"	5.00	"
W. H. Butler....	Incand.	Dec.	3.80	O. K
Benj. Hunkins.......	"	"	75	"
C. M. Allen.	"	Jan'y.	3.20	"
W. H. Butler.........	"	"	4.60	"
Good Templars' Hall.	"	"	5.00	"
N. Y. Life Ins. Co....	"	"	1.00	"
E. G. Bascomb, res...	"	"	3.60	"
Smith & Adler.......	"	"	2.00	"
Benj. Hunkins...	"	Feb.	75	"
Odd Fellows' Hall...	"	"	4.68	"
James D. Sheedy.....	"	"	1.00	"
E. G. Bascomb, res...	"	"	3.00	"
F. A. Engle, res......	"	"	1.00	"
Smith & Adler.......	"	"	1.00	"

Austin, Minn., June 10th, 1893.

Geo. C. Duffie, Esq.,
403 Sibley St., St. Paul, Minn.

Dear Sir: I notified the men that the company would dispense with their services after July 1st They went uptown and asked the merchants to sign a petition to the company to retain them in their employ. Friday afternoon they began to abuse the company and me for not keeping them, and a little before time to start up called for their time, which I gave them, nine days each, $18.00 and $12.00. I ran the station alone Friday night and wired Mr Lehmann to come down. They tried to have me arrested for running without an engineer's certificate, but the boiler inspector declined to do it knowing that I had a certificate. Will you please send two checks to bank for the amount of their pay. Every thing is running smoothly. Hoping my action in matter will meet with your approval, I am yours very truly,

G. F. Perin.

Austin, June 25.

Mr. Duffey.

Dear Sir: I tought I would write you to see what the reason was you did not com down you know you promest me you would be down in a few days. Well I don't think you are running your Plant Mr. Cheaper then you was when I was thair? I see they have a man hired to trim the Lamps and Perin has a man hired to Straiten up his books.

I don't wonder at that the way Perin is drinking every night.

It seemes queer to me that the compney would discharge me without any cause and all ways trid to make the Plant a sucess and keep a man like Perin this has disspointed me teribel had bought Property and was to Pay quartly never thinking that I would bee discharged while I give good sadsfaction and do my work in good shape and take a strange man [illegible] is all for this time hopes to hear from you. Please ancer drect to

Barney Farington.
Austin

Austin Electric Co.
Austin, Minn., July 19, 1893.

Geo. C. Duffie.

Dear Sir: Inclosed please find daily report. We are very *low* on coal, having nothing but slack which will run not more than four nights including this evening. The coal can not be pushed too fast. I'm at work picking up the threads of the business. The situation is bilious, but nevertheless I have the promise of a goodly increase the first of next month. I have secured four old customers, who will go into circuit the first of Aug. I shall eventually get nearly all the old back and some new ones. It will take a little time, so we must not expect a rebound in one week or two. All is running well.

Yours very truly, W. S. PIERCE.

Austin, Minn., July 20, 1893.

C. B. Hyde.

My Dear Sir: Yours of July 20th at hand, and am surprised at its contents. Perin turned the plant over to me Monday, July 17th, and left here as I supposed for St. Paul, Tuesday the 18th. I could not find out from his books how much uncollected money belonged to the company or how much collected money was in his possession. The books were, as he said, not brought down to date, and claimed he would have to take the books with him to St. Paul, because he could not make his final report without, and inasmuch as he was responsible as an employee of the company, he insisted on taking the books to the company. He claimed, however, he would reach St. Paul Tuesday, and if you see fit you could return the books to me at once. It is now evening, and I can't report how much is in the bank. Will see in the morning. I have been at work helping put in a job of lighting to-day, and have been around the town none at all; in fact I did not mistrust anything exceptional and hence was not on guard. Things are in such fearful shape all over the city that I hardly know what to tackle first. Perin took his bank book with the rest of the books. The readings of the meters were on the meter book, and how I can find out what they were without the old book is more than I know unless it be from the old receipts the customers have. If Perin shows up please let me know at once. Very truly yours,

W. S. PIERCE.

Austin, Minn., July 22, 1893.

G. C. Duffie.

Dear Sir: Inclosed please find two freight bills on coal. It is necessary that a draft for this amount be forwarded at once, because any delay in such bills will not be tolerated by the freight agent here. Please ship immediately 2,000 7-16″ plain carbons. We are very low on these, so the shipment must be made promptly. Yours very truly,

W. S. PIERCE.

Austin, Minn., July 24, 1893.

G. C. Duffie.

Dear Sir: Inclosed please find a package of small bills which were here when I took possession. I have no way of telling whether these are correct or not, hence I have not O K'd the same. I believe, however, these bills are due, because Perin claims they are. Perin is here but for what purpose I cannot find out. Please send down the uncollected bills and I will try and get them collected up. Everything running well. Shall take on more lights the first of the month. Yours truly,

W. S. PIERCE.

STATEMENT.

THE ANSONIA ELECTRIC CO.

(Formerly the Electrical Supply Co.)

RANDOLPH STREET AND MICHIGAN AVENUE.

Folio 2327. *CHICAGO, July 31, 1893.*

Acc't of Austin El. Co.,
" Minn.

Subject to sight draft without notice if not paid when due.

June | *13* | .... | | | *$20* | *00*

Draw on you to-day for above.

. Birum & Birum, Dealers in General Hardware, &c.
Austin, Minn., July 31, 1893.

Mr. George C. Duffy,
St. Paul, Minn.

Dear Sir: Enclosed find bill for $13.05 which we have on our books due us from the Austin Electric Lt. Company. Please send draft for this and oblige.

Yours truly,
BIRUM & BIRUM.

Austin Electric Co.
Austin, Minn., August 9. 1893.

Mr. George C. Duffie.

Dear Sir: When I took hold here I supposed the dynamos were in good condition, but by close inspection I find one of the alternators has been badly injured. The Perin crew overheated the armature and then tried to repair the same, yet their efforts were not successful. The armature will necessarily have to go to the repair shop. There is no hurry however, and I speak of this now so it will be understood that we have not injured the machine, or even run it at all. Yours truly,

W. S. PIERCE.

Extract from local paper, August 8, 1893.

Last night owing to an accident at the power house all the electric lights went out. It was pretty dark and late pedestrians were left to feel their way home. When the new engine is ready for business this kind of a mishap cannot take place.

Austin, Minn., August 9, 1893.

Geo. C. Duffie: Yours of Aug. 7th at hand. Will see you the next time I am in the city, say about September 5th, and then talk the situation over.

If these times continue much longer, people here will have no use for any light, and will simply go back into old night. Have taken about $50 worth of new business. Things are in much worse shape than has ever been told. Tell Mr. Hyde the voucher for oil at 9 cents per gallon was kerosene, and I enclose one to-day for the machine oil. The motors which were shipped and billed here I can not find in the city. The last seen of them was in the Masonic Hall just before Perin left, and it is supposed he took them with him. I will make further search as soon as possible, yet I think they are not here now. Can we exchange some meters for sockets, lamps and transformers? If so I will ship up a train load.

Very truly yours
W. S. PIERCE.

Austin, Minn., August 11, 1893.

C. R. Hyde.

Dear Sir: Inclosed please find deposit check for $12.70 which is for the goods attached by us to secure a lighting claim of $17.70. These goods have been sold and after paying costs there remains the $12.70 which I have placed on deposit. This affair took place before I came here. I have ordered the sight draft returned. Those motors I can not find in the whole town. Very truly yours,

W. S. PIERCE.

Austin, Minn., August 13.

C. R. Hyde.

Dear Sir: Enclosed please find a bill handed me by H. Hunkins for labor contracted by Mr. Perin. I have investigated this matter and find the actual work has been done and the fellow has not been paid. If there is a shortage of money here, so we can not reasonably check this month, you can date the check ahead to September 2d, so I can get in another collection, or I will pay the bill myself if you so desire.

Yours truly,
W. S. PIERCE.

1670.

The First National Bank.

O. W. SHAW, President.
N. F. BANFIELD, Cashier.
H. L. BANFIELD, Ass't Cashier.

Austin, Minn., Aug 9, 1893.

Austin Electric Light Co.,
Austin, Minn.

Gentlemen:-

The Ansonia Electric Co. has drawn on you for $20 and exchange. Kindly give this your attention and oblige

Yours truly,
N. F. BANFIELD, Cashier.

MEM.—This must receive prompt attention.
W. S. PIERCE.

Austin Electric Company.
Austin, Minn.. Aug. 9th, 1893.

C. R. Hyde.

Dear Sir: I found a 15 light transformer out on the lines not in use which I took down and put up in the place where I have just finished a small job of 5 lights; so there is no hurry at present. I send you with to-day's report a list of small accounts not collected when I made out the monthly report; this ought to be added to the July collection. There are only two uncollected bills for July at this time, each $1.00, making only $2.00 outstanding, except two or three on the delinquent list sent here by you. As the meters were read by Perin the 8th of July, it cuts down the receipts for July. Next report we will make a better showing. There is a sight draft here in favor of the Ansonia Electric Company, amount $20.00. Please send check at once and oblige

Yours very truly,
W. S. PIERCE.

Free Lectures on Electricity.

Prof. A. L. Arey of the Free Academy of Rochester, N. Y., will give free evening lectures to a class of electricians during the winter months.

The McKeesport Case.

The Long-Delayed Decision Handed Down.

The United States Supreme Court has decided the case of the Consolidated Electric Light Company against the McKeesport Light Company in favor of the defendants. The Court holds the Sawyer-Man patent invalid. The decision was handed down by Judge Brown.

The patent in suit is United States Patent No. 317,676, dated May 12, 1883, granted upon the application of Wm. E. Sawyer and Albon Man to their assignee, the Electro Dynamic Light Company, for an improvement in electric lamps, and assigned to the Consolidated Company.

The bill was filed December 8, 1887, and is in the usual form, setting forth the granting of a patent and its assignment to the complainant, and alleging infringement by the defendant. The defendant answered the bill, setting up the usual defences, and, in addition, certain special defences which will be considered fully further on. Issue was joined; proofs were taken by both parties, and the case was held at final hearing on the pleadings and proofs by Mr. Justice Bradley and Judge McKennan, and an opinion was filed on October 5, 1889, holding the patent in suit to be invalid and directing the bill to be dismissed. A final decree was entered in accordance with the opinion on October 10, 1890, and from this decree the complainant appealed to the Supreme Court.

The questions involved on the appeal relate to the validity of the Sawyer and Man patent in suit, the proper constructions of the claims of the patent and infringement by the defendant.

The errors relied upon by the appellant were as follows:

1, The Court below erred in giving too broad a construction to the claims of the patent in suit; 2, in holding that the claims of the patent in suit were void for lack of novelty; 3, in not following the adjudication of the Patent Office on the issue of priority of invention between Sawyer and Man and Edison with respect to the invention in suit; 4, in holding the evidence that Sawyer and Man made the invention in suit prior to Edison to be insufficient; 5, in holding that the invention covered by the claims in suit was not patentable; 6, in holding that the claims of the patent in suit were for a different invention from what was described in the original application for the patent, and that the amendments to the original applications which were made in the Patent Office were not justifiable; 7, in not holding the patent in suit to be valid and to have been infringed by the defendant, and in not granting a decree for an injunction and an accounting as prayed in the bill.

This is a negative victory for the Edison interests, though an important one for them, in that they are saved from paying several hundred thousand dollars for past damages for infringement.

As to the future the decision has no interest for any one; the incandescent lamp field is now free forever.

American Institute of Electrical Engineers.

The 101st meeting of the American Institute of Electrical Engineers, to be held on November 20th, will be devoted to a discussion of the "Storage Battery Outlook." All members having information to impart, bearing upon this subject, are invited to contribute toward a better understanding of the possibilities of the accumulator.

The Henry Electrical Club.

At the weekly meeting, on the 8th inst., of the Henry Electrical Club, at the rooms of the American Institute, New York City, Mr. Joseph Sachs gave an illustrated lecture on "Systems of Dynamo Regulation."

Removal.

Coleman Sellers, E. D., consulting engineer, and Horace W. Sellers, architect and engineer, have removed to rooms 537–539 Philadelphia Bourse.

LEGAL NOTES.

Abraded Insulation is Negligence.

Justice Lathrop of the Supreme Judicial Court of Massachusetts has just rendered an opinion which cannot fail to be of interest to electric lighting men. A tinsmith named Griffin, while engaged in placing an iron conductor on a building in Springfield, Mass., came in contact with a live wire the insulation of which had become abraded. He sustained a severe shock and instituted suit for damages against the owners of the wire, the United Electric Light Company of Springfield. In the lower court the verdict was for the defendant. When the case was appealed, Justice Lathrop reversed the finding of the lower court. In his opinion he said:

"The plaintiff was not a trespasser or a mere licensee, who must take the premises of another as he finds them. He was rightfully on the premises for purposes of business. On these premises the defendant had rightly placed two electric wires. These were a source of danger unless properly insulated. This fact was recognized by the defendant by insulating them. But it was negligent if it failed to use reasonable diligence in seeing that its wires were kept in a state of repair. This duty it owed at least to every person who, for purposes of business, was rightfully upon the premises."

An action was begun at St. Paul, Minn., on the 1st inst., by Thomas Wallace, Jr., against the Carpenter Electric Heating and Manufacturing Company and the American Electric Heating Corporation to recover from the second named defendant $5,587 under the law relating to the liability of stockholders. The plaintiff claims to have just secured a judgment for the amount named against the first named defendant, but that an execution was returned unsatisfied, and the American Corporation holding $250,000 of the $400,000 stock of the Carpenter Company, he demands judgment against the former.

Judge Lawrence, of the New York Supreme Court has dissolved the Electrical and Mechanical Engineering Company, of No. 41 Cortlandt street, and made the temporary receiver, Jonathan H. Vail, permanent receiver.

Joseph Donaldson, manufacturer of gas and electric fixtures at No. 74 East Ninth street, New York, has made an assignment. Liabilities, $23,672; nominal assets, $28,022; actual assets, $7,157.

Personal.

J. G. Ihmsen, manager of the Keystone Telephone Company, Pittsburg, was a New York visitor last week.

W. H. Webb, the Solar Carbon missionary, was distributing tracts and gathering in orders on Manhattan Island last week.

European Agency for Walker Company.

An agreement has been entered into between the Walker Manufacturing Company of Cleveland and F. De La Briere and C. La Blanc, representing a group of capitalists of Paris, whereby the apparatus of the Walker Company is to be extensively introduced into Europe.

GENERAL NEWS.

What is Going On in the Electrical World.

Little Valley, N. Y.—It is proposed to bond the town for $7,000 for municipal electric lights.

Heyworth, Ill.—J. L. Humphreys' grain elevator and electric light plant were recently destroyed by fire.

Catawissa, Pa.—By a vote of 307 to 59 the citizens of this borough have voted in favor of a municipal electric light plant.

Uhrichsville, O.—The franchise for an electric line between Uhrichsville and New Philadelphia has been given to C. E. Michener.

Alexandria, Can.—The town council has entered into a contract with Ahearn & Soper, of Ottawa, to furnish electric lights for the streets.

Bessemer, Ala.—It is probable that the Electric Light Company will get control of the street railway and change it to an electric line.

Burlington, Vt.—The mayor's veto of the franchise granted to the Columbian United Electric Company has been sustained by the Board of Aldermen.

Montesano, Wash.—The city council has passed an ordinance granting to Albert Daub a 15-year franchise for operating an electric light plant.

Valatie, N. Y.—The trustees have entered into an agreement with Robert P. Richmond to light the streets of this village with sixty 25 C. P. electric lights.

Unionville, Mo.—A committee of citizens has been appointed to confer with the city council on a proposed issue of bonds for water works and electric lights.

Toluca, Mex.—It is proposed to introduce electric lighting in Toluca, capital of the State of Mexico, employing power generators at neighboring water falls.

Ontonagon, Mich.—At a special election held for the purpose the citizens voted to bond the village for $12,000 for the purpose of putting in an electric light system.

Los Angeles, Cal.—The council has passed the final ordinance granting to the Los Angeles Traction Company a franchise for an electric railway in Eighth street.

Lafayette, La.—Proposals are wanted until November 20 for surveys, maps and estimates for waterworks and electric light plant. T. M. Biossat will furnish information.

North Wilkesboro, N. C.—W. F. Trogdon, North Wilkesboro, wants estimates on cost of transmitting by electricity 100 horse power a distance of one and one-half miles.

Richmond, Va.—The Traction Company have about 200 hands employed in the construction of the new trolley line in Broad street and to the Exposition grounds.

Skaneateles, N. Y.—The village trustees have granted to the Auburn Inter-Urban Railway Company a franchise to lay and operate an electric surface railroad in this village.

Kansas City, Mo.—The Missouri, Kansas & Texas Trust Company and the Metropolitan Street Railway Company are rival applicants for an electric car line on Wyandotte street.

Cincinnati, O.—Manager Heck of the "Zoo" recommends putting in a new electric light plant of capacity sufficient to light the entire grounds and all the buildings, to cost about $20,000.

Woburn, Mass.—It is reported that the Woburn Electric Light Company is about ready to liquidate all indebtedness, and that it will continue the business after a thorough reorganization.

Tarrytown, N. Y.—Two companies have made application to the board of trustees for a franchise to build an electric railroad in this village to connect with the White Plains road at Elmsford.

Mankato, Minn.—C. L. Alleman and S. R. Snow will ask the council for a franchise for a combined electric street railway, electric light and steam heating plant, to be built and operated as soon as possible.

Halifax, N. S.—Preparations have been made to lay the rails for the electric tramway immediately on their arrival from New York; the cars and equipment generally are expected to be first class.

Hagerstown, Md.—The Hagerstown and Potomac Electric Railway Company has reorganized, with the following local directors: Peter J. Mayberry, John H. Blake, Albert J. Everly and McKinley B. Embrey.

Long Branch.—The Long Branch Lighting Company's plant has been bought by the Consolidated Gas Company of New Jersey, and the latter has assumed control of the plant here. There will be no change in the local management.

Tennallytown, Md.—The Potomac Electric Light and Power Company has secured the contract to light this city by electricity. They will immediately string overhead wires and erect seventy electric lights in place of the naphtha lamps now in use.

Worthington, Minn.—Work on the city electric light plant is well under way and the lights will be turned on about December 10. About 400 private lights have been ordered by citizens, and the city will use eight arcs, besides several on the court-house.

Scranton, Pa.—The Delaware, Lackawanna & Western Company have demonstrated the success of electric motive power in mining operations at their Bellevue shaft, and will introduce the electric system of haulage in all their mines in this section.

Athens, Ga.—This city is now experimenting in the operation of its own arc light plant, recently purchased from the owners here for $9,000. The incandescent plant is now owned by Mr. R. L. Bloomfield, president of the Athens Manufacturing Company.

West Chester Pa.—The representatives of a party of Philadelphia and New York capitalists are interviewing the farmers between this place and Quarryville, Lancaster county, relative to securing the rights of way between these points for an electric railway.

East Orange, N. J.—The Suburban Electric Light & Power Company, an East Orange corporation, has applied to the township committee for an electric light franchise and for authority to lay underground conduits for the transmission of their current.

Jacksonville, Fla.—J. F. Eldridge, treasurer of the town of Orange Park, states that Boston and Chicago capitalists are interested in the projected electric railroad between Jacksonville and Orange Park, and there is every indication of its early construction.

Moreland, Cal.—At a meeting held here recently to get the views of the people as to contributing aid to the proposed San Jose and Saratoga Electric Railroad it was decided to raise a fund of $50,000 for the purpose. L. M. Hale, of San Jose, is an active promoter of the railway project.

Standish, Mich.—Beecher Kimbel, of Au Sable, has asked the council for a twenty-five-year franchise for an electric light plant. He says he will light the city for $48 a year per lamp and furnish it to business houses for 75 cents per month. It is thought that his offer will be accepted.

Salida, Col.—The Edison Electric Light Company have sold their entire plant to the Mountain Electric Company of Denver. All local interests have been sold and all property and franchises pass into the hands of the new company. Mr. Bentley, of Florence, will be the new manager.

South Braintree, Mass.—It is reported that the New York, New Haven & Hartford Railroad Company will at once commence the erection of repair shops and a large power house here to furnish electric power for the proposed line between this place and Boston to be operated by electricity.

Rutherford, N. J.—A franchise has been granted to New York and Philadelphia capitalists connected with the Union Traction Company of New Jersey under which that company can begin the construction of its proposed trolley line from Rutherford to Newark, a distance of fifteen miles.

New York.—The Madison Avenue Street Car Company will have two cars fitted with storage batteries in regular service on its line in a few days. One of the cars has been run over the line already and worked without a hitch of any kind. If the experimental cars prove a success after sufficient trial all the cars on the line will be similarly equipped.

Quebec, Can.—Canadian capitalists are interesting themselves in the project of an electric street railway in Buenos Ayres, Argentine Republic. The city has 750,000 inhabitants, and there are only two streets in which the electric company has not the right to lay down tracks. Canadian trade with the Argentine Republic is now $4,000,000 a year.

Wakefield, Mass.—A company to be known as the Peabody, Lynnfield & Wakefield Street Railway Company has been formed to build an electric railroad from Peabody to Wakefield through Lynnfield. The men interested in it are B. W. Russell, Daniel Low, Thomas H. Johnson, of Salem, with J. M. Danforth, of Lynnfield, and E. P. Shaw, of Newburyport.

Biwabic, Minn.—Steps have been taken to incorporate this place as a city so as to enable it to sell bonds and use the money for improvements. It is proposed to raise at least $10,000 in this way, put in an electric light plant, extend the water system, improve the streets, etc. Biwabic is a mining town.

Benton Harbor, Mich.—A franchise for a new electric street railway company will be asked of this city probably at the next regular meeting, December 4. The line will run from the City Hall on Main street to Easton Springs. The enterprise is backed by a syndicate of Chicago and local capitalists.

Philadelphia.—The stockholders of the People's Traction Company at a recent meeting decided to reduce the capital stock of the company from $10,000,000 to $6,000,000. This action makes the par of the stock $30 instead of $50, so that it is now full paid and subject to no further calls.

Beverly, Mass.—The old storage battery railway between Beverly and Danvers, which failed in operation and was abandoned three years ago, is now being repaired. It has come into the possession of the Lynn & Boston Street Railway Company who will equip it with the trolley system and operate it.

Trempealeau, Wis.—Business men here will make an effort at the next session of the Legislature to have an appropriation made for improving the Trempealeau river so as to make it navigable for canal boats and smaller craft. The next step will be to fit out a trolley electric system for running the canal boats.

New Haven, Conn.—The "Leader" states that it is announced "that a new electric railroad is to be built and put in condition to operate by early spring. It will connect existing lines in Hartford with the city of Rockville, thus making a through line from the capital city to one of the most bustling centers of the State."

Beatrice, Neb.—The consolidation of the two electric companies here has been completed and the new concern will be known as the Beatrice Electric Company. The capital stock is fixed at $100,000. The officers are: J. A. Horbach, president; J. E. Smith, vice-president; A. S. Maxwell, secretary; Paul W. Horbach, treasurer.

Winona, Minn.—The profiles and plans of the projected electric railway from La Crosse to Neillsville, through Black River Falls and Merrillan, about 70 miles, have been nearly completed in the office of Engineer Pickles in this city. The company projecting the road will decide this winter whether to go ahead with its construction.

Downsville, N. Y.—Citizens of Downsville have subscribed a sufficient sum to cover the expense of surveying a line for an electric railroad to East Branch. A New York company is said to be satisfied that there is business enough to make a railroad to East Branch pay and is willing to consider the matter of building the road when surveys are submitted.

New Albany, Ind.—The Commercial Club of New Albany have about completed arrangements for the construction of the long-talked-of electric line from New Albany to Evansville, Ind. The line will extend along the river front between the two cities, taking in Corydon, Leavenworth, and in fact all of the river towns in Indiana between the terminal cities.

Akron, O.—The Akron, Bedford and Cleveland electric line started its first trains on October 30, and there is now an hourly service between the two terminals. The line is thirty-nine miles in length and has a roadbed equal to the bed of the ordinary steam line, so that the limit of speed may be reached. The scheduled time to the heart of Cleveland is one hour and a half.

Milford, Pa.—The building of an electric or steam railroad between Frenchtown and Pittstown, Huntingdon county, is talked of by the citizens of these two towns and the residents along the proposed road. Many of the property owners have already offered the right of way free through their properties and it is thought other property owners will do the same.

Bennington, Vt.—A preliminary survey for the electric road between Bennington and North Bennington is being made, and has been completed as far as North Bennington. It is intended to continue the survey as far as Walloomsac to connect with the line to Hoosick Falls. The work of constructing the road will be commenced early in the spring if present plans be carried out.

Brooklyn, N. Y.—The entire system of the Brooklyn Heights Railroad Company is now operated by electricity, steam on the Cypress Hill branch having been done away with. The electric cars on that line began running on the 5th inst.—A deal has been consummated between the Nassau Electric Railroad Company and the Brooklyn Traction Company, by which the former is to secure control of the latter.

Grand Rapids, Mich.—Grand Rapids will in a few weeks be connected with the Grand river and Flat river water power at Lowell by an electric line which will convey 500 horse power in electricity to this city. The power transmitted here will be used for lighting and for running motors, contracts for power up to 200 horse having already been made. The cost of the line from Lowell to this city approximates $450 a mile and the distance is 19½ miles.

Chattanooga, Tenn.—The master commissioner, Henry O. Ewing, advertises the sale of the Chattanooga Electric Railway by public auction on the 23d day of December next. The property will be sold subject to any rights which the bondholders of the Chattanooga Electric Street Railroad Company or the City Street Railroad Company may have by reason of certain trust deeds executed by the said two last named companies and entered of record in the register's office of Hamilton county, Tenn.

Youngstown, O.—A number of capitalists of Pittsburg, New Castle, and Beaver county, Pa., are organizing a company and will apply for a charter to construct an electric line from Pittsburg to New Castle. The new line will probably be a continuation of the line which is now being constructed on the east side of the Ohio river, and will run through Rochester, New Brighton and Beaver Falls and reach Youngstown via Enon Valley and Poland.

Logansport, Ind.—Eastern capitalists are interested in the construction of a new north and south electric street railway here, and it is announced that the system will probably be completed within the coming year. J. T. McNary, ex-manager of the present east and west line, will be the manager of the new company. If proper encouragement is given along the proposed route the system will be extended as rapidly as possible to Delphi via Camden and thence to Burlington by way of Flora and Bringhurst.

Lorain, O.—According to plans now under consideration, the East Lorain street railroad will be extended to Cleveland on an air line along the lake shore, a distance of 24 miles, connecting with Cleveland lines at Rocky River. The road will be used for both passengers and freight. Nearly all the right of way has been secured, and the commissioners of Cuyahoga and Lorain counties will be asked for a franchise in a few days. Mark Hanna, of Cleveland, is reported to be the financial head of the scheme.

Washington, D. C.—During a recent visit of Mr. Geo. Westinghouse, Jr., to this city, he stated to a "News" reporter, "that work on the new electric locomotives, now being constructed at the Baldwin Locomotive Works, Philadelphia, is progressing rapidly. These locomotives will be completed within a short time, when experimental trials will be made on the Pennsylvania railroad between New York and Philadelphia. It is expected that the electrical engines will be able to haul an ordinary train of coaches and maintain a speed of 120 miles per hour."—Lieut. N. E. Mason, the naval officer in charge of the proving grounds at Indian Head, Md., recommends that in the interests of economy and safety the quarters and buildings at the station be lighted by electricity. Oil lamps are now used.

Chicago.—It is stated that the franchises and property of the Englewood and Chicago Electric Railway Company and of the Chicago and Morgan Park Railway Company have passed into the control of a syndicate which includes August Belmont, John I. Waterbury, Isaac L. Rice, President Griscom of the International Navigation Company, J. C. Shaffer, of Chicago, and President W. W. Gibbs of the Electric Storage Battery Company of Philadelphia. It is proposed by this syndicate to construct a suburban electric railway system 100 miles long, using the "Chloride Accumulator" as motive power.

Niagara Falls, N. Y.—The Cliff Paper Company of this city has decided to do away with their steam engines and adopt electricity as a motive power. The generator will be placed in the gorge of the Niagara River, coupled to a horizontal shaft and water wheel operated under a head of 125 feet. The Cliff Company will immediately build a power house above their pulp mill in which will be placed the generator. A 250-horse power water wheel of the Leffel horizontal pattern has been ordered and will be ready as soon as the power house is finished. Two motors of 100-horse power will be attached to each of the paper machines.

Madison, Wis.—William T. Fish and H. C. Adams have secured a franchise from the town of Madison to build an electric railway line from Camp Randall to Wingra park, thence to Greenbush and from there back to this city, connecting with the present line near the Illinois Central depot.—Surveyors are at work on the line of the proposed electric railway from Chicago to the Wisconsin lakes and summer resorts. The route as being surveyed will start from the St. Paul Railroad at Libertyville, cross the Wisconsin Central at Gray's lake and run through the Fox lake region up to Wilmot, Wis., and probably to Lake Geneva and Madison.

Oakland, Cal.—It is the intention of the Pacific Transmission Company to put in a plant at Corrall Hollow for the generating of electric power to be transmitted by wire to San Jose and Oakland. The former place is to be supplied with 1,200 horse power and the latter with 3,800 horse power. The plant to be erected will be of the latest and best improved, regardless of cost. It will generate the power from refuse coal which would otherwise be waste material at the mine.—The Oakland "Enquirer" says: "The great economy of electric railroads as compared with cables is proved by the fact that the Southern Pacific finds it can save $2,900 a month by converting the San Pablo avenue road into an electric line. That is the result of investigation and computation recently made by the experts of the company, and the change will be made very soon now."

Milwaukee, Wis.—The special committee on street lighting has decided to report to the common council in favor of entering into a five years' contract with the Milwaukee Street Railway Company for the lighting of the city streets and public places with 2,000 candle power arc lights. A two-mile radius is to be established inside of which are to be only underground wires, and lights fed by such wires are to be paid for at a rate of $109 per lamp per year—a dollar less than what is now paid all over the city. Outside of this limit it is proposed to permit the stringing of overhead wires and in that district the rate is to be $92 per lamp per year.—The ten miles of subways for the cables of the Pabst Heat, Light & Power Company have been completed and the work of putting in the wires in the conduits is under way. The other work necessary to complete the new system is being pushed, and will be done by the time the cables are laid and connections made. New Willans engines, of English make, are to be put in and new Westinghouse generators, and the new plant will have a capacity of 50,000 lights as against 5,000, the capacity of the present plant. It will be run on the alternating instead of the direct system, with a pressure of 240 volts in place of 110 as at present. It is asserted that it will be one of the most complete plants of the character in the country.

TELEPHONE AND TELEGRAPH.

The Berliner an Extension of Blake's Patent.

To the Editor of ELECTRICITY.

SIR: There is one point in the transmitter situation which I have not seen raised. A patent was issued to Francis Blake. No one will deny that the Blake transmitter operated by variable pressure on electrodes which were intended to be in "constant contact." The Bell Company had the sole and undisputed use under this patent during its entire legal life, which is all that the patent laws anticipate that any patentee or assignee shall have. To claim under the Berliner that which was so long practically used under the Blake would be really an extension. Do the patent laws admit of extensions in this way?

A. BLAKE.

[If the Berliner patent is sustained in the court of last resort it will certainly mean, in this case at least, that the generally accepted interpretation of the meaning and intent of our patent laws has been an incorrect one. It will mean that practically a reissue of a valuable expiring patent can be secured if the matter is gone about in the right way.—ED.]

The Motion Denied.

The Supreme Court of the United States on the 11th inst. denied the motion of the Bell Telephone Company to dismiss the appeal of the United States in the Berliner case. The court holds that it has jurisdiction to try the case.

A Cable Up the Amazon.

Mr. Alexander Siemens, of London, is now engaged in surveying the route for the new cable about to be laid up the Amazon from Para to Manaos under exclusive concessions from the Government of the Brazilian Republic. The entire length is 1,365 nautical miles, and there will be in all sixteen stations on the line. This long sub-fluvial line will for the first time bring these regions, so increasingly productive of india-rubber, coffee and sugar, into direct telegraphic communication with Europe. All past attempts on the part of the Brazilian Government to establish aerial lines through these districts have failed, owing to the rapidity and density of the forest growths.

To Extend the Postal Lines.

Officials of the Postal Telegraph Company have been at Memphis, Tenn., looking over the prospect of extending the Postal's lines west of the Mississippi River through Arkansas and Texas. It is also thought they contemplate purchasing a line from Memphis to New Orleans operated by the Yazoo and Mississippi Valley Railroad.

The Longest Telephone Span.

The longest suspended telephone wire is no doubt that extending across Lake Wallenstadt, Switzerland. The distance from post to post measures one and a half miles, yet at the lowest point the wire is still 120 feet above the lake.

Litigation in the Northwest.

Papers have been filed in Milwaukee in the case of the National Telephone Construction Company against the Wisconsin Telephone Company in which it is sought to restrain the defendant from taking down a short telephone line in Waukesha and to prevent it from being disconnected with the long-distance service of the Wisconsin Company.

The subscribers of the Wisconsin Telephone Company at Milwaukee, who object so vigorously to the rates and rules recently enforced by the company, have formed an association for the purpose of "mutual action in seeking relief." Each subscriber is to contribute to a common fund which is to be used for the "purpose of investigating the workings of the telephone business and securing relief from burdensome charges and inefficient service."

The new exchange of the Wausau Telephone Company, Wausau, Wis., was opened last week with 121 subscribers. Service is supplied at $3 and $1.50 per month. To meet the rates, the Wisconsin Telephone Company announced a reduction to $1.25 and $1 per month.

The United Telegraph, Telephone & Electric Company, under a franchise granted to the Hyde Park Telegraph, Telephone & Electric Company in 1889, and purchased at a receiver's sale, is laying conduits and erecting pole lines in the streets of Hyde Park, Chicago. The company announces that it will establish a complete telegraph, telephone and messenger service.

The Automatic Telephone & Electric Company of Chicago has made an assignment to Frank C. Wood. The assets of the company are about $5,000 and the liabilities slightly exceed that amount. The company was organized about two months ago as the licensee for an automatic telephone for the State of Illinois outside of the city of Chicago. The company had not begun actual operations when it got into financial difficulties and finally concluded to make an assignment.

The manager of the Wisconsin Telephone Company at Oshkosh, Wis., has declared his company to be willing to furnish free service in that place if necessary to hold the business. The Oshkosh Telephone Company is about ready to open its new exchange, hence the desperate effort of the old company.

The Automatic Telephone Service Company, Buffalo, N. Y.—to provide for the use of the Strowger automatic telephone in that city. Capital stock, $300,000. Directors: Oliver Watson, Edward Mitchell, Henry Koons, Charles Eck and Tracy C. Becker, all of Buffalo.

The Lake Superior Telephone Company, which has already secured a franchise at West Superior, Minn., has applied for similar privileges at Duluth, Minn. John Goodnow, of Milwaukee, is identified with the new company.

The capital stock of the Southern New England Telephone Company is to be increased from $1,500,000 to $1,650,000. The increase is to be applied to improvements.

The Southwestern Telephone and Telegraph Company will extend its line from Waco to Houston, Tex.

The new telephone exchange with seventy-five subscribers is now in operation at Ocala, Fla.

The Delmaria Telephone Company is being organized at Wilmington, Del., with a capital stock of $250,000.

A fire alarm system is to be installed at Medina, N. Y.

New Companies Incorporated.

The People's Telephone and Telegraph Company, San Jose, Cal. Capital stock, $50,000. Directors: W. C. Andrews, Gus Lion, F. E. Spencer, H. G. Hickok, C. E. Severance, Nicholas Bowden, F. H. Burkholder, W. H. Field and Fred S. Moore.

The Western Telephone and Telegraph Company has been organized at Fort Wayne, Ind. The company is composed of local Lima, Ohio, capitalists. G. W. Beers is president and D. J. Cable, of Lima, is secretary. The company already controls telephone exchanges at Lima, St. Mary's Defiance, Van Wert and Wapakoneta, Ohio, and toll lines at many other points. It has options on lines at Decatur, Portland, Bluffton and Hartford City. Telegraph stations will be operated in connection with the telephone.

COMMERCIAL PARAGRAPHS.

Mr. J. M. Atkinson, already well known in the electrical trade, has been placed in charge of the Forest City Electric Company's Western office recently opened in Chicago.

W. D. Forbes & Company, 1300 Hudson street, Hoboken, N. J., are distributing an attractive circular calling attention to their high speed engines and other machine specialties.

The Siemens & Halske Electric Company, Chicago, has issued a series of catalogues devoted to Band Arc Lamps, Electric Rock Drills, Electric Motors, and other forms of apparatus. The books are profusely illustrated and contain considerable interesting and valuable data.

Fred M. Locke, Victor, N. Y., has issued an illustrated catalogue and price list of his well-known High Insulation Line Material. Supplementary to it he is publishing a long list of testimonial letters from people who have been using his goods.

The Ruete Conduit Company has established its general sales office in the Havemeyer Building, New York, with Mr. Frederick Noll, already well known to the electrical fraternity, in charge. The works of the company at 164 and 166 First street, Jersey City, are being fitted throughout with the latest types of labor-saving machinery, and within a few days the company will be able to take care of all orders. Mr. E. T. Greenfield, an interior conduit pioneer, and W. T. Ruete, whose name the company bears, will have personal supervision of the manufacturing department.

H. L. Merritt has become proprietor of the Boston Incandescent Lamp Company, and will continue the manufacture of the "Boston" lamp at 70 Pearl street, Boston.

INCORPORATIONS.

The Metropolitan Electric and Power Company, Allegan, Mich.—to do a general electric supply and water power business. Capital stock, $50,000. Promoters: John S. Rannay, Chicago, Ill.; F. A. Makin, Samuel Clark, Monterey, Mich.; Frank E. Semon, Allegan.

The Mexican National Exposition and Land Company, Jersey City, N. J.—to purchase, hold and improve lands, construct buildings thereon, establish electrical works, tramways, water works, etc. Capital stock, $1,000,000. Promoters: John P. Stockton, Trenton, N. J.; John R. Dos Passos, J. M. Ceballos, H. B. Hollins, New York City; C. N. Jordan, Brooklyn, N. Y.

The Camden Water, Light and Power Company, St. Louis, Mo—to deal in light, power and water. Capital stock, $50,000. Promoters: F. W. Paramore, E. E. Paramore, H. F. Mueller, Chas. Brown, St. Louis.

The Standard Brass and Electric Company, St. Paul, Minn.—to manufacture electrical and mechanical apparatus and supplies. Capital stock, $50,000. Promoters: Jehiel W. Jaggar, Jacob Heilbron, Theodore Guitting, St. Paul.

The Hafemeister Electric and Machine Company, Cleveland, Ohio—to manufacture machinery and electric goods. Capital stock, $5,000. Promoters: F. C. Hafemeister, G. C. Spaller, Henry F. Stolte, Wm. C. Hafemeister, E. F. Cowley.

The Nortonville Electric Light, Heat and Power Company, Nortonville, Kan.—to manufacture and supply light, heat and power to the public. Capital stock, $2,200. Promoters: John Campbell, John W. Harris, L. F. Randolph, C. C. McCarthy, Nortonville.

The Canton, Ohio, Light, Heat and Power Company has increased its capital stock from $50,000 to $150,000.

The Electric Light Company of Manitowoc, Wis, has filed an amendment to its articles increasing its capital stock from $40,000 to $50,000.

The Western Electric Transit and Power Company, Boulder, Col.—to construct electric plants, railway lines, carry on a general business of an electric transit company, etc. Capital stock, 100,000. Incorporators and directors: E. B. Goodwin, W. K. Mehollin, Oliver I. Cheney, John Leahy, A. J. Macky, H. J. Danford, Bernard Mallon and Frank Kline.

The Oakdale Electric Light, Heat and Power Company, Oakdale, Pa. Capital stock, $8,000. Directors: John C. Bryson, Ebenezer A. Thompson, Samuel E. McClurg, Harry D. Robb, Samuel D. Bryson, Oakdale.

The Hyde Park Thomson-Houston Light Company, Chicago, has increased its capital stock from $100,000 to $125,000.

The Newton Traction Company, Jersey City, N. J—to contract for, build and construct street railways, electric railways, electric power and light systems, etc. Capital stock, $1,000,000. Promoters: Horace B. Parker, Newton, Mass.; Louis Pfingst, Boston, Mass.; Frank P. Hillyer, New York City; John N. Baldwin, Council Bluffs, Iowa.

The Acetylene Electric Gas Company (incorporated in W. Va.), Philadelphia, Pa.—to manufacture calcium, carbide and other metallic compounds and liquifying acetylene gas, etc. Capital stock, $1,000 minimum, $1,000,000 maximum. Promoters: I. D. McKee, Jos. Cooper, Wm. T. Emerson, Edw. P. Carpenter, Philadelphia, Pa.

The Fulton Street Railroad Company, New York City (re-organization of the North and East River Railroad Company). Capital stock, $500,000. Promoters: J. H. O'Rourke, A. H. Smith, Wm. Farrell, John Bray, J. J. Mahoney, Brooklyn, N. Y.

The Los Angeles Petroleum Smelting and Milling Company, Los Angeles, Cal.—to buy and sell mineral and other lands; build and operate smelting works; buy and construct railroads, telephone lines and electric light systems. Capital stock, $200,000. Promoters: J. H Canavan, E. M. Wade, E. J. Reed, J. H. Bryant, Los Angeles; S. J. Keese, Pasadena, Cal.

The Dunmore Street Railway Company, Scranton, Pa. to build an electric street railway. Capital stock, $30,000. Promoters: Frank Silliman, Jr., Horace E. Hand, Robt. F. Fox, Scranton, Pa.

The Waddell-Entz Machine Company (incorporated in W. Va.), New York City—to purchase, sell, etc., electric apparatus and machinery, etc. Capital stock, $50,000. Promoters: Alfred A. Whitman, New York City; Jose A. Machado, Plainfield, N. J.; Antonio Knauth, New York City

The Washington Light, Heat and Power Company, Washington, N. J.—to generate electricity for light, heat and power. Capital stock, 24,000. Promoters: Jno. Karr, Hackettstown, N. J.; Wm. A. Stryker, Frank P. McKinstry, John W. Fitts, Joseph W. Johnson, Washington.

The Mount Lowe Railway Company, Pasadena, Cal.—to construct, lease and operate electric and other railroads; operate telephone and telegraph lines, water and electric lighting and power plants. Capital stock, $1,000,000. Promoters: Thaddeus S. C. Lowe, Leon P. Lowe, Herbert C. Brown, Sobieski Lowe, Pasadena; Thaddeus Lowe, Altadena, Cal.

The Pasadena and Altadena Railway Company, Pasadena, Cal.—to construct an electric railway and operate same by electricity or stationary or locomotive gas or steam engines or wire cables. Capital stock, $100,000. Promoters: Leon P. Lowe, Thaddeus S. C. Lowe, Thaddeus Lowe, L. A. Lowe, Herbert C. Prown, Pasadena.

The Reed Electric Company, Philadelphia, Pa.—to manufacture electrical and mechanical appliances and apparatus. Capital stock, $500,000. Promoters: Amos W. Bacon, Carl Hering, Philadelphia; Marcellus T. Morrill, Camden, N. J.

The Osborn Electro Magnetic Railway System (incorporated in W. Va.), Auburn, N.Y—to manufacture apparatus for transmitting electro-motor cars, and all appliances pertaining to electric railway equipment, etc. Capital stock, $30,000 minimum; $1,0 0,000 maximum. Promoters: Byron E. Osborn, J. Harrison-Pearson, Ruth E. Osborn, A. J. Parker, Auburn, N. Y.; Chas. Thompson, New York City.

The Standard Electric Storage Battery Company (incorporated in W. Va.), New York, N.Y.—to own, lease and sell electrical appliances, batteries, etc.; electrical contractors, manufacturers, etc. Capital stock, $1,000 minimum, $5,000,000 maximum. Promoters: Ernest Thalman, R. T. Mc Donald, James Marwick, W. H. Bankier, New York City.

The Scott & Janney Electric & Manufacturing Co. (incorporated in W. Va.), Philadelphia, Pa.—to manufacture and construct electrical motors, dynamos, etc. Capital stock, $5,000 minimum, $5,000,000 maximum. Promoters: Dudley W. Lane, Geo. W. Edmunds, Chas. Watson, Geo. H. Hill, Philadelphia, Pa.

The International Electric Company (incorporated in W. Va.), New York, N. Y.—to manufacture motors, dynamos and all kinds of electrical apparatus, etc. Capital stock, $10,000 minimum, $2,000,000 maximum. Promoters: Jno. H. Hankins, Steubenville, Ohio; G. M. Rundle, Danbury, Conn.; G. V. P. Lansing, Seattle, Wash.

BUSINESS HINTS.

Public Buildings, Theaters, Residences, &c., Proposed or in Course of Construction.

[The following summary is prepared weekly for ELECTRICITY for the information of advertisers and readers who are dealers in apparatus and, articles required in the electrical equipment of public and private buildings.]

Albany, N. Y.—The Albany Insurance Co. will erect a building on the Gladding property, adjoining the Albany Savings Bank.

Allentown, Pa.—Philip Schneider, shoe manufacturer, will build a factory on Jefferson and Pine sts.; the motive power of the new factory will in all probability be electricity.

Baltimore, Md.—The Baltimore Athletic Club is considering the question of erecting a club-house, to cost $60,000; Dr. B. Merrill Hopkinson is president of the club.

Beaver Falls, Pa.—An option has been secured by Pittsburg parties of a large plot of ground at Beaver upon which they propose to erect a magnificent hotel if the Masonic University is built; estimated cost, $500,000.

Brooklyn, N. Y.—E. R. Barteaux will build 3 four story brick dwellings on north side of Montgomery Place, east of 8th ave., to cost $57,000.

New York City.—Henry & Hartmann Schmidt, 112 East 129th st., will build 2 five story flats, on north side of 119th st., east of Madison ave.; Architect Edward Wenz, 205 East 84th st.... John Nold, 429 West 48th st., will build a five story flat and store on east side of Amsterdam ave., south of 100th st., to cost $17,000; Architect George F. Pelham, 503 5th ave.... Francis A. Clark, 1879 Second ave., will build 8 five story and extension brick stores and flats of various dimensions on west side of 1st ave., between 95th and 96th sts.; Architect Edward Wenz, 205 East 84th st.... Dora Bernschild, 1026 Westchester ave, will build a five story tenement and store south side of Westchester ave., east of Union ave.... Wm. W. & Thomas M. Hall, 687 Madison ave., will build 9 four story dwellings of various dimensions on north side of 87th st., east of Riverside Drive; Architect A. M. Walsh.... Curming & Ferguson have purchased a plot on the east side of Amsterdam ave., north of 106th st, and plot on Amsterdam ave., south of 108th st., upon which they will erect five story flats and stores.

Paterson, N. J.—The building which is to be erected by Quackenbush & Co. on Main st. will be equipped with electrical appliances.

Philadelphia, Pa.—Work will be begun in a short time, renovating St. Augustine's Roman Catholic Church, 4th, below Vine st.; among the new features to be introduced are electric lights in place of gas.... Preliminary sketches have been prepared by Architect Henry D. Dagit for the elevation and details for a large ten story office building to be built by the Pennsylvania Mutual Life Insurance Co.... The dwellings, twelve in number, which Wright & Prenzel will erect on west side of Germantown ave., above Broad st., will be lighted by electricity.... The Philopatrian Literary Institute has adopted plans prepared by Yarnell & Goforth for its new building, which is to be erected on the site of the present one, on 12th st., below Walnut; the structure will contain a library, reading room, reception parlors, conversation rooms, offices for the officers of the institute and gymnasium on the upper floors, a culinary department, bath and a swimming pool in the basement.

Pittsburg, Pa.—C. L. Flaccus, the glass manufacturer, has broken ground for a residence at the intersection of Negley, Stratford and Roup sts., to be equipped with all modern improvements.... Architect W. S. Fraser has completed plans for a six story fireproof building on Penn ave. above 9th st., for Charles Lockhart.... Chess & Hall will erect a six story business house on 10th st.

Rahway, N. J.—Mr. Rothschild, who is to establish a shirt factory in Rahway, will probably introduce electric motors to run the sewing machines.

St. Paul, Minn—The plans prepared by Cass Gilbert have been accepted for the Minnesota State capitol.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

NOVEMBER, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	3.30 A. M.	1	5.30 A. M.
2	No light.	2	No light.
3	"	3	"
4	"	4	"
5	5.20 P. M.	5	7.40 P. M.
6	5.20 "	6	8.40 "
7	5.20 "	7	9.50 "
8	5.20 "	8	11.10 "
9	5 20 "	10	12.20 A. M.
10	5.20 "	11	1.00 "
11	5.20 "	12	1.30 "
12	5.10 "	13	2.50 "
13	5.10 "	14	4.00 "
14	5.10 "	15	5.20 "
15	6.10 "	16	6.00 "
16	5.10 "	17	6.00 "
17	5.10 "	18	6.00 "
18	5.10 "	19	6.00 "
19	5.10 "	20	6.00 "
20	5.10 "	21	6.00 "
21	7.30 "	22	6.10 "
22	9.00 "	23	6.10 "
23	10.20 "	24	6.10 "
24	11.00 "	25	6.10 "
25	11.20 "	26	6.10 "
26	...... "	..	....
27	12.20 A.M.	27	6.10 "
28	1.20 "	28	6.10 "
29	2.20 "	29	6.10 "
30	3.20 "	30	6.10 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED NOVEMBER 5, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

549,094. Brake for Electric or Other Cars. Edward S. Amrock, Waltham, assignor of one-half to James H Walsh, Boston, Mass. Filed March 16, 1892.

549,256. Fender Attachment for Trolley-Cars. Henry F. Risch, Brooklyn, N. Y. Filed Aug. 4, 1894.

549,416. Insulating Rails. Francis W. Wilson, New York, N. Y. Filed June 22, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

549,132. Electric-Arc Lamp. Francis Jehl, Vienna, Austria-Hungary, assignor to F. Hardtmuth & Co, same place. Filed May 12, 1894.

549,201. Incandescent-Lamp Reflector. Charles J. Klein, New York, N. Y. Filed April 18, 1895.

549,268. Arc Cut-Out. Caryl D. Haskins, Newton, Mass., assignor to the General Electric Company of New York. Filed March 6, 1895.

549,409. Electric-Arc Lamp. Charles F. Vogelius, Bloomfield, N. J., assignor to Joshua F. Bailey, New York, N. Y. Filed Jan. 17, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

549,153. Controlling Electric Motors. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Aug. 8, 1895.

549,162. Electric Switch. Joseph B. Smith and Albert L. Clough, Manchester, N. H. Filed April 26, 1895.

549,189. System of Electrical Distribution. William M Fairfax, Brooklyn, N. Y. Filed Feb. 7, 1893.

549,209. Electromagnetic Switch. Charles L. Penny, Newark, Del. Filed March 12, 1895.

549,234. Armature for Dynamo-Electric Machines or Motors. Ward Decker, Owego, N. Y. Filed Nov. 17, 1892.

549,237. Electric Switch. Gerald W. Hart, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company, same place. Filed March 19, 1895.

549,383. Automatic Regulator for Converters of Energy. William E. Moore, Augusta, Ga. Filed March 20, 1895.

549,456. Carbon-Contact-Resistance Switch. Friederick G. H. Meyer, Charlottenburg, Germany, assignor, by mesne assignments to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed April 4, 1894.

549,461. Electrical Dental Engine. Frank C. Priestly, Denver, Colo. Filed Feb. 12, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

549,179. Printing-Telegraph System. Jonathan E. Woodbridge, Duluth, Minn. Filed Jan. 29, 1895.

549,304. Telephone. Samuel Alexander, Hartford, Conn. Filed Sept. 24, 1895.

549,477. Local Transmitter-Circuit for Telephones. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed March 29, 1895.

MISCELLANEOUS.

549,152. Electric Heater for Curling-Irons. George D. Pogue, Jerseyville, Ill. Filed March 29, 1895.

549,186. Electrolytic Apparatus. Thomas Craney, Bay City, Mich. Filed March 16, 1893.

549,195. Electric Meter. Ralph O. Hood, Danvers, Mass. Filed March 9, 1895.

549,240. Electrical Annunciator. Robert L. Hunter, Minneapolis, Minn. Filed Dec. 11, 1893.

549,241. Electrical Annunciator. Robert L. Hunter, Minneapolis, Minn. Filed Feb. 3, 1894.

549,254. Method of Making Insulator-Rings. Charles F. Peterson, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed June 1, 1895.

549,346. Transmitting-Time-Signals. Charles E. Buell, North Plainfield, N. J. Filed May 27, 1895.

549,443. Electric Supporting-Insulator. Joseph Collins, Washington, D. C. Filed Sept. 23, 1895.

549,470. Electrical Resistance. Henry E. Werline, Lancaster, Pa., assignor of three-fourths to Frank S. Barr, same place, and Edwin L. Reinhold and Henry Burd Cassel, Marietta, Pa. Filed Dec. 23, 1895.

ELECTRICITY.

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ELECTRICITY

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EDITORIAL NOTES.

American vs. English Progress. No one who has been abroad recently, or who reads the English technical papers, can fail to note that in electric traction work America is far in advance of the parent country. Nothing shows more plainly the difference between the character and forces of the two nations than a comparison of their progress in this line. Electric railroads of various kinds have become so common in America that a new line with 25, 50, or 100 miles of track creates little comment. Not so in England. At the opening of every new line, however small, there is a public function at which some of the leading dignitaries of the Empire are expected to preside, and several pages of the best technical papers are devoted to descriptions and illustrations which must be interesting to English readers (else they would not be printed), but which would be considered commonplace and stale by the American public.

Knowing that this sort of thing was looked for in the English press, our London correspondent (who is, by the way, one of the brightest newspaper men in London) recently sent us for publication a long description of one of these events, beginning as follows:

"On Monday, October 14th, there was publicly opened a new line of electric tramways on the overhead trolley system, running between Kingswood and Bristol, two West of England towns, a distance of nearly four miles."

He also reported:

"The journey of about four miles occupied about thirty minutes, but it must be borne in mind that red tape will not allow us to run our cars at more than about eight miles an hour in England, therefore that is no index to the capacity of the cars. On the return journey the party stopped at the power house, which is about half way down the line, to inspect the machinery there, and afterwards adjourned to partake of the usual banquet."

Commenting on the slowness of the British public in going ahead with traction work, he says:

"In one respect our slowness to adopt electric traction over here is a distinct advantage, inasmuch as now that there are evidences of an extensive revival of the business and important schemes are in progress, while various others are in the air, we are enabled to make use of the past and dearly purchased experiences and the conclusions deduced therefrom by electric traction pioneers in the United States. We have far more light to guide us in the choice of systems and the various details of apparatus, as to what is the more suitable and so forth, than you had in the States when you laid down your first important traction schemes. It may thus be expected that all our systems which are now in progress will be in every way successful and satisfactory."

Of course there is more than a little common sense in this view of the case: Millions of capital were lost here in establishing successful electric railways, and it is a purely American characteristic that so much money can always be had here for experimental work when the looked-for success appears to justify the expenditure. From the narrow point of view of the capitalist, we have no doubt Englishmen showed good judgment in waiting for America to blaze the way. But from the broader standpoint, considering the greatest good to the greatest number, America has no mistakes of judgment to confess. As early as 1890 or 1891, millions of American workingmen were giving thanks for the introduction of trolley roads, giving them the opportunity of living cleanly and wholesomely in suburban districts—something never before attainable. This number has been increased every year.

Moreover, from recent reports we are not willing to admit that English construction of electric railways is better than our own. Certain it is that although several years behind us in the lighting field, we have maintained our superiority at every point—if we except the application of the gas engine and the accumulator adjuncts. The great American public does not regret the ardor and enthusiasm with which the electric railway business was pushed here. The rooster crows.

If we have paid for the education of our British friends, we are a philanthropic people, and will continue to lead the world and teach progress.

* * *

Electricity and Sewage. The decomposition of sea water by electrolysis, and the application of the chlorine thus obtained to the disinfection of sewage has, wherever tried, demonstrated not only the complete practicability of the method but its economy, commercially considered.

Prof. John W. Langley, of the Case School of Applied Science, Cleveland, Ohio, who has given considerable attention to this problem by investigation and experiment, states some interesting facts in his address elsewhere published in this issue. To those interested in the problem of the cheap and effective purification of sewage, the data deduced from Prof. Langley's experiments will be of considerable value. Although the operating plant used by Prof. Langley was of a capacity totally inadequate to the needs of a large city, the results attained show that from the expenditure of one electrical horse power per hour 6.37 pounds of chlorine can be produced.

"The quantity," Professor Langley says, "would purify over fourteen thousand gallons of sewage per day of ten hours. A hundred horse-power would therefore disinfect nearly a million and a half gallons in the same time. The cost of the process will be but little more than the cost of electricity plus that of pumping the sea water and the small additional amount for wages. These can be approximately estimated at twenty-five cents for 1,400 gallons when carried out on a scale of 500 horse-power. Taking the wholesale price of bleaching powder, its cost to do the same amount of disinfection would be at least twenty times as great. For inland cities the cost of salt would have to be added, but even then the expense would still be much below that of bleaching powder."

The economy and simplicity of this method would, it seems, indicate its general application in the near future.

* * *

Russell Sage and Stockjobbing Trusts. One would as little expect a discourse from Dr. Chauncey M. Depew on "The Vanity of Flattery" as a dissertation by Mr. Charles A. Coffin on "The Evils of Bonding." Treated by the authors, these subjects would be as incongruous in the literature of post-prandial and business life as the subjects themselves are foreign to the habits, tastes, inclinations and achievements of the distinguished gentlemen named. Scarcely less surprising would it be to learn that Russell Sage, the multi-millionaire, has become the author of what may properly be termed a treatise on the "Wickedness of Trusts."

Mr. Sage, it may truthfully be said, has more than a speaking acquaintance with Wall Street. There have been days in his eventful career when he was on the wrong side of the market, but he hasn't stayed there long. By the aid of the experience of years, a highly-developed Shylockian instinct, and a careful perusal of ELECTRICITY, he has discovered that the annual reports of stockjobbing companies, like dynamite bombs, are not always what they seem. The process by which vanishing assets are converted into tangible, or a deficit into a profit, like some of the processes of nature and of science, are known only by the results accomplished, or by the phenomena exhibited.

Yet, notwithstanding Mr. Sage has learned that the stock of companies which one day sells at 34, on another at 29¼ and on another at 30¾, is actually worth but about $4 a share, and not a particularly safe investment at that. For aught the public knows, it may have been the discovery of this and similar facts that prompted him to exclaim, more in anger than in sorrow:

> The public, or rather stock and bond holders and dealers in the certificates and bonds of these corporations, should be enabled to know what the companies are doing. Regular reports should be forced from them. They should not be allowed to run as blind pools, over-capitalized, watered, mismanaged by the cliques in control, over whose actions the stockholders really have no power.

It is to be regretted that Mr. Sage has neglected to be specific in his remarks, omitting, as he has done, to name the particular stocks to which the designations "blind pool," "over-capitalized," "watered," "mismanaged," etc., are applied. To have enumerated this class of insecurities would have added much strength to another observation he made anent this subject:

> It is all very well to say that nobody is forced to invest in these concerns, but the securities are put out through the regular channels and powerful influences are willing to induce the public to come in with its money. There is no valid excuse for secrecy on the ground that the independent trade otherwise would learn about inside business. Whatever cannot stand up under open competition has something wrong with it.

* * *

The Farmer Patents. The announcement that a number of patents issued to the late Moses G. Farmer are now offered for sale will create considerable interest. Mr. Farmer was one of the earlier pioneers, a prolific inventor, and one who did much good work. Although partially paralyzed for some time before his death, his mind was clear and bright, and he was active to the last in originating new devices and improvements on some of his earlier products.

It is more than possible that some of the new telephone companies will find in these Farmer patents just what they need to insure a successful business and as a protection against patent litigation.

Under the Searchlight.

Views and Opinions on Timely Topics.

By those best posted, the rumor that Mr. Coffin has resigned from the General Electric Company is regarded as sheer nonsense. It is stated by those who know, that Mr. Coffin will never be forced out. When he retires if at all, it will be voluntarily.

Mr. Coffin still has confidence in his star, and believes he can yet pull the General Electric Company out of all its difficulties.

We are authorized to announce that Mr. Coffin is not a quitter.

* * *

A Western View of the Standard Telephone Company.

(From the Pacific Electrician.)

When the Standard Telephone Company was organized in the East it was stated that it had unlimited millions back of it, that it had secured valuable patents, and was prepared to push the telephone business in all parts of the United States.

It has had its agents out in different parts of the country endeavoring to form local companies to sell *rights* (?) and has talked about starting factories in various localities. Lately there has been considerable inquiry from different quarters as to the purpose and standing of this company, and until recently no satisfactory answer could be given. ELECTRICITY seems to have got at the true inwardness of the concern.

The Standard Company has no factory, it has no rights, and it is evidently running a skin game. A concern that will calmly advise the commission of a felony will be pretty sure to swindle its own licensees

* * *

This Man Is a Fraud.

(Aberdeen [Miss.] Special in New Orleans Picayune.)

At a meeting of the Board of Aldermen a contract was awarded for lighting the town by electricity to Thompson Houston.

Mr. Coffin Resigns

Continued Friction in the United Electric Securities Company.

As a result of the three-cornered fight between the General Electric Company, the United Electric Securities Company and the Ft. Wayne Electric Corporation, Mr. Charles A. Coffin handed in his resignation as a director in the United Electric Securities Company of Boston last week.

The resignation has not yet been acted upon.

The General Electric Company holds all the common stock of the Securities Company—$500,000. There is $1,000,000 preferred stock widely scattered. At this year's annual meeting, early in September, Mr. Coffin appeared with proxies enough to give him about 100 majority. The opposition threatened to make the controversy public through circulars, and the meeting was adjourned without action.

Mr. Coffin's contention was that Messrs. Pevear, Allston Burr and Perry be ousted from their official positions. This was an impossible concession on the part of the honest investors who believe, and properly so, that these three gentlemen are looking out for the best interests of the Securities Company regardless of entanglements with any manufacturing company.

Since September 10 there have been several meetings of Securities Company stockholders; all adjourned without action.

The present holdover officers of the Securities Company are: Samuel Carr, President; Arthur Perry, Vice-President; Allston Burr, Treasurer. Directors: Oliver Ames, Allston Burr, Isaac T. Burr, Samuel Carr, C. A. Coffin, Robert Treat Paine, 2d, Francis Peabody, Jr., Arthur Perry, H. A. Pevear.

A Submerged Electric Railway.

(From our London Correspondent.)

An interesting electric railway is now in course of construction along the coast between Brighton and Rottingdean, on the southeastern coast of England. The line is intended purely for pleasure purposes. It is questionable whether the novelties and peculiarities of this line are to be met with in any other part of the world.

The coast is bold, practically the whole distance having chalk cliffs varying from 60 to 120 feet in height. The rails being laid a considerable distance from the shore, a fine view of the coast is obtained.

The rails are laid on concrete block (made *in situ*), spaced about 3 feet apart, mortised into the sound rock, the height of the blocks varying with the irregularities of the shore; a shifting sand of very moderate depth covers the rocks in places; the track, however, has been laid sufficiently high to prevent any trouble from accumulations on the rails. The steepest gradient is 1 to 300 and the radius of curves 40 chains. The line consists of four rails (54 lbs. per yard) laid as two tracks of 2′ 8½″ gauge, spaced about 18 feet between outer rails, thus giving a gauge of 18 feet, this being rendered necessary to give the required stability to the cars. The rails are secured by steel clips and bolts, the latter being embedded in concrete, oak blocks, through which the bolts pass, being placed between the rails and the concrete blocks. Tie rods are also used every 10 feet on the straight and every five feet on the curves, heavy angle fish-plates being used for the rail joints.

The depth of water over the rails at high tide is 15 feet. Although the most violent gales experienced for many years occurred during the winter of 1894-5, no damage whatever was done to the permanent way, so the fact that it possesses ample strength to resist the force of the sea has been satisfactorily demonstrated, and no accumulation of sea weed, etc., has taken place at any time.

The car is a structure on 16 wheels, 33 inches in diameter, carrying the passengers at a height of 24 feet above the level of the rails; the four main legs are tubes of drawn steel 11 inches in diameter. At the bottom of each leg is placed a bogie truck having four wheels, the outside of the bogie being shaped like an inverted double-ended boat to facilitate its passage through the water, and also to remove any obstructions from the rails. The four bogies are firmly held together by steel tubular struts. The wheel base is about 28 feet and the effective gauge 18 feet, giving great stability. The tops of the main legs are firmly built into lattice girder work carrying the deck, and the whole structure is firmly secured by cross ties and is of great strength although offering but a small surface to the force of the waves.

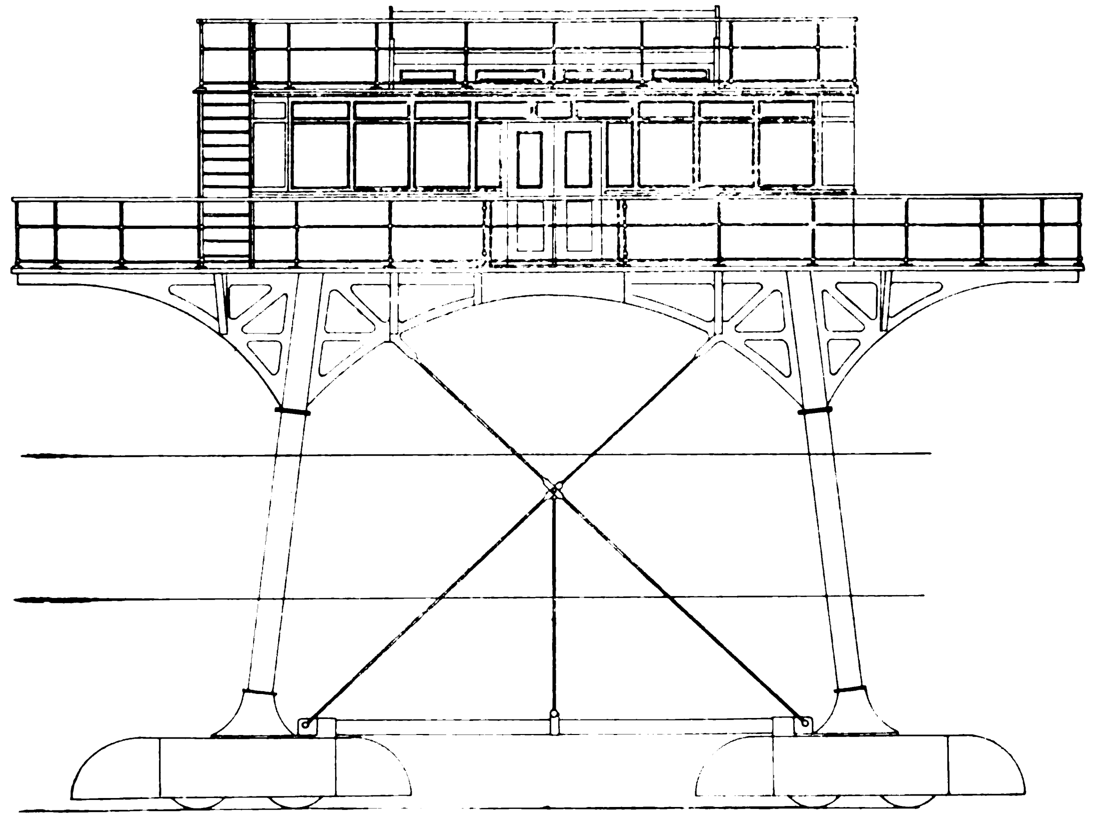
The main deck appurtenances and erections are carried out exactly as if for a yacht; the deck measures 50 feet long and 22 feet wide, the railings round the deck being of iron with a wooden top rail and wire netting. Seats with reversible backs are provided. The center space of the deck is occupied by the saloon, a structure 12 feet wide by 25 feet long, provided with plate glass windows all round and a large central ottoman. The center of the ceiling is occupied by a stained glass dome. The roof of the saloon is railed round and forms a promenade deck, and on this upper deck are placed the controlling apparatus for driving and stopping the cars. The total accommodation is for 100 to 150 passengers. As the journey will be undertaken more for the sea air than for quickly making the trip, the speed will be kept between six and eight miles an hour.

The driving machinery consists of two 30 H. P. electric motors placed vertically immediately over *two of* the main legs, one on each side of the car, the shafting being carried down inside and communicating with toothed gearing which actuates the wheels. The brakes are worked by rods passing down the remaining two legs. The current at 500 volts will be conveyed to the car by means of a trolley pole and overhead wire, provided the consent of the corporation of Brighton be obtained for the portion within the borough.

It was originally intended that accumulators should supply the motive power, but it has since been considered that to make the undertaking a commercial success current should be carried by wires, poles being laid along the foreshore for this purpose. The weight of the accumulators necessary was found to be equal to that of about 60 passengers, a consideration which weighed largely with the promoters in deciding.

The total cost is said to be only $100,000 and the system is to be worked by the company, who have laid it without the assistance of contractors.

Mr. St. George Moore is engineer, in conjunction with Mr. Magnus Volk, whose name has been associated with the Brighton Electric Railway for the past ten years or more, and who is really the promoter of the present undertaking and will supervise its construction. It should be mentioned that it was with Mr. Volk that the idea of running a self-propelling car on a railway submerged in the sea originated.


ELEVATION OF CAR—SUBMERGED ELECTRIC RAILWAY.

DR. CUSHMAN'S LECTURES ON THE TELEPHONE.

ABSTRACTED BY JOHN S. BIGGAR.

The expiration of Bell's 1876 and 1877 patents does not affect Cushman's 1851 claims now pending. Bell's 1876 and 1877 patents covered broadly, as stated by the Supreme Court's decisions, two methods of electrically transmitting and receiving speech. One method was by passing through a circuit, then occupied by a current, a second current, making use of articulate speech in the creation of this last current. The apparatus used by Bell, as described in his patent, to produce this second current, was the same as the receiver now commonly used.

The other method patented by Bell was increasing and diminishing the transmitting current by increasing and diminishing the resistance of the circuit through which the current passed. The apparatus used in this method operated upon the principle of variable pressure between electrodes, the variations being produced by the vibrations impinged upon the transmitting device when it was spoken into.

Cushman invented such apparatus in 1851. In 1868 George B. Hicks improved Cushman's instrument o 1851 by employing a loose connection in a local circuit, using coke in its construction. Morse invented and patented a method of placing in a circuit a variable contact, the pressure of which could be regulated by the hand so as to increase the sound at the receiver.

The Bell Company have proven, and the courts have decided, that a microphone carbon transmitter is the equivalent of Bell's magneto-transmitter. A large number of suits have been brought by the Bell Company against parties making, using and vending telephones employing battery transmitters, and in every case where decisions have been reached the courts have held such infringing transmitters to be the same as the apparatus, and operating by the same method as set forth in the patents granted to Bell in 1876 and 1877. Over one hundred patents upon transmitters have issued since 1876, to live only till the courts could say: "Begone, you are an equivalent of Bell's 1876 and 1877 patents. These patents to Bell are not dead. They live. They have been made strong by litigation.

In regard to the 1876 patent the Supreme Court says: "The patent is for the apparatus described or its equivalent." Any apparatus, then, that will increase and diminish the resistance of the circuit in the manner described so as to vary the current will infringe the apparatus constructed under the patent of 1876. The Berliner patent of 1891 is the same patent of 1876 under a different name. On March 4, 1895, the Supreme Court unanimously decided that the date of a United States patent, not the application, controls in determining the life of a foreign patent. This decision sounds the death knell of the American Bell Telephone Company's chief reliance.

The Berliner patent is void and has been once so decided. It is void because anticipated by Bell in 1876 and others since then. If valid at all Berliner's patent must be confined to mechanical construction, combination and design. He must combine those particular parts, so designed and shaped. He cannot combine old parts that produce old results.

Berliner stands in the same relation to the Bell patents of 1876 and 1877 as Jones stood to a patent issued to Smith. Smith obtained a patent on a machine for killing ducks. He combined a man, a gun and a dog, which made his machine; Jones combined a woman, a gun and a dog, which combination constituted his invention. The courts held Jones's patent to be void because the mere change of words, or a slight variation, did not constitute an invention.

DYNAMOMETER FOR STREET CARS.

A dynamometer car is to be used on the Chicago City Railway for track inspection. The idea originated with Superintendent M. K. Bowen.

Mr. Bowen's scheme is to register the dynamometer curve in dollars and cents so that a glance at the map will tell the total cost to the company in pulling a car over any part of the track.

Personal.

Mr. W. D. Packard, secretary and treasurer of the Packrad Electric Company, Warren, Ohio, was an Eastern visitor last week.

G. E. EXPLOITING WORK.

OBJECT LESSONS—THE CHARACTER OF ESTABLISHED STATIONS.

Samples of the Facilities Afforded to Local Enterprises.

[The Edison Company, to a small extent, and the T.-H. Company (the organization of which was mainly adopted by your company), to a greater extent, had been in the habit of doing more or less exploiting work, resulting in the acquisition of stocks and bonds of local lighting and railway companies. By the facilities which it had thus been able to afford to local enterprises it was enabled to expand its business.—*G. E. Company's Annual Report, 1894.*]

CHAPTER II.

TRIALS AND TRIBULATIONS OF A G. E. CENTRAL STATION MANAGER.

Reports of the Superintendent of the Austin (Minn.) Station.

Austin, Minn., Aug. 27, 1893.

C. R. Hyde.

Dear Sir: I have been trying some of these lamps with adapters, and find they are wholly unfit for any place. These adapters fit the lamp base so tightly that you cannot make contact with the pole piece of the adapter and the pole piece of the lamp. Only about one out of ten will work, so you see that I can do but little with these goods. Yours very truly,

W. S. PIERCE.

Austin, Minn., Sept. 13, 1893.

Geo. C. Duffie.

Dear Sir: Inclosed please find statement of the 2 cars of coal ordered the 2d day of August, not the last two cars. There are two cars on the track, just in, on which I paid the freight charges this morning with my personal check, amounting to $80.00. Please send check for this amount payable to either Arthur Cole, or as usual, and he will endorse and give to me, so I can get my money back. Yours truly,

W. S. PIERCE.

Robinson & Cary Company,
Railway, Mill and Miners' Supplies, Engines,
Boilers, Machinery, etc.
St. Paul, Minn., Sept. 21, 1893.

Austin Electric Light & Power Co.,
Austin, Minn.

Gentlemen: Kindly hand us payment $6.60, the amount of your invoice of July 17th last, so that the same may reach us not later than the 25th inst., and greatly oblige yours truly,

ROBINSON & CARY COMPANY,
By S. M. CARY.

Austin Electric Company.
Austin, Minn., Sept. 22, 1893.

C. R. Hyde.

Dear Sir: Please ship us 50 lbs. waste and 100 lbs. boiler compound. We can not keep our boilers from scaling with the kerosene. Yours truly,

W. S. PIERCE.

Austin Electric Company.
Geo. C. Duffie, Treasurer.
W. S. Pierce, Manager.
Austin, Minn., Sep. 29, 1893.

C. R. Hyde.

Dear Sir: Enclosed please find bills of time, for which please send check. I will see that enough has been collected to pay these checks before I give them to the parties. Yours truly,

W. S. PIERCE.

Austin, Minn., Oct. 13, 1893.

C. R. Hyde.

Dear Sir: I have been absent on a trip to the World's Fair, and returned this morning. I have before me a letter from R. G. Tobey, requesting me to send him the monthly reports of this station for the months of July and August. This is the first knowledge I have had that I was to send duplicates each month to the Boston office. Very truly yours,

W. S. PIERCE.

Austin, Minn., Oct. 18, 1893.

C. R. Hyde.

Dear Sir: We are low on carbons. Please ship at once 2,000 $\frac{7}{16}$″ plain carbons. Don't ship the T. & H. such as we had which caused so much trouble, but send the "National" if possible. The boys worked me on those tips or half carbons, because they are simply those poor carbons broken off.

Yours very truly, W. S. PIERCE.

Austin, Minn., October 23, 1893.

C. R. Hyde.

Dear Sir: I send you receipt for freight paid by myself on four cars of coal. Please send me check for the $160 and oblige, or make the check payable

to Arthur Cole and he can endorse and give to me.
Very truly yours,
W. S. PIERCE.

Austin, Minn., November 1, 1893.
Austin Electric Company, Dr.
To Barney Farrington.
Salary as first engineer for the month of October 1893.. $60.00

[It is evident from the above that Mr. Barney Farrington got his job back.—ED.]

Austin, Minn., November 10, 1893.
Austin Electric Company, Dr.
To W. S. Pierce.
For money advanced on company bills up to date:

Bills for July, 1893.

Voucher No. 1.........	$ 30	Voucher No. 7.........	$ 25
“ 2.........	75	“ 8.... ...	55
“ 3.........	1.25	“ 9.........	70
“ 4.........	20	“ 10..... ...	3.00
“ 5.........	1.20		
“ 6...	85		$8.55

Bills for August.

Voucher No. 11.........	$ 25	Voucher No. 18.......	$ 78
“ 12........	1.25	“ 19.........	25
“ 13........	1.30	“ 20.........	1.75
“ 14	65	“ 21.........	1.50
“ 15........	1.50	“ 22.........	1.30
“ 16........	55		
“ 17........	1.50		$12.58

Bills for September.

Voucher No. 23..	$ 30	Voucher No. 33.........	$ 37
“ 24.........	18.00	“ 34.........	1.62
“ 25	75	“ 35.........	5.42
“ 26.........	21.00	“ 36.........	1 30
“ 27.........	1.50	“ 37.........	30
“ 28	30	“ 38.........	3.00
“ 29.........	65	“ 39.........	3.34
“ 30.........	8.24	“ 40.........	2.85
“ 31.........	35		
“ 32.........	44.91		$114.20

Bills for October.

Voucher No. 41	$1 25	Voucher No. 64	$1.60
“ 42........	15	“ 65	6.51
“ 43	30	“ 66.........	2.00
“ 44........	30	“ 67.........	3.00
“ 45	3.96	“ 68.... ...	9.00
“ 46........	44.00	“ 69.........	20.00
“ 47........	6.00	“ 70.........	14 00
“ 48	60	“ 71.........	23.70
“ 49........	1.50	“ 72.........	9 00
“ 50	2.50	“ 73.........	15 00
“ 51........	1.50	“ 74.........	12.00
“ 52........	2.87	“ 75.........	9.00
“ 53........	95	“ 76.........	9.00
“ 54........	48	“ 77...... ..	9.00
“ 55........	43	“ 78.........	9.00
“ 56	30	“ 79	9 00
“ 57..	1.35	“ 80.........	3.00
“ 58........	2.00	“ 81.........	2.00
“ 59	3.23	“ 82	10.50
“ 60........	3.48	“ 83	30.00
“ 61........	2.35	“ 84.........	10.00
“ 62........	3 98		
“ 63...	10.50		$310.29

Bills for Novemb r.

Voucher No. 85........	$4.15	Voucher No. 96.........	$6.02
“ 86........	1.75	“ 97...... ..	52.00
“ 87........	51	“ 98	24 80
“ 88........	30	“ 99..	3.00
“ 89	6.56	“ 100.........	24 00
“ 90	2 39	“ 101.........	15.00
“ 91........	1.51	“ 102.........	8.50
“ 92........	5.00	“ 103.	11.50
“ 93	1.00	“ 101.	43.50
“ 94........	1.97		
“ 95..... ..	22		$213.68

Brought down, October	310.29
“ “ September	114.20
“ “ August......	12.58
“ “ July..	8.55
	$659.30
Railroad fare two trips from Austin to St. Paul and return.	11.80
	$671 10

Austin, Minn., November 10, 1893.
C. R. Hyde.

Dear Sir: Inclosed please find notice of expiration on insurance. Shall be in St. Paul Saturday. Want to see Duflie if possible. Have another scheme to lay before him relative to another contract with the city. Very truly yours, W. S. PIERCE.

Austin, Minn., November 1, 1893.
C. R. Hyde.

Dear Sir: Will hold checks till collections are made to cover the same. We are at work on the commercial circuit now. We can not connect up on switchboard till bank boards come. Very truly yours,
W. S. PIERCE.

Austin, Minn., Nov. 13, 1893.
C. R. Hyde.

Dear Sir: I found the company's account overdrawn only $9.90 at Citizens' Bank after paying the $70.00 check, and have covered the amount out of personal funds, and enclose duplicate deposit slip.
Very truly yours, W. S. PIERCE.

Austin, Minn., Nov. 17, 1893.
C. R. Hyde.

Dear Sir: Enclosed please find another deposit slip, which makes $20.00 I have put up at the C. N. Bank. This covers all checks and a little more I know of. Received the note for the money advanced on the street job, but not the back salary of $300. I supposed the company would send a draft for this last amount as I gave them time on the other. I made the first all-night run with street lights last night. Everything went all right and gave tip-top satisfaction. I shall reach out now for more commercial and resident lights. The dynamo we have will be unable to carry the load in a short time, and there is no way out unless we run both engines during the heavy load; *this means coal*, and hence there should be no time lost in getting a 1,000 light dynamo in place of one of these. Enclose some newspaper clippings which give an idea how the street lights are received by the public. This time of the year *takes coal* and makes us look down our noses. Very truly yours,
W. S. PIERCE.

Austin, Minn., Nov. 18, 1893.
C. R. Hyde.

Dear Sir: This all night business eats up coal like everything with this kind of a steam plant. This whole steam plant is an abortion from start to finish, and simply places on the company's shoulders the effects of the plans and work of a combination of a pack of fools. This station is heated with radiators, and these radiators are not connected with the exhaust steam but the live steam from the boilers. This is one instance of the economy planned in this plant. You will have to order 2 or 4 cars of COAL, because by the time it gets here we shall need it. *I can see no way by which this plant can make any money under present conditions. The outlook in the electrical industry to my mind is gloomy in the extreme.*

I have lost all the money I can stand in the cursed business, and don't propose to lose any more unless I am forced.

Now, then, I am reliably informed by one of the stockholders that the General Electric Company is preparing to dissolve or go into receivership.

The Northwest Company owes me one note of $2,200 and $300 back salary. It seems they make no effort to pay. I had the promise of the $300 from Mr. Levis while in St. Paul, but they slip out by saying I have been transferred to the Austin plant pay roll.

Strictly on the quiet, I wish you would give me the true facts why my salary is held back after advancing money out of my own funds to keep the business up. Just between you and myself personally I am red-headed, and unless some money comes my way in the near future I shall step down and out, and take radical measures to collect my due.

If the whole thing is going to crash, let the cross fall on those who have placed the company, and not on a weak cuss who has simply worked and obeyed orders. Let this letter be confidential and greatly oblige,
Very truly yours,
W. S. PIERCE.

Austin, Minn., Nov. 19, 1893.
C. R. Hyde.

Dear Sir: I am forced to hire one man extra for three or four days to help change transformers from all night to twelve o'clock circuit, but such a change pays vastly more than the expense comes to. We must exercise every means possible to save fuel, because the consumption for all-night work scares me nearly out of my boots. Expense must be cut down as low as possible. Very truly yours,
W. S. PIERCE.

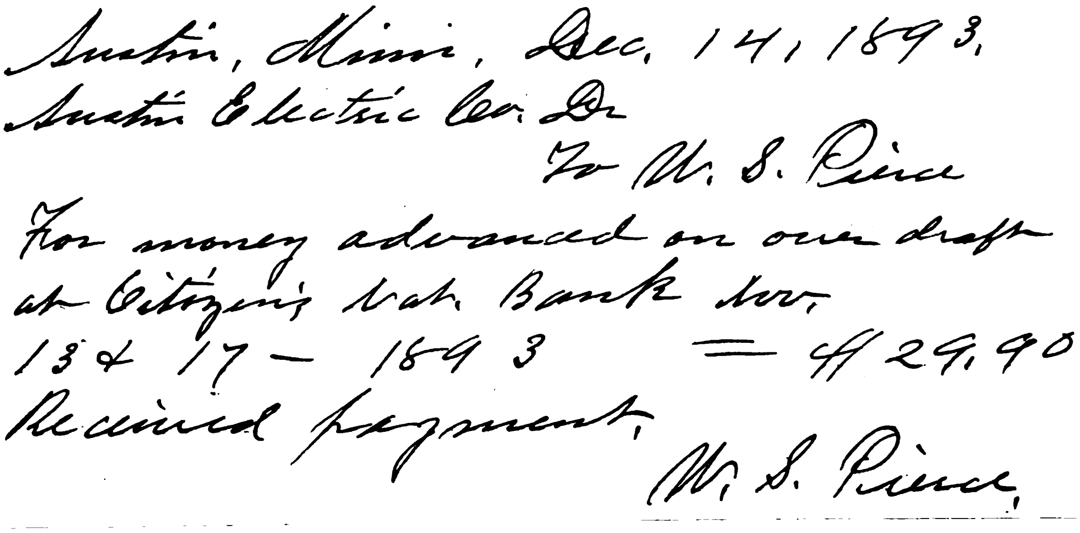
Austin, Minn., Nov. 22, 1893.
Howard C. Levis.

Dear Sir: While in St. Paul, I had but a few hours in which to do anything, because I had work here pressing a homeward march. After mentioning the condition of things here while in your office, I supposed I could go to the cashier and draw my salary up to Nov. 1st, but found only $75 placed to my credit, leaving $300 which I did not get. I advanced all the money for installing the street lights here, and in settlement got only a six-months note. This leaves me so I very much need my salary up to Nov. 1st, and in transferring me to the Austin plant account amounts to nothing because I have just advanced $30 more to that Co. to satisfy overdraft at the bank. I do not consider myself at work for the Austin Co., but for the N. W. Co. as before. When I came here I understood my salary was to be paid as before, and that I was here temporarily to bring about certain results. While these results are being realized, yet I cannot look to the Austin Co. for my pay, inasmuch as I have rendered them more aid now than is my duty, and inasmuch as this Co. has no cash at hand. If you will speak to Mr. Duflie or Mr. Hyde in relation to this matter, they will explain more fully than I can in this letter. Hoping to hear from you in the near future I remain
Yours very truly, W. S. PIERCE.

Austin, Minn., Nov. 30, 1893.
C. R. Hyde.

Dear Sir: Will make report of running supplies on hand promptly. One thing we have none at all on hand, and that is COAL. We are now running on borrowed coal. Please hurry up the last shipment. During the last two weeks there has been no end of trouble. First we tried to light the streets and supposed the tissue paper cutouts were all right. They did work well for a few nights, but all at once they cut out circuit after circuit till all the lights were out in spite of all the relief lamps we had. Then we fused up a little heavier, but they all went the same way again, breaking lamps and making lots of extra work and loss of light. We now have them fused with the right thickness of paper after several trials. Then again, the incandescent dynamo refused to generate, forcing me to take her apart. Found a lead wire grounded on the armature core. Have it repaired all right now. Next in line was the 50 light arc machine; while running all right she burned off a lead wire, and that had to be ripped up the back. Have that repaired all well and good. Next in order, our load was so heavy with the streets that our compound could not carry the load with 125 pounds of steam, yet our inspection certificate allowed only that much. I had the boilers tested for 135 pounds and now the engine carries the load. We can take on no more, however, unless we run both engines and that will not pay as the plant is now constructed. Will explain the reason why when I see you. Have worked days and nights for two weeks and a nearly dead. Have done nothing collecting yet. W try to get about that at once. In haste.
W. S. PIER

Better send a signed check blank so I can pay freight on coal promptly when it comes. I have money myself and the Co. still hold back the due for Sept. and Oct. salary.


Austin, Minn, Dec. 14, 1893.
Austin Electric Co. Dr
To W. S. Pierce
For money advanced on over draft at Citizens Nat. Bank Nov. 13 & 17 – 1893 = $29.90
Received payment,
W. S. Pierce

THE INEFFICIENCY OF THE DIRECT METHODS OF CONVERTING HEAT INTO ELECTRICAL ENERGY.*

BY LEON LE PONTOIS.

The production of electricity directly from heat is a problem which has occupied the attention of many able electricians. Could the enormous energy latent in coal and solar heat be made to appear as electric energy, by means of a simple transforming apparatus, more efficient and less cumbrous than steam or gas engines driving dynamos, there is no doubt that great progress might be accomplished thereby, and that one of those grand steps of progress would be taken of which the nineteenth century so justly boasts.

Unfortunately, it seems that there is no economical solution to the problem. Three quarters of a century have nearly elapsed since Seebeck discovered that by heating one of the junctions of a metallic circuit, consisting of two metals soldered together, an electric current was produced. The science of thermo-electricity thus originated has been developed by Becquerel, Pouillet, Pelletier, Mathiessen, Thomson, but these distinguished scientists and experimenters have never succeeded in producing an apparatus by means of which more than 2 per cent. of the heat energy could be converted into electricity.

Experiments have been made in another direction. Electricity has been obtained from heat by heating and cooling magnetic circuits in rapid succession, so as to modify their magnetic reluctance, thereby inducing alternating currents in coils surrounding such circuits. Thomson, Berliner, Edison, Tesla, have devoted some time to this mode of conversion, and although such ingenious apparatus as the pyro or thermo magnetic generator have been the outcome of their work, as far as we know the efficiency obtained by this mode of conversion has never been superior, if equal, to the efficiency of the thermopile.

Can these persistent failures be attributed to the fact that such distinguished experimenters and scientists have not as yet struck the right process of conversion, or must we come to the conclusion that after all the most economical solution to the problem lies in the construction of a more perfect heat engine driving the already highly efficient dynamo? My opinion is in favor of the latter mode of conversion, and I will endeavor to bring before you as clearly and briefly as I can a few of the reasons on which my belief is based.

Let us consider first the case of the thermo-electric battery. Here is one of a very simple construction; it consists of a bar of bismuth bent twice at right angles, at the ends of which are soldered two copper strips which terminate in two binding screws connected to a galvanometer. If one of the solderings is heated, the needle of the galvanometer is deflected, indicating the passage of a current from the heated to the cool junction; the deflection is greatly increased if the other junction is cooled at the same time.

Thermo-electric currents have long been attributed to an electromotive force produced by the contact of heterogeneous substances, a force which varies with the temperature. Becquerel ascribes them to the unequal propagation of heat in the different parts of the circuit. He found that when all parts of a circuit are homogeneous no current is produced on heating, because the heat is equally propagated in all directions. This hypothesis has been confirmed by many experiments showing that thermo-electric currents can be obtained in a monometallic circuit when a source of heat is applied between two neighboring points of the circuit under different atomic structure.

We will now attempt to show how the unsymmetrical propagation of heat waves along a metallic circuit is attended by the manifestation of electric force. But before going any further I beg leave to remind you of two strange facts of the thermo-electric science which are known as the Thomson and Peltier effects.

Thomson found that when a wire, which is the seat of unidirectional electrical disturbance, is heated, heat waves are not equally well propagated on both sides of the heated point; that is, the apparent conductivity for heat seems to be greater in one direction than in the other. This phenomenon shows that there is a close relation between electricity and heat. Indeed Hertz's experiments have demonstrated beyond doubt that light, heat and electricity, which have their origin in a vibratory motion of matter, are propagated by ether at an equal rate of speed. Moreover, Hertz has shown that an electrical disturbance, so improperly called "electric current," is not all propagated in the wire itself, but under all circumstances penetrates from without into the wire, and spreads into the metal with a comparative slowness. Now the electric force makes itself manifest by heating effects in the conductor, but more especially by a state of stress exerted in the medium surrounding the conductor, which stress is characterized by the magnetic properties exhibited by the medium.

The formation of this field of magnetic force is progressive, and is attended—while it takes place—with radiation of electric waves throughout the medium. Now, if the formation of magnetic whirls around the conductor characterizes these long ether waves known as electric waves, why should not the propagation of these shorter ether waves called heat waves, along a conductor, be also attended with the formation of magnetic fields of force in the surrounding medium?

It seems pretty well established that the only difference existing between electric waves and light waves is solely a question of wave length. Both are electro-magnetic disturbances. Why not extend this appellation to heat waves, which are much more likely to present the same characteristics as electric waves by reason of their wave length, being much longer than the wave length of light waves? It is very likely that these three apparently different forms of energy—light, heat, electricity—are endowed with the same capacity of exhibiting effects which we attribute exclusively to electricity. The only reason why they do not apparently possess the same electric capacity must be attributed to the fact that the bodies which we consider as conductors of electrical energy (because they prevent it being dissipated) present great resistance to the propagation of the rapid vibration characterizing heat, and an almost insuperable resistance to the more rapid vibration causing on our retina the sensation of light.

If we introduce this hypothesis in the study of thermo-electric phenomena, their understanding becomes absurdly easy. Let us take up, for instance, the case of the Thomson effect. A conductor AB is the seat of an unidirectional electric disturbance of direction AB. A source of heat—say a Bunsen burner—is applied in C. The propagation of heat waves on both sides of this point will be attended with the formation of two thermomotive forces equal and opposite. One of them will tend to decrease the original electromotive force, the other will tend to increase it. Whatever be the value of the original vector, as long as it is not zero, the thermomotive force of direction BA will be decreased, while the thermomotive force of direction AB will remain unaltered. Now, if the circuit is closed, it is obvious that the flow of heat energy in one direction will be greater than the flow of heat energy in the opposite direction. Thus heat is unequally propagated on both sides of the heated point.

The Peltier phenomenon is a consequence of the Thomson effect. When a current is propagated across the junction of two metals having different atomic structure, the junction is heated when the current is in one direction and cooled when it is in the other.

Let us consider two bars of antimony and bismuth, AB, soldered together in C. When a current is propagated in the direction AB, the bars become unequally heated on account of the resistance of antimony being greater than the resistance of bismuth. This causes a difference of heat potential between the two metals, and heat waves are propagated from the antimony to the bismuth. According to what we have seen previously, the action of the current tends to direct the largest part of the heat towards the soldered point, therefore its temperature is higher than the temperature of any part of the circuit. If now, the current is propagated in the direction BA, it can readily be seen that the result will be quite opposite, and that the point C will be the coolest point of the circuit. Allusion has already been made to thermo-electric currents produced when a circuit composed of two different metals has the two junctions unequally heated.

A variety of notions has been entertained by physicists as to the origin of thermo-electric currents. They generally have been attributed to an electromotive force produced by the contact of heterogeneous substances, a force which varies with the temperature. A few years ago, Dr. Oliver B. Lodge, the eminent English physicist, succeeded in a certain measure in demonstrating the probability of this hypothesis—in the particular case of a copper iron couple heated at some temperature below 275 degrees C. But the same hypothesis is not verified in many other combinations.

Becquerel ascribed them to the unequal propagation of heat in the different parts of a circuit. He found that when all parts of a circuit are homogeneous no current is produced on heating, because the heat is unequally propagated in all directions. But if uniformity of this is destroyed by coiling it in a spiral, or by knotting it, thermo-electric currents result from the unequal propagation of heat on both sides of the heated place.

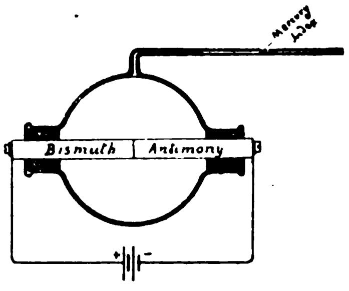


FIG. 1.—APPARATUS FOR DEMONSTRATING THE PELTIER EFFECT.

As, however, Becquerel employed a red heat in his experiments, it is possible that the current obtained was due to a softening of a portion of the wire, while the knotted portion retained its hardness.

I made an experiment which tended to prove this. I had a copper ring, about 10 inches in diameter, vertically mounted on a horizontal spindle. A little above the superior part of the ring a magnetic needle was delicately suspended by a silk thread and kept by the thread in the same place as the ring. A Bunsen burner and air blast were placed so as to heat and cool simultaneously the lower part of the ring. Thus a portion of the ring was softened while the other was hardened. If, now, the ring was slowly rotated on its axis, the intermediate portion was heated, and the deflection of the needle indicated that a current was circulating through the ring from hard to soft. After a few moments the needle would come back to its former position, but if the ring was slowly rotated the defection of the needle was kept nearly constant, and the angle of deflection was maximum for a certain speed, which was about 50 revolutions per minute—the angle of deflection increasing according to a parabolic function when the difference between the temperature of the hot and cool portions of the ring was increased.

I made some experiments with a view of increasing the efficiency of the apparatus. I used a series of rings 1-100 inches thick, coated with lampblack, and separated by small washers. The rings were mounted on iron spiders, and when they were set in rotation the spider and the shaft were very thoroughly magnetized—the plant efficiency was of course considerably increased, but the economical efficiency was practically the same; as in the former experiment, and as far as I could ascertain, it was about 1 per cent. or nearly so.

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* Paper read before the Engineers' Society of Western Pennsylvania.

This experiment seems to demonstrate that Becquerel's hypothesis is based on facts. The unequal propagation of heat in a metallic circuit may be caused by differences in thermal conductivity—by unequal decrease of temperature on both sides of the heated place. It may also be caused by differences in the specific heat of the two metals, or at two neighboring parts of the same metal, but whatever is the reason on account of which heat is unsymmetrically propagated on both sides of a heated point, it seems to me that the explanation of the phenomenon could be found in analyzing carefully these different causes.

I picture to myself what is going on inside a thermopile as follows: The propagation of heat waves on both sides of the heated point is always attended with electrical displacements in the surrounding medium which affect more or less the inside of the conductor. If the circuit is homogeneous, the resultant of the electric force inside the conductor is zero, but if such is not the case, the resultant is something different from zero, and an unidirectional electrical disturbance or current takes place inside the conductor.

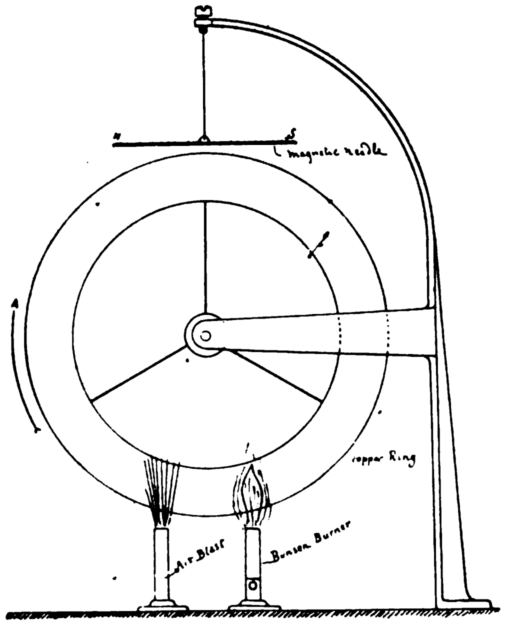

FIG. 2.—THERMO-ELECTRIC GENERATOR.

Now, it is obvious that the dissipation of a certain amount of heat energy in a thermopile must be attributed to a loss by radiation or convection, and to the absorption of heat energy in the atomic motions which determine the manifestation of electrical energy.

The thermopile may be considered then as an imperfect heat engine working between two temperatures, and its theoretical efficiency calculated as follows:

Let t and t_1 represent the temperatures of the hot and cold junctions; e the E. M. F. per degree Centigrade. The total E. M. F. will be represented in this case by $E = e\,(t-t_1)$ and the current by $C = \frac{e\,(t-t_1)}{R_1+R_2}$, R_1 and R_2 representing the internal and external resistances.

According to a well-known law of electrodynamics, the efficiency of a battery is maximum when the internal resistance is minimum. Thus in the particular case of the thermopile the efficiency depends directly on the specific resistance of the metals used. By looking over the following thermo-electric series, we can see that by choosing badly conducting metals, such as bismuth and antimony, or still better, bismuth, cobalt; potassium, nickel; sodium, lead; tin, copper; silver, platinum; gas coke, zinc; cadmium, strontium; arsenic, iron; red phosphorus, antimony, tellurium, selenium. With selenium and tellurium the efficiency is greatly increased; chosing non-conductors, it becomes enormous, but when we use non-conductors we cannot expect to excite currents flowing in closed circuits; we can only expect electrostatic forces.

It seems to me that the best way to treat the problem is to consider the case in which the external work done by the battery is maximum, and calculate the efficiency corresponding to that maximum; the maximum work of a battery is obtained when the internal resistance is equal to the external resistance, then we will have $W = \frac{e_2\,(t-t_1)^2}{2R_1} - \frac{e^2\,(t-t_1)^2}{4R_1} = \frac{e^2\,(t-t_1)^2}{4R_1}$ which expresses the value of the minimum work.

The internal resistance depends on the dimensions and the specific resistance of the bars constituting the battery.

Let r_1 and r_2 represent these specific resistances, and s_1 and s_2 the sections of the bars, having a length L, we shall have $R_1 = L\left(\frac{r_1}{s_1} + \frac{r_2}{s_2}\right)$.

The external work per second is, therefore,

$$W = \frac{e^2\,(t-t_1)^2}{4\,L\left(\frac{r_1}{s_1} + \frac{r_2}{s_4}\right)}.$$

Now let us compare this useful work to the energy wasted by the ordinary conductivity of heat along the bars.

If we represent by Q the amount of heat propagated and $r1^1$ $r2^1$ the thermic resistances of both metals, we have $Q = (t-t_1)\left(\frac{s_1}{r_1{}^1\,L} \div \frac{s_2}{r_2{}^1\,L}\right)$.

The amount of heat energy, furnished at a temperature t, which can be transformed into mechanical work by a perfect heat engine, working with a temperature difference $t-t_1$, is $\frac{t-t_1}{t_1}$. Therefore the heat lost per second will be in our case

$$\frac{J(t-t_1)^2}{t_1}\left(\frac{s_1}{r_1} + \frac{s^2}{r^1{}_2}\right),$$

J representing the mechanical equivalent of heat.

The relation existing between this wasted energy and the useful work is

$$\frac{4J}{te^2}\left(\frac{r_1}{s_1} + \frac{r_2}{s_2}\right)\left(\frac{s_1}{r_1{}^1} + \frac{s^2}{r^1{}_2}\right),$$

an expression which is absolutely independent of $(t-t_1)$ and of L.

The resistance being given, $\frac{s_2}{s_1{}^1}$ must be determined so as to make $\frac{s_2}{s_1}$ a minimum; this condition is fulfilled when $\left(\frac{s_2}{s_1}\right)^2 = \frac{r_2}{r_1} + \frac{r_2{}^1}{r_1{}^1}$; thus the expression giving the efficiency corresponding to the maximum work becomes $\frac{4J}{tL_2}\left(\sqrt{\frac{r_1}{r_1{}^1}} + \sqrt{\frac{r_2}{r_1{}^2}}\right)^2$.

I have applied this formula to the case of german-silver iron couple, and found for the value of the efficiency corresponding to the maximum work, 1.358 per cent. Of course, I do not give this value as being absolutely correct, for the exact determination of the specific resistance is an extremely difficult operation. However, I believe that this value is about correct, for I have made similar measurements on a copper iron couple and obtained nearly the same results.

Two characteristic figures enable us to compare the efficiency obtained by the direct method of conversion through the thermopile and the efficiency obtained by driving a dynamo by means of a gas engine. The Clamond Carpentier thermo-electric battery, which is recognized as being the most efficient, consumes 25 cubic meters per kilowatt hour. A good Otto gas engine driving a dynamo spends about 1.35 cubic meters per kilowatt hour. Hence the thermo-electric battery, to produce an equal quantity of available electric energy expends nearly eighteen times as much heat energy as the gas engines directly driving the dynamo.

(*To be continued.*)

A MODERN BRITISH ELECTRIC LIGHT STATION.*

BY H. R. J. BURSTALL.

The Edinburgh municipal plant was finally opened on April 11, 1895. Having regard to the different districts to be served, and taking into account all the local circumstances, a low-tension three-wire system was adopted for the central and northern district, and an alternating-current high-tension system for the southern and eastern district, both systems being worked from one central station and under the same control and management.

The boiler house is designed to contain seventeen boilers, of which at present only six at the west end are in place.

The boilers are of the dry-backed marine type, each 10¼ feet mean diameter and 12 feet long, with two Purves flues, 3¼ feet inside diameter, and 166 tubes of 3 inches internal diameter.

On the top of the boilers are fitted superheaters, each consisting of two nests of tubes enclosed between the top of the boiler shell and a fire-brick casing above, with a space left in the center for the steam-valves, safety-valve, etc. Sinclair's mechaniical stokers are fitted to each boiler, and are worked from two lines of shafting, which are carried by the columns of the boiler house and driven by an electric motor.

The pump room contains at present one duplex steam-pump and two three-throw pumps driven electrically; each pump has a maximum capacity of 4,500 gallons per hour. The electrically driven pumps are specially designed to run with a large range of speed; and for this purpose can be connected with either the 230-volt or the 115-volt mains. In the pump room is placed the electric motor for driving the mechanical stokers with its countershaft; and there is ample space for more pumps when they are required.

The engine rooms are each about 102 feet long, and are side by side, forming really one room divided by a line of columns. The engine room next the boiler house is reserved for the low-tension plant, the other contains the high-tension plant. A platform, raised 4 feet above the engine-room floor-level, runs the whole way across the west end of both engine-rooms, and on this are placed the switchboards and regulating gear for both the low and high tension systems, as well as the office of the engineer on watch.

The machinery at present in the low-tension engine-room consists of eight engines, four of 100 I. H. P., two of 250 I. H. P., and two of 360 I. H. P., with their dynamos; and provision is made for eight more engines of 360 I. H. P. in the future. All are Willans central-valve engines driving their dynamos direct. All the dynamos are two-pole shunt-wound machines with drum armatures, all wound to give 270 volts, except two which are driven by two 100-I. H. P. engines; these two are wound to give 135 volts, being used as balancing machines on the three-wire system.

An 8-ton traveling crane, running the whole length of the engine block, is provided in each engine-room, for convenience in overhauling, etc. These cranes are worked entirely from below by means of ropes.

The main leads from the dynamos are drawn through curved wrought-iron pipes let into the concrete, into chases in the center of the engine foundation-block, along which they are carried to the chamber under the switchboard platform. The leads from the field winding of the machines are also carried in the same manner to their regulating resistances, which are placed under the platform; the switches for these resistances are fixed upon the handrail on the platform, in front of the switchboard, the leads from the resistances being brought up through the posts of the handrail.

The switchboard consists of seven slate panels each about 7 feet high. The instruments and gear for regulating the battery are mostly placed on the center panel, and those for the switching and manipulation of the dynamos and feeders are on the six outer slates; the connections for the positive side of the system are on the left hand, those for the negative on the right, and the middle wire is connected on the center panel.

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*Abstract of paper read before the Institution of Mechanical Engineers in London, Oct. 24, 1895.

BALANCING MACHINES.

The foregoing description applies only to the high-volt machines; the connections for the balancing machines are somewhat different. The leads for each of these dynamos are connected—through fuses, ampere meters and automatic switches, as for the high-volt machines—to two contacts of a double-pole switch on the center panel, and can be connected alternatively with two of three contacts, one of which is connected to the middle wire and the other two to dynamo bars on the positive and negative sides of the switchboard respectively. Thus each balancing machine can be put between the middle wire and either the positive or the negative side of the switchboard. These machines are run in exactly the same manner as the high-volt machines, and the whole of their regulation is done from the switch platform.

In the circuit of each dynamo is a registering ampere-hour meter, from which are taken readings whenever the machine is started and stopped; and the station records of the units generated are made up from these readings. Voltmeters are provided, which can be connected to the terminals of each dynamo by means of multipolar switches; other voltmeters are also connected, so as to show the electromotive force between any of the omnibus bars on the positive and negative sides and also between the omnibus bars and the middle wire. A pair of voltmeters are fixed on the upper part of the center slate, and are connected through multipolar switches so as to show the pressure between the middle wire and the positive and negative wires respectively at any feeding point on the system; and for this purpose light wires are brought back from the feeding points. The switchboard attendant is thus able to know directly the electromotive force on the distributing mains and regulates the electromotive force at the switchboard so as to keep this constant.

The two lower horizontal omnibus bars can be connected by plugs to any feeder or any dynamo; by this means it is possible to run any feeder or feeders at a higher or lower electromotive force than the others, should occasion arise. The same two bars are also used for testing, and for the introduction of standard instruments into the circuit of any feeder, dynamo or battery, for the purpose of checking or calibrating the switchboard instruments without breaking any permanent connections or running the circuit on temporary connections. The instrument or standard resistance, etc., is connected between two of the omnibus bars, and the dynamo or feeder, etc., is plugged on one of the lower omnibus bars; the current passes through the resistance, etc., to the top bar, which is on the outside circuit. In the actual running of the station considerable use is made of these spare omnibus bars.

The battery consists of 132 cells of the new Crompton-Howell 31-plate type. It is arranged in two tiers on four rows of stands, which are of cast-iron with wooden longitudinal bearers, carrying the cells; the eight hospital-cells are arranged on separate stands. All the cells are similar, and have each a nominal capacity of 1,000 ampere-hours, the normal rate of discharge being 200 amperes. They are contained in lead boxes, and stand on glass-oil insulators upon the longitudinal wooden bearers.

The high-tension portion of the station consists at present of only two engines and alternators with their switchboard, and the rectifiers for arc-lighting with their regulating arrangements and switchboard; but in the immediate future this plant will be considerably extended. Each of the alternators is driven direct by a Willans three-crank engine of 150 I. H. P. on the same bedplate. The alternators are of the "Portsmouth" type, with some modifications necessary owing to their increased speed of 450 revolutions per minute. The exciting current is taken from the low-tension switchboard at 230 volts, and is only a few amperes. The alternators work at an electromotive force of between 2,000 and 2,200 volts with a frequency of 52½ complete alternations per second.

The switchboard is built up of slabs of slate, forming shelves projecting from the west wall of the engine-room, and divided up into compartments for each alternator and circuit by slate partitions. The outer pole of each circuit and each alternator is connected to an earth plate at the station, the whole of the rest of the system being insulated from earth; owing to this arrangement all the switching can be done on the inner pole, which renders the switchboard and its manipulation very simple. The inner pole of each alternator and each circuit is connected to two similar switches through ampere meters and fuses, and can by these switches be connected to either or both of two omnibus bars at the top of the switchboard. In this way any alternator and any circuit can be connected, and the system can be worked at two different electromotive forces if necessary. The primary object of this arrangement, however, is to enable a machine to be thrown into circuit rapidly by running the machine up to full volts on one omnibus bar, and changing circuits over from the other omnibus bar, on which the other machine is running, without having to synchronize the second machine; the two omnibus bars can then be synchronized, the alternator and circuits changed over at leisure, and all the circuits and alternators run in parallel. In the outer circuit of each alternator is connected a registering watt-hour meter for measuring its output. Voltmeters are connected between both of the inner omnibus bars and the outer omnibus bar; and duplicate synchronizing transformers with lamps and switches are provided between the two inner omnibus bars. In the exciting circuits are ampere meters and regulating resistances, the switches of which are placed opposite the switches and ampere meters of their respective machines. At present the switchboard is arranged for only two alternators and two circuits; but it can be readily extended when required, the gear for new circuits extending in one direction and that for new alternators in the other. The two circuits are at present connected only to the rectifiers for arc lighting.

Opposite to the alternators, and standing on the same foundation block, are placed the Ferranti rectifiers for the series arc lighting. These are three in number, one for each of the two circuits and one to spare. They each consist of a self-regulating transformer, of which the primary winding is connected to the omnibus bars of the high-tension switchboard, and the secondary winding is connected through a commutator and distributing switchboard to the arc lamps. One winding is hung on knife-edges in a frame, and is capable of movement nearer to and further from the other; this automatically keeps the current in the secondary winding constant at 12 amperes, varying the electromotive force to suit the number of lamps in circuit. The current from the secondary winding of the transformer is then changed, by a commutator driven by a synchronous motor, from an alternating current to a unidirectional pulsating current, which is distributed to the lamps. A small distributing switchboard is placed close to the rectifiers, by means of which any rectifier can be put on to either of the high-tension omnibus bars, and either circuit of arc-lamps can be put on to any rectifier; and provision is made on this switchboard for extending the number of arc-lamp circuits.

In the engine room the low-tension plant comprises eight Siemens dynamos; two have each an output of 450 amperes at 135 volts; two of 220 at 275; two of 600 at 260, and two of 865 amperes at 260 volts. The contractors for the engines, dynamos, steam and exhaust piping, feed-pumps, heaters, etc., were Messrs. Siemens Brothers & Company, who also supplied the switchboard and all connections. The high-tension plant in the engine room consists of two alternators, each having an output of 40 amperes at 2,100 volts, a high-tension switchboard, and three rectifiers for arc-lighting, with switchboard. The contractors for the whole were Messrs. S. Z. de Ferranti.

In the three-wire system of distribution for the northern and central district the electromotive force between the two outer conductors, positive and negative, is 230 volts, while that between the middle and the positive or negative is 115 volts. The latter is the electromotive force of the lamps on the consumers' premises, no trouble being now experienced in obtaining glow-lamps to work at this electromotive force, or even higher. All three wires are laid in those streets where the demand for current is large. In the other streets the positive and middle wires are laid on one side of the street, the negative and middle on the other; and a spare way is left on each side for a third conductor should the demand require it. The distributing mains are all in parallel, and are connected up throughout the system; rings are completed wherever possible, so as to ensure equality of pressure, and to admit of disconnections being made without interrupting the supply.

The feeders from the station are connected to the distributing mains at sixteen points. They consist of two conductors only, the positive and negative; the middle wire is interconnected throughout as much as possible, and is brought back from three districts on the system. The cables are put in parallel at the station, and one connection only is made to the switchboard. The positive and negative sides respectively of all the feeders are put in parallel at the switchboard, but any feeder or feeders can be put on a separate machine if required.

As far as possible, consumers in each street and district are balanced against one another by connecting them alternately between positive and middle wires and between negative and middle wires; large consumers have all three wires taken into their premises, and their lights balanced against one another in a similar manner. But however carefully this balancing is done it is impossible to get a really accurate balance; the "out of balance" current varies from hour to hour and even from minute to minute, and is different on different days of the week. The amount out of balance is compensated for at the station by means of the balancing machines, one of which can be put on either side of the system; the balancing during the light load is done from the battery alone. Light wires, forming potential leads or pilot wires, are brought back from all three conductors at each feeding point, and are connected to the feeder voltmeters on the switchboard; so that the pressure at the feeding points at any part of the system is directly known at the station, and the necessary regulation made for keeping the electromotive force constant. The distributing mains are brought back to the station, but are used only for the supply of light and power there; no regulation is done on the mains anywhere, except to the feeding points.

No high-tension feeders or distributing mains have yet been laid. They will be laid as concentric cables in ring circuits, and banked transformers in small sub-stations will be used wherever advisable, while houses in districts where the lighting is scattered will be served by isolated transformers. The concentric cables will be pulled into Doulton stoneware casings under the footways, and into cast-iron pipes under the roadways. The casings have already been laid in those streets which have been opened up for the low tension mains, and the work of laying the high-tension mains in the southern and eastern district is now being proceeded with.

The streets are lighted by means of 176 public arc lamps. In some streets the arc lamps are run four in series off the distributing mains; and each series of four is provided with a fuse, switch and line resistance. Each lamp in the series is also provided with an automatic device which, in the event of the lamp failing, cuts it out and introduces into the circuit a resistance equal to the lamp, so that the other lamps in that circuit are not affected. The lamps in Princes street are constructed for a normal current of 15 amperes, and all the other low-tension lamps for 10 amperes.

In certain streets, in which no low-tension mains are laid, the lamps are run on special high-tension series circuits from the rectifiers at the station. There are at present two series circuits, both of which are laid in all the streets lit by high-tension lamps, and the lamps are connected alternately to each circuit. The circuits are laid as concentric cable drawn into cast-iron pipes, the outer conductor of the cable being insulated. There are twenty-four lamps on each circuit, each provided with an automatic cut-out in case of its failing to act, and also with a switch in the pillar, by which it can be entirely disconnected from the circuit if necessary, while the switch is so made as to complete the circuit for the other lamps.

In arranging the circuits for the arc lamps care has been taken to put alternate lamps on separate circuits in all streets, whether run from the distributing mains or from the series circuits. This minimizes the risk of any street being left in darkness by the failure of any circuit, and also allows half the lamps to be switched off at or about midnight, still leaving the streets well lighted. The arc lamps are of Crompton-Pochin type, and are fitted with 18-inch spherical globes. They hang from the bracket of a cast-iron pillar, the center of the globes being 23 feet above the level of the pavement. In Princes street the lamps are about 45 yards apart and are on one side only of the street. In the other parts of the city the lamps are about 60 yards apart and are placed alternately on the two sides of the street.

THE APPLICATION OF ELECTRICITY TO THE SEWAGE PROBLEM.

Professor John W. Langley has been conducting at the Case School of Applied Science, Cleveland, elaborate experiments on the application of electricity to the purification of sewage. At a meeting of the Cleveland Council of Sociology, held on the 8th inst., he read a paper giving the results of his experiments and investigations.

"The members of the public are quite familiar," said Professor Langley, "with the uses of electricity as a source of light and power, but they have not had their attention called to its uses as a chemical agent. This, too, is a growing field for its employment in electro-metallurgy and in the production of alkali. One of the newest and perhaps one of the most general interest is a proposition to utilize the decomposing power of electricity for the destruction of bacteria and noxious odors, particularly in that fluid which is pre-eminently rich in them—sewage."

Referring to the practical results that have already been accomplished, Professor Langley said:

The plan was first tried in the village of Brewsters, N. Y., which is situated on the watershed of the Croton supply to the city of New York. The drainage from this town found its way into an adjacent marsh and from there into streams running into the Croton basin. An electrical engineer by the name of Wolf proposed to decompose sea water by electrolysis, and to turn the solution of chlorine thus obtained into the drainage from the village. The plan proved to be completely successful, as shown by a report issued by Dr. Cyrus Edson, Health Officer of New York, in 1892 and 1893. By an expenditure of a little over five-horse power to work a dynamo, the sewage was completely disinfected at an estimated cost of less than 1 per cent. of that of the older methods using chloride of lime or carbolic acid.

The next important trial of the new method was in the city of Havre, in France, where it is known as the Hermite process from the name of the inventor, who, in Europe at least, is considered to be the originator of the idea. After an extended trial of the system a commission appointed by the Mayor of the city made a lengthy report, establishing the following points: First—The method is cleanly, practical, and easily carried out. Second—When the disinfecting fluid is allowed to lie a sufficient time in contact with the sewage the bacteria are completely destroyed, none of them survive. Third—An amount of free chlorium one-half a gram to the litre of sewage accomplishes complete disinfection. Fourth—The process as worked at Havre, with the price of coal and wages there prevailing, seems slightly more expensive than the older methods by chemical precipitation, but this might be remedied by further experience.

The next important installation is in the city of Ipswich, in England, where it is now being applied to the entire sewerage system of the town, and with complete technical success if we may judge from a report which appeared last summer in the London journal *Lightning*.

The process consists in pumping sea water or an artificial brine made from salt through tanks in which are placed electrodes supplied with current from dynamos. The chlorides of magnesium and sodium in the sea water are decomposed into alkali at one pole and free chlorine at the other. The latter dissolves in the water and becomes the disinfecting fluid, which is then turned into the sewers or is delivered to tanks in which the sewage is temporarily arrested. The disinfecting fluid itself is colorless and has only a moderate odor of chlorine, while the alkali formed in the decomposition of the salt greatly lessens the corrosive action of the chlorine on metal pipes.

In order to give a scientific basis on which to make estimates of the cost, I have made in the electrical laboratory of the Case School of Applied Science numerous experiments, using an artificial sea water which practically represented the real article. Small decomposing tanks were made after the pattern of the large ones, and the electrical energy used was carefully measured. From these it appears that six and thirty-seven-hundredths pounds of chlorine can be made every hour from one electrical horsepower. This quantity, using the Havre estimate, would purify over fourteen thousand gallons of sewage per day of ten hours. A hundred horse-power would therefore disinfect nearly a million and a half gallons in the same time. The cost of the process will be but little more than the cost of electricity, plus that of pumping the sea water and the small additional amount for wages. These can be approximately estimated at twenty-five cents for 1,400 gallons when carried out on a scale of 500 horse-power. Taking the wholesale price of bleaching powder, its cost to do the same amount of disinfection would be at least twenty times as great. For inland cities the cost of salt would have to be added, but even then the expense would still be much below that of bleaching powder.

This method is one especially adapted to hospitals and large public buildings. No special electric installation would be necessary for buildings already wired for light or power, since a moderate amount of current could be drawn from them. The salt water could be decomposed in moderate sized tanks placed on each floor, and allowed to run into the drain system in small quantities either automatically or by hand regulation. Thus this cleanly and practically inoffensive fluid would fill the traps of the various sinks and basins, and so disinfect all the material while it was yet within the building and before it reached the city sewers.

American Institute of Electrical Engineers.

The 101st meeting of the Institute will be held at 12 West 31st street, New York, on Wednesday, November 20th, at 8 o'clock P. M.

The meeting will be devoted to a topical discussion on "Storage Battery Applications."

Several members, having had experience in this field, have expressed their intention of giving their views, and communications on the subject have already been filed by Messrs. Arthur E. Childs and C. L. Edgar, of Boston; Dr. F. B. Crocker and Mr. Nelson W. Perry, of New York City, and Mr. Carl Hering, of Philadelphia. It is the wish of the Committee on Papers and Meetings that all members who can contribute something of interest on this occasion should send in communications in case they cannot be present.

A similar meeting of Western members will be held the same evening, Wednesday, November 20, at 8 P. M., in the rooms of the Western Society of Engineers, 1737 Monadnock Building, Chicago. The California members will also discuss the subject the same evening.

THE DEPARTMENT OF ELECTRICITY AT THE ATLANTA EXPOSITION.*

If asked to specify the notable features with which the Atlanta Exposition may hereafter stamp itself on electrical history, the writer would be inclined to name electrical transmission over long distances and in factories, and the further differentiation of important classes of work in the department of lighting, heating and intercommunication. The advance in these respects from 1893 to 1896 is thus again individualized just as political evolutions are by successive Presidential terms or the tenure of European monarchs. Those who are intimately familiar with the electrical advances know that the recent three lean years of national depression have been singularly fruitful in valuable innovations and improvements which, perhaps, the reckless disregard of economy manifested in the flush days of prosperity might have left in obscure neglect. As a corollary to this higher refinement and better engineering has come a lower range of prices for apparatus, so that equipments shown at Atlanta may be purchased for prices that would have seemed incredibly low at Chicago in 1893. This again means a boon to the inspecting public and a further popularization of electrical arts and appliances. . . .

MR. LUTHER STIERINGER.

In the case of buildings and grounds, the true principle is to outline and accentuate against the dark background of the night. Thus the imagination is given a chance, and this freedom is pleasant to all intelligent minds. The contour of the landscape is caught, the contrast of light and shadow is agreeably heightened, the expenditure of energy for the given result is minimized, and the spectator whose eye is not stunned or dazzled moves about with serene disposition, the rest given to the optic nerves being felt by the body as a whole. It may be said that success in this respect must depend largely upon artifice. It does, but not of the kind which betrays itself. The artist in light looks upon any subject just as the painter does upon a landscape. He has to compose a perfect picture by means of the disposal of illumination, and he must be judged by the resultant harmonious whole. For example, to erect huge towers and masts for lamps outside buildings would inevitably dwarf the structures. To make each building a blaze of light would blot out the grounds. A sea of light in the paths and lawns would reduce the buildings to islands of darkness; so that the study of interaction, distribution and diffusion becomes for a lighting expert not only a severe problem but a fascinating and absorbing pursuit. In dealing with questions of light for strictly utilitarian purposes, means must be adopted quite different from those that promise success in spectacular displays, but the result is ever a matter of guess-work. The experiment is much the same as the firing of modern heavy artillery; each shot is so costly and so irretrievable when fired, that native genius and prayerful study must be taxed to the full in advance to insure the hitting of the mark. Let the reader of these words, for example, give a few minutes to the lighting of the grounds and buildings as a matter of plan. Be his approval or criticism what it may, he will see at once how extremely difficult it would have been to change this plan after adoption, and, therefore, how much experience and thought must necessarily have gone *into it in* advance.

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*By Luther Stieringer, E. E., Consulting Electrical Engineer of the Exposition.

. . . Before proceeding to touch on other ex*hibits*, it may be noted that the electrically luminous twin fountains "Atlantis" will embrace water designs of endless variety, including the untried novelty of a "mist bank," supplemented by the hardly less new forms of lily jets, geysers, wheat sheaves, ring curtains and parabolas. The lighting will be done by means of 24 projectors, each of which focuses a beam of light of not less than 250,000 candle-power. The hydraulic part is on an equally imposing scale, water being furnished to the fountains at 100 pounds pressure through a 24-inch main with a capacity of 15,000 gallons a minute. The fountain island is about 100 feet in length by 50 in width, and its jets will shoot to an altitude of full 150 feet.

The Atlanta Exposition will, in the domain of industrial electric lighting, emphasize as with the punctuation of a full stop the close of a most notable period of electrical controversy, namely, that as to the superiority of the direct or the alternating current.

Another point to emphasize is the fact that much of the series arc lighting has succumbed to the use of arc lamps on the direct current incandescent circuits, which, as Atlanta will show, thus combine on one set of wires arc lamps, incandescent lamps, motors and heating appliances. Where series arc light holds its own, economically, it is done by abolishing the small arc machines of 25 or 30 lights shown so profusely several years ago as beau ideals at the Philadelphia Electrical Exhibition and by adopting dynamos that will carry as high as 150 arc lights. Expositionally speaking, the demonstration of this new class of work will date from Atlanta.

As the direct current still maintains its sway and dignity in the field of lighting, motor work and the operation of the ubiquitous trolley car, and is facile princeps in the art of distribution, so the alternating current has found its special and peculiar field in transmission by the electrical utilization of large or remote water powers. The gaze of the world is fixed on Niagara, but since the Chicago Fair a great many plants of similar interest have been put in successful operation.

The storage battery has one of its happiest exemplifications in the electric launches, and the Atlanta exhibit will, commercially, be worthy of observation. The ingenious inventor can make his opportunity here and be very welcome. The storage battery has, until very lately, been the spendthrift and black sheep of the electrical family. Barely now has it reformed, and the road is long that it has to travel before capital can be freely drawn out for its exploitation as it was after the Paris Electrical Exposition in the early '80s. But what there is good of it is to be seen at Atlanta, and the result is far better than any of us dared anticipate before the fleet at Chicago had carried its 1,000,000 passengers with such remarkable success. Visitors to the Fair will note the absence of storage battery railway work—a branch that once was watched and nursed with the liveliest expectations.

Electricity has hitherto been peculiarly the enjoyment of the dweller in the city. May we not hope for the demonstration at Atlanta, choice center of one of the finest raw material portions of the whole world, that electricity is now to be tamed for the service of the farmer?

The second of the suggestions it is desired finally to make is that electricity belongs to no man. Rich as it is in countless beautiful inventions, its unpreempted auriferous soil has scarcely been scratched. Morse and Edison, Brush and Tesla, Bell and Gray, Thomson and Sprague—great as their ideas and discoveries have been, are but exemplars and sign-posts for the younger men who must come after, and of whom the South must furnish its quota.—*Dixie*.

When the Russian squadron came over to participate in the naval display in New York Harbor and Hampton Roads on the occasion of the Columbian festivities in 1892 the Grand Duke Alexander, who was with the fleet, took a great fancy to the electric launch that had been provided as part of the equipment of the United States ship New York. Through the courtesy of this Government the Grand Duke was permitted to purchase this launch. Grand Duke Alexander took his new acquisition back to Russia with him, and it proved to be a source of envy to all who saw it, not excepting the Emperor himself, who has, through the naval attache of the Russian Embassy at Washington, invited bids for an electric boat.

LEGAL NOTES.

RECEIVER FOR THE LOUISIANA ELECTRIC LIGHT COMPANY.

The United Electric Securities Company Wins.

Judge Pardee of the United States Circuit Court at New Orleans has appointed George Q. Whitney and Gen. A. S. Badger receivers of the Louisiana Electric Light Company.

The United Electric Securities Companies of Portland, Me., filed last summer a bill alleging that the Louisiana Company was insolvent, and making very sensational charges of mismanagement by its directors and of malversation of the huge amounts it received for lighting the city. Temporary injunctions were granted and a hard fight was made by the Louisiana people to continue in control.

The American Loan and Trust Company, holders of $670,000 worth of Louisiana Electric Light bonds, have filed a bill in equity asking injunctions restraining Maurice J. Hart and Ronald T. McDonald from disposing of $200,000 worth of Edison Electric Light Company capital stock, which is one of the principal assets of the defendant company.

Marcus C. Gormley has filed a bill in the Circuit Court asking for a receiver for the assets and franchises of the General Electric Street Railway Company of Chicago, and also to cancel a quantity of stock which he says has been issued to various persons.

The Siemens & Halske Company have prepared a series of suits for infringement against a large number of electrical lighting and railway concerns, involving a large sum of money. The patent at issue is on the direct-current booster.

Chief Justice Beasley of the New Jersey Supreme Court has handed down a decision in the case of the Pennsylvania Railroad Company's appeal from the State Board of Taxation in the matter of the taxing by Atlantic City of a trolley line within the city limits. The Court holds that the tracks, ties and like property of the company must be assessed by the State Board of Assessors, but that the electric cars, equipment, electric plant and other property pertaining to the electric railway shall be assessed by local assessors.

Judge Waddell, of West Chester, Pa., on the 12th inst. decided that the city of Chester could not enter into a contract for lighting the city with the Beacon Electric Light Company, and made the injunction perpetual restraining the city officials from entering into such a contract. This action grew out of an attempt of councils to award the contract for lighting the city for five years to a new company at a saving of some $16,000. The Chester Electric Light Company, which has been furnishing the light, asked for the injunction on the ground that the city could not enter into such a contract unless the money was appropriated to pay for the same at the time the contract was signed. The case will be appealed.

THE MICROPHONE QUESTION.

To the Editor of ELECTRICITY.

SIR: Is there really any meat in the "constant contact" chestnut?

Prof. Bell had demonstrated, and published as early as March 7, 1876, that an "undulatory current" was required in the transmission of speech.

In his anticipation of a battery transmitter, in his patent, the intention to have an unbroken circuit is unmistakable—in fact the battery circuit could not be broken by any possible vibration of the diaphragm. This patent was issued fifteen months before Berliner's original application, to say nothing of his subsequent "constant contact" amendment. It was a matter of common knowledge among those skilled in the art at that time that an "undulatory current" could not be produced by broken contact.

Prof. Bell's description of the current required was most perfect "undulatory." If it means anything it means an unbroken current of variable strength. With this to guide them, every early experimenter worked on this line. I do not know of a case where the early descriptions and models do not plainly indicate "constant contact," even if not so worded in the claim.

Edison certainly knew that "undulations" could not be produced by breaking the circuit, and that an intermittent current could not be "undulatory."

In his patent No. 474,230, application filed April 27, 1877, thirty-eight days before Berliner's original application, in Claim 1 he says: "The contiguous faces of said disk and diaphragm being in contact." Too bad he did not say "constant," though the device plainly says it and does it. In Claim 2 he says: "Both having broad surfaces in vibratory contact with each other." Is the English language so flexible as to admit of construing "vibratory contact" to mean vibratory separation? I think not.

I never thought or heard of transmitting by means of broken contact until some years later, when it was attempted to evade the Bell patent by using intermittent instead of undulatory currents. This failed, of course, for two reasons—first, because it did not evade the Bell patent, and second, because it could not be made to work well, as anyone might know who had heard his correspondent talk too loudly in a Blake transmitter.

A. BLAKE.

BOOK REVIEWS.

THE ELECTRICAL TRANSMISSION OF ENERGY. A Manual for the Design of Electrical Circuits. By ARTHUR VAUGHAN ABBOTT, C. E. 567 pages, with 7 curve sheets in pocket. Cloth, 8vo. Price, $4.50. New York: D. Van Nostrand Company.

This work is the first comprehensive attempt yet made to collect together the innumerable details of which it treats. It is truly, as the author calls it, a manual, and as such will doubtless find its way most extensively into the class room.

From the title one would be led to suppose that its chief aim was to lay before the reader the various transmission questions. This it does with sufficient fullness in a descriptive way, but its scope is rather the laying out of circuits than the transmission of currents.

Happily it is by no means a mathematical treatise, only such mathematics being used as is required to show in true relation cause and effect and to enunciate laws. By this means the author has very widely enlarged the usefulness of the work, for there is no one engaged in line construction who cannot understand, nor any one who will not benefit by the possession of the work.

The book is divided into twelve chapters with the following titles:

I—Introduction, which discusses distribution in general, in series, parallel, mixed systems and indirect distribution. II—The Properties of Wire: The Conducting Circuit, Wire Manufacture, Hard Drawing, Wire Gauges, The Circular Mil, Insulated Wire, Testing and Inspecting, Wire Specifications, Tension of Aerial Lines. III—The Construction of Aerial Circuits; this is divided into three heads, viz., General Line Work, Electric Railway Circuits and Lightning Arresters. IV—Construction of Underground Work: 1, Conduits; 2, Cables and Conduit Conductors. V.—Electrical Instruments. VI—Methods of Electrical Measurements. VII—Continuous Current Conductors; *a*, Conductors and Insulators; *b*, Heating of Conductors. VIII—Conductors for Alternating Currents. IX—Series Distribution. X—Parallel Distribution. XI—Miscellaneous Methods and Long Distance Transmission. XII—The Cost of Production and Distribution.

Scattered throughout the work are almost innumerable tables referring to the subject under discussion, and one possessed of this book need scarcely look elsewhere for anything in this line that he may need.

A chapter which will be particularly appreciated by a very large number of people is VIII, on Conductors for Alternating Currents. In this the subject is most fully treated and the methods of calculating them given. Three of the pocket-sheets refer to this subject.

Chapter XII, treating of the cost of production and distribution, is admirably handled, and Pocket-sheet Table 75 enables one to determine without calculation cost of generating plant per H. P. Pocket-sheet Tables 76, 77 and 78 enable one to determine directly, by means of curves, other items of cost.

In connection with 78 there is a small table giving curves for the determination of cost of underground conduit work, and in connection with 77 another smaller one, No. 24, with curves representing the current strength required for elevation of temperature in wires.

GENERAL NEWS.

What Is Going On in the Electrical World.

Cottondale, Ala.—The Tuscaloosa Manufacturing Company will put in an electric lighting plant.

Preston, Minn.—This city has declared by vote in favor of issuing $18,000 bonds for an electric light and waterworks system.

Rochester, N. Y.—The supervisors have adopted a resolution to expend $18,000 for gas and electric fixtures for the new court house.

Thompsonville, Mich.—The vote taken on the question of bonding the village for electric lights was almost unanimous in the affirmative.

Tacoma, Wash.—The city's electric lighting business has increased beyond the capacity of the plant and the power of the plant is to be increased.

Mauch Chunk, Pa.—At the election in East Mauch Chunk the citizens voted to bond the town in the sum of $15,000 for the erection of an electric light plant.

Corunna, Mich.—At the recent election there was a large majority vote in favor of bonding the town in $30,000 for waterworks and an electric light plant.

Madison Ind.—Proposals are wanted by the city of Madison for the purchase or lease of its electric light plant and for the construction of an electric railway in connection therewith.

Gowanda, N. Y.—At a special election held on the 9th inst. the taxpayers voted for the appropriation of $1,200 per year for the maintenance of electric lights to light the village streets.

Fulton, N. Y.—The Oswego Falls and Fulton Street Railway has changed hands and will be converted into an electric road, with the probability of its extension to the city of Oswego.

New Orleans.—J. J. Cohn, M. Ber and associates have petitioned the city council for a franchise permitting them to establish an electric lighting plant and to furnish light to the citizens.

Brunswick, Ga.—An effort is being made to get outside capitalists to take hold of the street railway here, transform it into an electric road and extend the system. Col. W. A. Jeter is promoting the scheme.

Schenectady, N. Y.—The second of three electric locomotives which are being constructed at the General Electric works in this city for the Baltimore and Ohio railroad was sent away from the works last week.

Hagerstown, Md.—Powell Evans, representing a Philadelphia syndicate, has bought out the Schuyler Electric Light Company of Hagerstown. Mr. Powell and his associates have the contract for lighting the streets.

San Leandro, Cal.—At the next meeting of the San Leandro town trustees, the ordinance calling an election on the question of bonding the city for the purpose of providing an electric light plant will be finally passed; the amount decided on is $10,000.

Boston, Mass.—Brookline is to have a new electric railway, to be known as the Brookline Street Railway. Its promoters are some of the best-known business men and financiers of Boston, Newton and Brookline, who will have the co-operation of moneyed men of New York.

Yonkers, N. Y.—A fire at the car shed of the New York and Putnam Railroad Co., at Van Cortlandt Park, destroyed a number of cars and a new electric motor. The motor was valued at $6,000 and the secret of its construction, which belongs to the company, at many thousand dollars more.

Oxford, Pa.—Farmers and citizens in the neighborhood of Cochranville have subscribed $14,000 and given rights of way for the proposed electric railway from Philadelphia to Lancaster via Cochranville. A branch will be constructed to Oxford.

Mechanicville, N. Y.—The water power below this village has lately been inspected by capitalists who are reported to have in view the erection there of a great electric power plant to furnish heat and power for the electric railroads in the vicinity and also for Troy and Albany.

York, Pa.—The electric light plant of the borough of Delta, this county, was destroyed by fire on the 11th inst. The loss is about $2,000, partly insured. The plant will probably be rebuilt.

Pottstown, Pa.—The survey of a large portion of the route for the electric railway between West Chester and Pottstown has been completed and the construction work will begin in a short time.

Frederick, Md.—The board of managers of the Frederick-Middletown Electric Railroad have adopted a route for the proposed road. They are now closing contracts for the right of way. The work of grading will soon begin.

East Orange, N. J.—The Suburban Electric Light and Power Company, which was recently given a franchise in East Orange, has secured subscribers to its system equal to the capacity of its plant, 1,000 lamps. The plant is to be enlarged at once.

Jersey City, N. J.—It is probable that in a few days advertisements will appear for bids for lighting the city with electric lights under the plan adopted by the Street and Water Board. About three times as many electric lights are to be used as are now in service.

Milwaukee, Wis.—The "Wisconsin" states that the Milwaukee Street Railway Company's property will be sold to the highest bidder within three months, probably shortly after the New Year, and will then be reorganized and operated by a new and strong company.

Glenville, Ohio.—The citizens of Glenville will on December 10 vote on the proposition, which has been favorably passed upon by the council, to issue $100,000 bonds, the proceeds from which will be devoted to the fire department, sewers, electric lighting and water works.

Elizabeth, N. J.—The Consolidated Traction Company have secured dock facilities at Elizabethport and on Staten Island and are arranging for connection with the trolley lines on Staten Island, whereby they can establish rapid transit by a short route from Elizabeth to New York city.

Winchester, Mass.—Col. Charles F. Woodward and others have applied to the selectmen for a franchise for an electric street railway to enter Winchester. If the franchise is obtained and the line built, power for its operation will be furnished by the Wakefield & Stoneham Company.

Chicago.—The recent earthquake damaged the electric plant of the Parisian Circus, on Wabash avenue, by jarring and knocking out of adjustment all the finer machinery, destroying the usefulness of many delicate connections and parts of the equipment. Almost an entire new outfit is necessary, costing about $500.

San Francisco, Cal.—The reconstruction of the Ellis street cable line into an electric line will be completed in about three weeks. It is the intention to eventually extend the road across Market street into Fourth street, and continue down the latter thoroughfare to the Southern Pacific depot at Townsend street.

Vincentown, N. J.—It is stated that the Pennsylvania Railroad Company is so well satisfied with the operation of the Burlington and Mt. Holly branch by electricity that it will soon introduce the trolley on the branch between Evansville and Vincentown and also the Newtown Square branch, starting at Fernwood.

Fenton, Mich.—The common council has granted a franchise of the streets to John E. Nolan, of Saginaw, to construct an electric street railway. Mr. Nolan has a franchise for the city of Flint, and an electric line will connect the two towns, a distance of sixteen miles. It is promised that the railway will be in operation by July, 1896.

Akron, O.—The Rapid Transit Company and the projectors of the second electric road between Akron and Cleveland have pooled issues and will build the road. It reaches Cleveland by a westerly route, while the Akron, Bedford & Cleveland line, already built, takes an easterly course. Philadelphia capital is backing the move.

Richmond, Va.—The stockholders of the Rappahannock Electric Light & Power Company have elected the following officers: H. Browning, president; J. B. Ficklen, vice-president and general manager; A. B. Botts, secretary and treasurer. Directors: H. Browning, A. B. Botts, J. B. Ficklen, Mrs. Letitia Souther and Mrs. C. D. Willis.

St. Louis.—The Franklin avenue car line is having a new track laid, the rails being welded together by the electric process. When completed there will be about ten miles of track thus welded. The rails used are sixty feet long.—A certificate of lease of the Manchester Road Electric Railway to the St. Louis and Meramec River Railroad Company has been filed.

Albany N. Y.—The Mt. Vernon Railroad Company has applied to the State Railroad Commissioners for permission to substitute electricity for horse power and to extend its lines to White Plains, New Rochelle and other points.—A fly wheel in the power house of the Albany Railway Company burst on Wednesday last killing one man, injuring three others, and doing much damage to the building and machinery.

Washington, D. C.—Crosby & Fish have acquired control of property in Georgetown known as the Dent foundry and iron works and intend to establish a plant on the site for the purpose of furnishing electric light and power.—The National Convention of Electrical Workers was held here last week. There was a good attendance from all parts of the country and the meetings were animated and of great interest to the members of the organization.

Baltimore, Md.—Clemens Herschel has approved plans and specifications for the dams, waterways and electrical machinery submitted to him by the Susquehanna Construction Company for the great electric generating plant to be established at Conowingo, on the Susquehanna river. The purpose of the company is to transmit the power developed to Baltimore, Wilmington and other places. The cost of the works as estimated will be about $3,000,000. The company was incorporated at Baltimore on the 7th inst.

Niagara Falls.—Last week, current from the Power Company's works, reduced to 600 volts by the big rotary transformer from the Westinghouse works at East Pittsburg, which had arrived and been set up a day or two before, was turned into the wires of the Buffalo and Niagara Falls Electric Railway and made the cars travel over the road between North Tonawanda and the Falls with unprecedented speed. The Railway Company's own current was cut off for the experiment.

Brooklyn, N. Y.—Sealed proposals will be received at the Department of City Works, Municipal Department Building, until the 25th inst. for the installation of electric light wiring in the municipal building. Plans and specifications may be seen, and forms of proposals may be procured on application at the Department of City Works. F. Kingsbury Curtis, representing the New York Guaranty and Indemnity Company and a special master appointed by the United States Courts, will offer at public sale at 111 Broadway, New York, on December 5 next, the rights franchises and property owned by the Long Island Traction Company and the interest it owns in the capital stock of the Brooklyn Heights and the Brooklyn, Queens County and Suburban Railroad Companies, together with all assets receivable by the Brooklyn Heights Company under the lease of February 14, 1893, and all the interest of the Traction Company in a certain guarantee fund of $4,000,000 mentioned in the lease.

Los Angeles, Cal.—The way in which the work is being pushed makes it likely that before the first of the year the cable roads of the Los Angeles Consolidated Street Railway Company will be operated by electricity. Wires are now being strung on the line and new machinery has been ordered for the generating plant. The chief engineer has fitted up a room at the power house where on certain evenings he gives lectures to the grip men on the uses of electricity and the management of electric cars.

Naugatuck, Conn.—An electric railroad company is to be organized immediately to build a line from Naugatuck Junction southward to the shore, thence to Milford, with extenison to Woodmont and Woodmont station. It will be about eight miles long. Some of the men interested in the proposed railroad are Gen. G. H. Ford of New Haven, ex-Sheriff Charles A. Tomlinson, ex-Judge William B. Stoddard, ex-Senator George M. Gunn, ex-Representative Tibbals and Charles W. Beardsley.

Asbury Park, N. J.—Articles of incorporation and a map of location have been filed at Trenton, showing the proposed route of a new trolley road to be constructed from Belmar to Point Pleasant. This road is to be known as the Asbury Park, Belmar, Spring Lake and Manasquan Division of the Atlantic Highlands, Red Bank and Long Branch Electric Railway Company. The road, after belting the town of Belmar, will pass through Como, North Spring Lake, Spring Lake, Sea Girt, Manasquan, Brielle, and Point Pleasant. Connections will be made at Asbury Park with the Atlantic coast line, which runs to Long Branch and Pleasure Bay. Work on the new line will be begun at once.

Philadelphia.—The management of the entire business of the consolidated street railways is to be turned over to the Union Traction Company on December 1, on which date the superintendents and engineers appointed by General Manager Beetem will take charge of their departments. Since the consolidation the three systems have been practically operated by the old management under the general supervision of Mr. Beetem, and at present each company is buying its own supplies and materials and charging them against the Union Company, which is also credited with the receipts. After December 1 the Union Company will make all purchases and handle all receipts, though separate accounts will be kept for each of the three companies.

Syracuse, N. Y.—A company has been organized to build an electric railway from this city to Pleasant Beach on the lake, where grounds will be laid out as a park and furnished with all the attractions of the period. There will be among other things a bicycle track one-third of a mile long with a grand stand seating 3,000 people; observation tower, 400 feet in height, after the plan of the Eiffel tower; dancing pavilion, 150 by 150 feet; water toboggan slide, 250 feet in length; carousal building and wheel, with a carrying capacity of 100 people; music pavilion; electric fountain, modelled after the famous fountain at Fairmount park; Ferris wheel, 100 feet in height; scenic theater, etc. The whole park is to be lighted by its own electric plant. The officers of the company, just elected, are: President, A. T. Hoteling, Baldwinville, N. Y.; vice-president, John W. Truesdale, Syracuse; treasurer, Frank T. Miller, Syracuse; secretary, J. M. Price, Philadelphia; manager, A. E. Aldrich; promoter in chief, J. L. Dailey. The capital stock is $100,000.

Niles, Mich.—There was much rejoicing here over the opening of the Mahoning Valley Electric Railway. When the first cars arrived from Youngstown an impromptu meeting was held at the Sanford House, and several good speeches were made in which great things were predicted for the valley through the operation of the line. Hon. J. J. Sullivan, of Warren, paid a high tribute to John E. McVey, of Youngstown, and others connected with him in the building of the road, and evinced his pleasure in a jolly speech, saying among other things, that "ever since Raymond D. Sykes (a new arrival in Niles) was awarded the prize at the Canfield fair for being the handsomest baby in the Mahoning valley, I knew that Niles had a great future before it." Judge King, also, in a similar vein, showed how the advent of the trolley in a community connects itself with social interests of the most profound concern. "Something," he said, "had been mentioned about sparks. Now it seems to me that one good effect of the opening of this line will be to increase sparking. Young men will not have to pay livery bills and their horses eat pint oats, because they can call on the girls and get back home at any hour with little expense. So that for that reason the line is a good thing."

New York.—The Edison Electric Illuminating Company of New York reports gross earnings for October of $148,219, a decrease of $336 as compared with the same month of last year, and net $62,716, a decrease of $5,909. For the ten months ending October 31 the gross earnings were $1,469,376, an increase of $148,936 as compared with the corresponding period of last year, and net $708,433, an increase of $84,486.—The Metropolitan Traction Company has succeeded in leasing the Forty-second street and Boulevard surface line, and has also secured control of two other lines in the lower part of the city, which latter gives it the much desired connections with the ferries in the lower part of the city on the North and East rivers. The company will inaugurate a system of transit to and from the down town ferries, which will be feeders for its main lines, and will open up for the public an easy transit from the ferries to the different shopping centers of the city. A system of electric power will, it is stated, be used on these smaller lines.—The Kingsbridge street railway franchise was sold on the 14th inst. by Comptroller Fitch to the Third Avenue Railway Company for 38½ per cent. of its gross receipts over and above the three per cent. for five years and the five per cent. for the following five years required by law, and in addition the company gave to the city a bonus of $250,000. The franchise carries with it a provision that other companies shall have the right to use a certain part of the new route.—An explosion in the Brush electric light plant at 210 Elizabeth street, on Friday evening, threw many of the city's streets into darkness and caused considerable damage at the station. The cause of the trouble was the bursting of one of the main pipes leading from the boiler room to the engine room. None of the employees was injured.

TELEPHONE AND TELEGRAPH.

The Mutual Plan in New England.

George W. Coy, of New Haven, Conn., has just completed the organization of a new telephone company in Bridgeport and another in Norwalk. The Bridgeport exchange is to have 600 instruments and the Norwalk company have contracted for 136 telephones. In both instances the companies organized are mutual concerns and the maximum cost of the telephones are to be $20 a year for each instrument. It is stated that a number of business men of New Haven are awaiting the result of the Bridgeport venture, and if it proves a success a local rival to the Southern New England Company will be started.

Sold the Pole Lines For Taxes.

For some time past the Western Union Telegraph Company has refused to pay its taxes in several of the towns of Orleans county, N. Y., on the ground of excessive valuation. The county treasurer put up the company's property at auction and sold it to William A. Parmelee. The effects consist of standing poles and wires in use.

The Milwaukee Telephone Users' Association has elected permanent officers as follows: President, Eugene S. Elliott; vice-president, E. H. Bottum; secretary, Frank M. Hoyt; treasurer, David Adler. The association will continue its fight for lower rates in that city.

The Merrill Telephone Company, recently organized at Merrill, Wis., has let the contract to put in a telephone exchange to the Standard Telephone and Electric Company of Madison. The contract calls for the completion of the new exchange by December 10.

An ordinance is now pending in the common council of Hoboken, N. J., which if passed will give the Citizens' Telephone & Electric Company of that city subway rights on most of the important streets.

A tax of 25 cents per pole has been imposed upon the electric light, telephone and telegraph companies of Jacksonville, Fla. The companies will combine in a fight against the tax.

W. S. Rowe, manager of the Missouri Mercantile Telephone Company, has taken charge and will complete the construction of the new exchange at Pierre, S. D.

The International Telephone Company, Chicago, has made an assignment to Lynden A. Seymour. The liabilities are about $1,500 and assets nominally the same.

Marshall & Tobie will at once begin the erection of a telephone exchange at Keithsburg, Ill., having secured the requisite number of subscribers.

The Trenton Telephone Company, Trenton, Mo., will improve its exchange by the addition of a new switchboard and new 'phones.

The Northwestern Telephone Company of Milwaukee, Wis., is seeking a franchise to operate a telephone exchange at Racine, Wis.

A telephone exchange company is being organized at Newberg, Ore., by Gen. A. C. Parkinson and John Lamont.

James M. Lemon, of Minneapolis, Minn., has asked for a franchise to construct a telephone exchange at Orlando, Fla.

The DeKalb County Telephone Company is planning to construct a telephone line between Sycamore and Sandwich, Ill.

The town council of Fort Valley, Ga., has granted a ten-year telephone franchise to W. H. Harris and W. P. Harwell.

The Providence Telephone Company will erect an exchange building at Pawtucket, R. I., to cost $60,000.

The American Telephone and Telegraph Company has been granted a franchise at Kalamazoo, Mich.

The Iowa Union Telephone Company will extend its lines from Traer to Diwadle and Reinbeck.

Du Bois, Pa., is being canvassed to secure subscribers for a new telephone exchange.

New Companies Incorporated.

The Bluff City Telephone Company, Trempealeau, Wis. The incorporators are: Dr. B. A. Corneille and Clarence S. Utter. The object of the company is to build a telephone line from Trempealeau to Centerville, a distance of five miles, to connect with the Galesville line of Luce & Veitch, which also connects with the line of the Northwestern Telephone Company at Winona, giving a service to St. Paul, Chicago and the East.

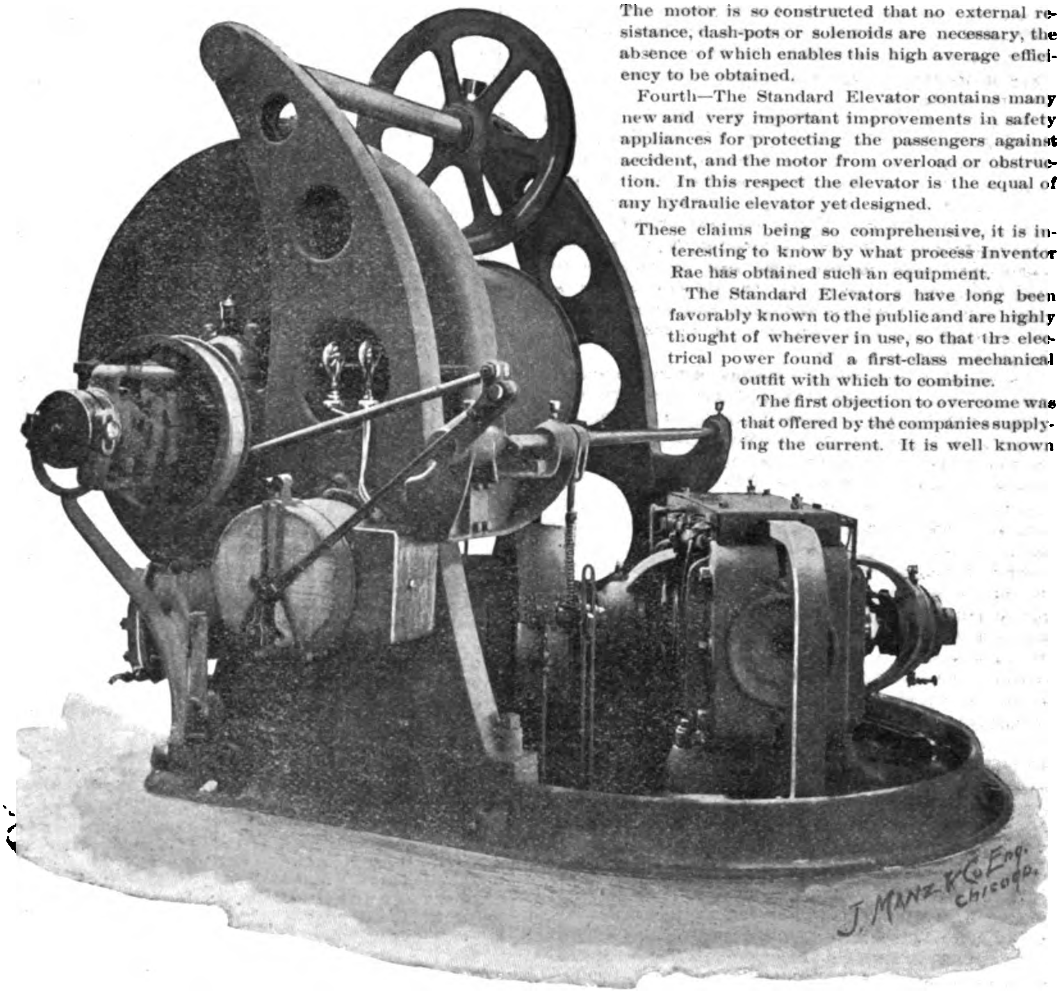
The stockholders of the Boyd's Telephone Company, of Rockville, Md., have elected these directors: Dr. J. E. Deets, Mahlon T. Lewis, Glen Poole, L. E. Price, Charles Waters, R. Barnes, Perry E. Waters, A. C. McCardell, R. K. Day, W. B. Burdette, and R. H. Bowman. The directors elected R. K. Day president, W. B. Burdette secretary, and Dr. J. E. Deets treasurer.

The Home Telephone Company, Alexandria, Va. Capital stock, $250,000. The officers are F. B. Hubbell, president; William L. Marbury, vice-president; James Russell, treasurer, and W. J. Atkinson, secretary and general manager.

The Western Telephone and Telegraph Company of Lima, O., has been incorporated with a capital stock of $25,000. Incorporators' names not given.

Standard High Duty Electric Elevator.

The adaptability of electricity to all service where power is required was never so apparent as in its application to passenger elevators.



STANDARD HIGH DUTY ELECTRIC ELEVATOR.

The modern elevator is one of the essential features of civilized society. Not only is it indispensable to all office buildings, but it is now considered a necessity in all hotels, club houses and houses of any pretension.

The many drawbacks of the hydraulic elevator, coupled with the great cost of installation and maintenance, has limited the field of the elevator up to date, but the success of the electric hoist seems destined to develop a field the extent of which has not yet been calculated.

The essential features of the electric elevator are (a) high speed, (b) absolute safety, (c) completely under control of operator, (d) applicable to the current to be supplied by the lighting mains, (e) low cost of operation and maintenance.

Each and all of these features are combined in the new electric elevator recently placed on the market by the Standard Elevator and Manufacturing Company of Chicago. The electric design is by Frank B. Rae, the well-known electrical engineer.

One of the reasons for the limited use of electricity in elevator work up to the present time is that elevator manufacturers have paid little or no attention to the design of the motor. In nearly all cases they have purchased an ordinary motor of some standard type from one of the electrical companies, and by the use of external resistance and complicated switches, controlled by dash-pots and solenoids, have operated a winding drum with more or less success.

Of course this clumsy construction would lift the load, start and stop the car, but it was highly inefficient as an elevator engine, and subject to the annoyances of stoppage, breakdowns, etc., inseparable from such makeshift construction.

The Standard Electric Elevator bids for public patronage on some very broad and interesting claims.

First—The operator has complete control of the car. He can move the car the entire distance of its travel at any speed irrespective of its load. At the same time the design of the motor is such that he cannot damage things by carelessness or a wilful manipulation of the controlling lever.

Second—The car starts immediately upon moving the lever, reaches maximum speed quickly and without jar. This is a feature of vital importance, as it enables the motor to assume a full load without the delay incident to all other types of electric elevators.

Third—The car *starts* with its maximum load, and secures a *high average efficiency*. As the percentage of total energy expended throughout the day in an electric elevator system is greater for starting the car from rest than in moving it at full speed, this is a matter of the first importance to the owner, who has the cost of operation to meet. The motor is so constructed that no external resistance, dash-pots or solenoids are necessary, the absence of which enables this high average efficiency to be obtained.

Fourth—The Standard Elevator contains many new and very important improvements in safety appliances for protecting the passengers against accident, and the motor from overload or obstruction. In this respect the elevator is the equal of any hydraulic elevator yet designed.

These claims being so comprehensive, it is interesting to know by what process Inventor Rae has obtained such an equipment.

The Standard Elevators have long been favorably known to the public and are highly thought of wherever in use, so that the electrical power found a first-class mechanical outfit with which to combine.

The first objection to overcome was that offered by the companies supplying the current. It is well known that the Edison companies refuse to permit more than 25 amperes of current at 220 volts to be drawn from their mains at any one instant, as a greater strain would seriously interfere with the lights. Heretofore this has been obviated by the operator waiting until, by the cutting out of resistances, the 50, 60 or 70 amperes necessary to start the load is introduced into the motor. This involves considerable delay, in addition to consuming a large amount of energy that in the Standard Elevator is not required at all.

Mr. Rae solved this problem by designing a motor specially adapted for the work, that is, a motor having a field of very large magnetic carrying capacity that can be energized at starting by a very large number of ampere turns. Thus the starting torque is provided by an intensely strong field and a small current.

Heretofore the greater part of the 220 volts provided by the lighting mains to electric elevators has been wasted in external resistances, leaving but little for the motor. In the Standard motor, however, there are no external resistances whatever, but a large number of turns are provided, giving the required ampere turns for energizing the field naturally.

The safety devices are novel and effective. An automatic locking device on the electrical controller and switch prevents injury if the car is loaded beyond its rated capacity. Under this condition of overload it is impossible for the operator to increase the current, the locking device holding switch at the position of maximum lifting capacity of motor. This permits a heavy load to be raised at slow speed with absolute safety.

In case of the car meeting with an obstruction when running at high speed, such as a tight place in the guides, the controller device will automatically diminish the speed and increase the power applied, so that when the obstruction is passed the car will again accelerate independent of but under the control of the operator.

Another valuable feature is that in case the current ceases, owing to interruption by stoppage of generating plant, or break in the supply conductors, the controller at once assumes the starting position independent of the operator, so that should the current be suddenly turned on again it finds the motor and appliances in condition to receive it without injury either electrically or mechanically.

Power Plant of the Niagara Falls Hydraulic Power & Manufacturing Company.

The hydraulic basin from which water is now taken for furnishing power to the various mills supplied with power by the above company, is located parallel to and about 300 feet back from the edge of the high bank of the Niagara River. For this new plant the water will be taken in an open canal from this hydraulic basin to a forebay 30 feet wide and 22 feet deep, which is now being built near to the edge of the high bank. From this forebay penstock pipes built of flange steel, 8 feet in diameter, conduct the water down over the high bank 210 feet to the site of the power house on the sloping bank at the edge of the water in the river below the Falls.

The building will be 60 x 100 feet, the intention being to add to the length of the building (60 feet) and place other wheels, fed by separate penstocks, from the same forebay as above as demand arises. There are four turbine wheels of the horizontal type, furnishing about 8,000 horse-power, to be located on the first floor of the power house. These wheels will work under a head of 210 feet, the highest head under which water has ever been used for power in the quantity proposed in this plant. The pressures exerted by water under this head are enormous, and every detail of the penstock and water wheels must be designed with the greatest care to hold it.

The penstock leads from the forebay vertically about 135 feet to the top of the sloping bank, thence down the slope to the side of the station next to the bank, making the total length of the 8-foot pipe about 240 feet. Into the building the pipe, 10 feet in diameter, runs horizontally, suspended over the tailrace. The thickness of the steel is fifteen-sixteenths of an inch. All horizontal joints are butt-strapped, held with three rows of rivets on each side. The cross seams are all double riveted. The necessity for strong work in this pipe will be seen when it is remembered that the total pressure on the end of the pipe exceeds a million pounds. From this horizontal portion of the penstock the water is taken directly up through 60 inch valves on to the water wheels, which are supported upon iron beams stiffened by braces into the side of the tailrace. The four wheels for this plant are being built by James Leffel & Co., of Springfield, Ohio, under general plans and specifications made by the engineer of the Niagara Falls Hydraulic Power & Manufacturing Company. Three of these turbines are specified to generate each 1,700 horse-power under a head of 205 feet, which is the minimum head estimated as obtainable, and to run at a speed of 250 revolutions per minute. As the ordinary head will be from 240 to 215 feet, the power of these wheels will be from 1,800 to 2,000 horse-power each.

The turbines are mounted on horizontal shafts of the double discharge design. These large turbines are fitted with runners 74 inches in diameter, made of extra quality of bronze metal, fitted with balance gates. The turbines are so designed that the wheel runners are absolutely balanced, due to the equal discharge of water on each side, thus doing away with all end-thrusts on the shafts. The wheels are fitted in cases 11 feet in diameter, made of best heavy plate steel, double riveted. The feeder pipe connections to these large cases are on the bottom of same, being riveted directly to the 5-foot hydraulic cylinder valves. All these valves are connected to the main feeder pipe, which is 10 feet in diameter, and occupy the space under the turbines between the foundation walls. The draft tubes from the turbines pass down each side of the main feeder pipe, connecting with the tail water, which is set at a distance of 27 feet from the center of the turbine shaft.

W. C. Johnson, of Niagara Falls, chief engineer of the company, is in charge of the plans for this work.—*Canadian Journal of Commerce.*

INCORPORATIONS.

The Electric City Malting and Brewing Company, Niagara Falls. Capital stock, $125,000. Directors: J. S. Macklem, C. F. Hathaway, A. C. Buell, and F. L. Lovelace, of Niagara Falls.

Hayes-Tracy-Fyfe Company at Chicago—to manufacture electrical devices. Capital stock, $30,000. Incorporators: Jamas Hayes, Edward C. Tracy and Herbert A. Schyver.

The Sheboygan Lamp Company, Sheboygan, Wis.—to manufacture electric lamps. Capital stock, $10,000. Promoters: J. Donahue, W. C. Johann, J. E. Collins, Sheboygan.

The Leechburg Electric Light and Power Company has been chartered at Harrisburg, Pa. Capital, $16,000.

The Columbian Construction Company, Clarksburg, W. Va.—to construct and operate ice, cold storage, electric light, gas and water plants, etc. Capital stock, $500 minimum, $5,000,000 maximum. Promoters: H. T. Miller, J. H. Johnson, Washington, D. C.; Fred. Balcolm, Jacksonville, Fla.; Fred C. Suter, Philadelphia.

The Philadelphia Electrical Equipment Company, Philadelphia. Pa.—to manufacture and sell electrical machinery and devices necessary and useful in the erection and use of electrical apparatus. Capital stock, $50,000. Promoters: Matthew A. Rettew, James R. Rettew, E. T. Watts, Philadelphia.

The Susquehanna Construction Company, Baltimore—to develop a water power on the Susquehanna River, near Conowingo, and generate electricity there for transmission to Baltimore and elsewhere. Capital stock, $100,000. Incorporators: J. Wesley Kerr, Otto J. Fisher, John Henry Miller, George K. McGaw and Fridge Murdock, who, with Edward J. Silkman and George W. Haulenbeck, comprise the board of directors.

Articles of agreement and consolidation have been filed of the St. Louis, Siloam and Southern Railroad Company of Missouri, and the St. Louis, Siloam and Southern Railroad Company of Arkansas, under the name of the St. Louis, Siloam and Southern Railroad Company. The consolidated company has a capital stock of $8,000,000

The North End Street Railway Company, New York—to build a street railway thirteen miles long, beginning at the junction of Manhattan avenue and 116th street and ending at the junction of Kingsbridge road and the northerly line of the city. There will be several branches. The directors are Daniel H. Shea, Thomas J. Regan, Pierre Jay, Frank F. Ogston and William C. Shailor, of New York; Edward K. Lynch, William D. Davis and Thomas E. Laughlen, of Brooklyn, and Charles H. Sisson, of Mount Vernon.

The Catskill, Cairo and Windham Street Railroad Company—to construct a street railroad, about ten miles long, in Greene County, from Catskill Landing to the village of Cairo, N. Y. Capital stock, $100,000. Directors: Louis E. Robert, Michael W. Conway, Wm. C. Wood, Daniel H. Gilligan, John L. Heins and Jacob Faber, of Brooklyn; Daniel Sharp, of Catskill, and S. Mattison, of Newark, N. J.

Articles of incorporation have been filed at Des Moines, Ia., by the Foreign Patent Company of Polk County, Ia. The capital stock is $15,000,000. The incorporators are Thursday Gordon Hall, Truman Hall, Robert H. Laird, all of Buffalo; William H. Laird, New York; Charles Turner Brown, Chicago. The company was organized for the purpose of handling patents issued by countries other than the United States for the manufacture, preservation and distribution of a fixed gas from carbonaceous material, steam and air with electric, catalyic or chemical action. Articles were filed at the same time by the same incorporators of the Rhode Island Electric Gas Company, having its headquarters in Polk County. The capital stock is $3,000,000. The company will sell the territory and construct plants for the patents of the parent company.

The West Side Suburban Water Company, Los Angeles, Cal.—to acquire water and water rights; construct dams, ditches, reservoirs, etc., for distributing water for irrigation and domestic purposes; operate machinery; generate electricity for supplying light and power. Capital stock, $2,000,000. Promoters: C. E. Brook, C. W. Buchanan, John McDonald, J. D. Cory, Pasadena, Cal.; W. S. Montgomery, E. C. Hine, James Kerr, Los Angeles, Cal.

The Contoocook Electric Light Company, Contoocook, N. H.—to operate an electric light plant in Contoocook and Warner. Capital stock, $10,000. Promoters: Walter S. Davis, G. A. Curtice, Horace I. Davis, George W. Paige, Amos A. Currier, Contoocook.

The Newark Consolidated Electric Railway Company (incorporated in W. Va.), Newark, Ohio—to construct railroads in Newark, Ohio, and operate them by electricity, etc. Capital stock, $500 minimum, $250,000 maximum. Promoters: Reinhardt Scheidler, J. A. Flor, John Schlagal, F. A. Crane, W. C. Christian, Newark.

The American Signal Company, Chicago, Ill—to manufacture and sell electrical and other machinery and appliances. Capital stock, $100,000. Promoters: Charles C. Arnold, Joseph P. Eames, John T. Bailey.

The Pacific Electric Company, Tacoma, Wash.—to manufacture, sell and dispose of electric lights and shades and other electrical apparatus. Capital stock, $2,000. Promoters: W. S. Dean, A. T. Espersen, Charles Bedford.

The Clay City Electric Light Company, Clay City, Ind.—to furnish the town of Clay City with electric light and power. Capital stock, $5,000. Promoters: Wm. Parsons, Chas. F. Nickey, Benj. M. Guirl.

The Oregon Electrical Construction Company, Portland, Ore.—to build, operate and maintain telegraph and telephone lines between Portland and Astoria, Oregon. Capital stock, $20,000. Promoters: G. F. Heusner, F. C. Miller, J. S. Urquhart, Portland, Ore.

The Pacific Water Company, Kings City, Cal.—to deal in real estate; develop and pipe water for domestic and irrigation purposes; establish plants for electric lights for all purposes; construct and run street cars. Capital stock, $300,000. Promoters: Wm. E. Ward, Benj. S. Coppock, E. Coppock, H. V. Morehouse, A. L. Burbank, San Jose, Cal.

The Sierra Development Company, Sausalito, Cal.—to deal in lands, goods, wares and merchandise; construct and operate mills for working ores; construct reservoirs, dams, ditches, flumes and pipe lines for distributing water for power; agricultural, mining, electricity, or other forms of power. Capital stock, $250,000. Promoters: M. F. Hudson, Oakland, Cal.; E. H. Rixford, T. B. Keret, H. C. Campbell, San Francisco; O. C. Millet, Sausalito, Cal.

The St. Joseph Railway, Light, Heat and Power Company, St. Joseph, Mo.—to build and operate street railways, etc. Capital stock, $3,500,000. Promoters: W. T. Van Brunt, R. A. Brown, J. R. Van Brunt, St. Joseph; W. M. Harriman, New York City.

The Lorain and Cleveland Railway Company, Cleveland, Ohio—to construct, operate and maintain a railroad to be operated with electricity between Lorain and Cleveland; generate electricity, selling the same for light, heat and power purposes. Capital stock, $500,000. Promoters: B. Mahler, E. W. Moore, E. C. Tillotson, S. H. Short, J. B. Hoge.

The Highland Railroad Company, New Albany, Ind.—to own and operate street or electric railroad in New Albany, to be operated by steam, electricity or other power. Capital stock, $25,000. Promoters: Henry Terstegge, John S. Shrader. Jacob Zinsmeister, Chas. Schwartzel, New Albany.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

NOVEMBER, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	3.30 A. M.	1	5.30 A. M.
2	No light.	2	No light.
3	"	3	"
4	"	4	"
5	5.20 P. M.	5	7.40 P. M.
6	5.20 "	6	8.40 "
7	5.20 "	7	9.50 "
8	5.20 "	8	11.10 "
9	5 20 "	10	12.20 A. M.
10	5.20 "	11	1.00 "
11	5.20 "	12	1.30 "
12	5.10 "	13	2.50 "
13	5.10 "	14	4.00 "
14	5.10 "	15	5.20 "
15	5.10 "	16	6.00 "
16	5.10 "	17	6.00 "
17	5.10 "	18	6.00 "
18	5.10 "	19	6.00 "
19	5.10 "	20	6.00 "
20	5.10 "	21	6.00 "
21	7.30 "	22	6.10 "
22	9.00 "	23	6.10 "
23	10.20 "	24	6.10 "
24	11.00 "	25	6.10 "
25	11.20 "	26	6.10 "
26	...... "	..	....
27	12.20 A.M.	27	6.10 "
28	1.20 "	28	6.10 "
29	2.20 "	29	6.10 "
30	3.20 "	30	6.10 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED NOVEMBER 12, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

549,485. Electric Locomotive. Francis B. Badt, Chicago, Ill., assignor to the Siemens & Halske Electric Company of America, same place. Filed Aug. 1, 1895.

549,580. Conduit-Electric Railway System. Byron E. Osborn, Auburn, N. Y. Filed July 14, 1894.

549,652. Underground Electric Propulsion. John E. Parker, New York, N. Y. Filed June 23, 1894.

549,655. Contact Device for Electric Railways. Constantin A. Philipsborn, Berlin, Germany, assignor by mesne assignments, to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed April 20, 189

ELECTRIC LIGHTS AND APPLIANCES.

549,577. Arc Lamp Globe Holder. Gilbert L. Moyer, Hartford, Conn, assignor to the Perkins Electric Switch Manufacturing Company, same place. Filed March 19, 1895.

549,664. Apparatus for Heating and Lighting. Homer T. Yaryan, Toledo, Ohio. Filed Aug. 6, 1894.

549,724. Bracket for Incandescent Electric Lights. Wilber R. Hitchcock, Cornwall, Canada. Filed March 27, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

549,502. Dynamo-Brush. James Dickson and Robert G. Shapcott, London, England. Filed July 7, 1893. Renewed June 24, 1895.

549,422. Electric Motor System and Traction Device. Thomas P. Milligan, South Orange, N. J. Filed Jan. 26, 1895.

549,597. Combined Rheostat and Reversing Switch for Electric Motors. Jonathan P. B. Fiske, Alliance, Ohio Filed Nov. 6, 1894.

549,598. Electric Controller. Jonathan P. B. Fiske, Alliance, Ohio. Filed Feb. 13, 1895.

549,608. Electric Controller. William H. Morgan, Alliance, Ohio. Filed Aug. 22, 1895.

549,621. Controller for Electric Motors. Merle J. Wightman and Oscar Urban, Scranton, Pa. Filed Feb. 6, 1895.

549,636. Electrical Steering-Gear. George S. Grimston and Alfred H. Dykes, London, England. Filed April 9, 1895.

549,644. Regulation of Alternating Generators. Francis P. Ide, Eau Claire, Wis. Filed April 6, 1895.

549,874. Electric Speed-Regulator. Carl W. Larsor, Schenectady, N. Y., assignor of one-half to Walter N. Sheaff, Lynn, and Amond U. Jaasted, Boston, Mass. Filed April 8, 1895.

549,876. Electric Motor. Robert Lundell, Brooklyn, assignor by direct and mesne assignments to the Electric Experimental and Developing Company, New York, N. Y. Filed March 2, 1893.

TELEPHONE AND TELEGRAPH APPARATUS.

549,491. Railway Telephone System. William H. Clewley, Providence, R. I., assignor to William H. Nixon, same place. Filed April 10, 1895.

549,709. Multiple Telegraphy. Thomas B. Dixon, Henderson, Ky. Filed Sept. 12, 1895.

549,802. Telephone-Transmitter. Ignatius Lucas, Passaic, N. J. Filed May 15, 1895.

549,803. Telephone-Transmitter. Ignatius Lucas, Passaic, N. J. Filed May 31, 1895.

549,860. Telephone. Alfred Stromberg and Androv Carlson, Chicago, Ill. Filed Sept. 21, 1893.

MISCELLANEOUS.

549,501. Electric Shunting Device Augustus B. Depuy, Camden, N. J. Filed March 19, 1895.

549,542. Electric Elevator. Humphrey R. Smith, Chicago, Ill., assignor to the Winslow Brothers Elevator Company, same place. Filed March 4, 1895.

549,556. Automatic Electric Cut-Off. Clinton E. Whitney New York, N. Y. Filed Jan. 2, 1895.

549,715. Electric-Clock System. Adolf Franke, Berlin, Germany. Filed Sept. 19, 1893.

549,789. Automatic Danger-Signal Apparatus. Frederick Henius, Newark, N. J. Filed April 22, 1895.

549,794. Lightning and Heavy Current Arrester and Alarm. Miller R. Hutchison, Mobile, Ala. Filed May 25, 1895.

549,810. Electric Switch. William T. M. Mottram, Dallas, Tex. Filed July 9, 1889.

549,886. Electric Meter. Ralph O. Hood, Danvers, Mass Filed June 8, 1895.

ELECTRICITY.

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EDITORIAL NOTES.

Conduit Electric Railway Activity. Although there has been comparatively little publicity attached to the subject, there is no doubt that for several months past the question uppermost in the minds of the larger manufacturing companies has been that of conduit electric railways.

The business of corporations is conducted very much as the business of individuals, and it is not to be wondered at that up to very lately these manufacturing companies have all been inclined to throw cold water upon the underground conduit business.

It is remembered that the Bell Telephone Company held back for a number of years any comprehensive long-distance service out of consideration for the Western Union Telegraph Company, which was a large holder of Bell Telephone Company stock. Probably the motives which have impelled the treatment of the conduit problem have been somewhat similar. The trolley systems were installed, business was growing rapidly, it was profitable, trolley securities were on the market in large quantities, and the introduction of a successful conduit system two years ago would no doubt have been an injury rather than a benefit to the manufacturing companies themselves. The continued and growing hostility to the overhead trolley, however, in large cities has no doubt convinced the manufacturers that sooner or later some one would come into the market with a successful conduit system, and there has of late been a decided awakening and a very lively effort among the riva companies to get control of and develop a practical system. It is now generally admitted that the solution of the problem will soon be thoroughly demonstrated.

ELECTRICITY has already commented on the system in use in Lenox avenue in this city and also in Washington, and the figures would seem to show that this system is out of the question on the ground of excessive first cost, whatever claims are made for economy in operation. It is equally true, however, that even this system is fully as practical as were the early Sprague and Van Depoele trolley systems. The General Electric Company may be said to stand committed to an open conduit, and it should be remembered that until very recently they have had in their employ, in the railway department, Mr. Walter H. Knight, who was one of the earliest advocates of the conduit system in this country, and it is probable that he has been giving more or less thought to this question ever since the absorption of the Bentley-Knight Company by the Thomson-Houston Company. We believe it is admitted, however, by the General Electric Company's best engineers that the open conduit costs at least $30,000 more per mile for construction than the best closed-conduit systems. Of course, however, first cost is not the only consideration.

The Westinghouse Company have taken hold of the problem in earnest, and believe that they have already got something commercial. and fit to sell, in their surface-contact system. This system would certainly not be extravagant in first cost for construction, and has the presumption of success in its favor.

The Siemens & Halske Company have had a system in practical use at Buda-Pesth for some years, and for the purposes of that city there is no doubt of its success. It should be borne in mind, however, that at Buda-Pesth on 27 miles of track there are only 60 cars used, which is a very different situation from that to be found in any city in the United States requiring a conduit system.

The Johnson-Lundell Company has recently been incorporated to promote the closed-conduit system which was chiefly the invention of Mr. Lundell. This has been in experimental use for some time, and has attracted much favorable comment. It is announced that Frank S. Hastings, one of the old guard of Edison men, has resigned as a director of the General Electric Company, and will devote the greater part of his time to the business of the Johnson-Lundell Company.

Beyond this, there are several inventors in the field with patents of more or less value. not yet disposed of. It is understood that the General Electric Company has purchased the Love patents, and it is believed that they are looking far enough ahead to take some interest even in patents for a closed-conduit system that they may be better in position to meet the competition of the Westinghouse, Johnson-Lundell, Gray and other more or less conspicuous systems.

One of the best-known engineers in the country has taken control, as a private speculation, of one of the newer systems, and his experience and judgment are known to be such that whatever he expresses public approval of would at least command respect.

There is no doubt that in the numerous crowded thoroughfares in our larger cities overhead trolley systems will sooner or later be abolished. Capt. Wm. Brophy, in an address printed in another column, takes the sensible view that if other wires are to be buried, trolley wires should be no exception. There is a fortune awaiting the company which first establishes beyond peradventure the success of an underground conduit electric railway. This can only be done by the equipment of a considerable length of road where the traffic is heavy, and by at least one year's operations. It is not conceivable that it will not be done. Who will do it? Who will be the first to reap the reward?

The Institute and The Storage Battery.

The most recent meeting of the American Institute of Electrical Engineers serves no less aptly to illustrate the growing interest in the storage battery than it shows the highly gratifying results to be obtained from a topical discussion of a live subject. There have been meetings of the Institute which have lacked as much in interest as in value, but the last was not one of these.

In the engineering and commercial fields of electrical development the storage battery is just now receiving that measure of attention which its importance and utility seem to demand. It is therefore both fitting and proper that the Institute, representing as it does the most advanced progress in the development of the art, should consider this timely subject.

There is much that the electrical public wants to know about storage batteries. Chiefest in importance is the question of cost. It is now the contention of storage battery advocates that for specific purposes, such as generating plant adjuncts, sub-stations, etc., there is economy of both first cost and maintenance in a storage battery equipment as compared with an all steam plant. To be convinced of the truthfulness of this statement the central station manager wants data upon which to estimate comparative cost for himself. A price per K. W. hour of output does not supply such information. In the calculations of the engine-dynamo central station manager or engineer the term "K. W. hour" but rarely enters. The K. W. is the unit of capacity upon which the cost of existing central station equipments has been estimated.

As assisting to avoid the confusion of the terms K. W. and K. W. hour of output, the remarks of Prof. Crocker are of value. He said:

> Most accumulators have a normal time of discharge of about 10 hours, hence the cost per K. W. hour is only one-tenth of the cost per K. W. of output, and this would, of course, vary with any change in the time of discharge. In many cases it is specious and leads to mistakes to speak of K. W. hours, to appreciate which fact we have only to realize that the K. W. hour capacity of a dynamo is almost infinite since it might run for twenty years. The actual K. W. of output, or in short, how many lamps can be simultaneously fed, is the question in electric lighting.

The storage battery situation has been cleared of the incubus of patent litigation; as an electrical apparatus the storage battery as now perfected is efficient and reliable. To extend the field of its applications, prospective users must be satisfied as to its commercial value. The discussion before the Institute is a good beginning in this direction.

One of the conspicuous features of this meeting and discussion was the exhibition of the changed views on the storage battery problem held now by technicists from those entertained and expressed two or three years ago. Few people cared then to discuss the question at all. It was regarded as a dead issue as far as any wide application was concerned. Now it is a live subject in which every practical man is interested and to the discussion of which he comes in a receptive frame of mind. There is no denying, moreover, that many converts have been made.

If the storage battery makers look for the reason of the general feeling of skepticism or direct hostility exhibited by the technical public in years past, they find it in their own acts, the conduct of their own business. Many of the unfortunate features of the situation in the past have of course been beyond the control of any individual concern, and have therefore been charged up against the business as a whole. The history is not so ancient but that it is fresh in everyone's mind.

A half dozen or so companies owned patents of various kinds. No one company had a monopoly on the score of patents or of skill, yet several had in them the possibilities of disturbance and of preventing any material progress in the art. Millions were spent and wasted in litigation and in experiments—continued misrepresentations were made by every concern in the trade, and the one which came nearest to success had the most patent suits to defend. All exhibited a dog-in-the-manger policy, and the results are on record.

At length all the patents of value and all the companies of any prominence are merged into one company controlled by a strong mind, and we now look for better things. It is easily within the bounds of truth to say that America is now producing as good a storage battery as there is in Europe. Europe is a large user of storage batteries. Up to a year ago it may be said America had not begun to use them. If they are found economical abroad, why not here?

The Institute discussion will go further to clear the atmosphere than would appear at first consideration. And we compliment the officers of that body upon their exquisite judgment in finally declining to throw out the paper of Mr. Nelson W. Perry. Mr. Perry's views on any subject are always interesting, and his wide experience, thorough training and achievements in this field entitle him to be heard. There is music in discussion, and the American public likes music. The brilliant success of the meeting was largely due to the reading of Mr. Perry's contribution.

Under the Searchlight.

Views and Opinions on Timely Topics.

Chinese to Learn Electricity.

China is about to establish a new foreign university at Tientsin, where science, civil, electrical, and mechanical engineering, mining, and law will be taught by foreign professors.

* * *

Lights and Shadows of St. Paul.

(From the Pioneer Press.)

We are expending over $100,000 a year for keeping the city in perpetual darkness with the aid of gas lamps to make it visible, to say nothing of the amount squandered on the deeper shadows in which its outer districts are enveloped by the sickly gasoline.

* * *

Some With Wheels in Their Heads.

(Niagara Falls Special in Syracuse News.)

There will be power to give away if all the motors that are brought here by sanguine inventors to be immersed and experimented with in the waters of Niagara do anything like what is claimed for them.

While Eugene Ruhlman of Lockport is getting a big screw wheel in position near the Devil's Hole, Marshall Thatcher, the United States consul at Windsor, Ont., comes along with a wheel in hand which he sets revolving in the whirlpool rapids. Hardly a week passes now that some chap with wheels cannot be seen along the margin of the river either below or above the falls.

* * *

Is This True?

(From St. Joseph, Mo., Herald.)

The Philadelphia Electric Street Railway Company plans to run a number of unlighted cars over its lines "for the benefit of the girls who cannot receive their young gentlemen friends at home."

Seeking Better Prices.

Meetings of a number of electrical contractors, supply dealers and members of the Building Trades' Council have been held in both Buffalo and Chicago to develop a plan looking to the interests of skilled workmen, the securing of better prices, and arrange for some satisfactory basis on which bids could be made. It was decided to appoint a committee of three to meet a like committee from the Building Trades' Council to draw up resolutions which might be of service in this matter, and this report will be made before a larger meeting of those concerned.

Electric Light and Art in Europe.

Electric lighting is to be applied to art in Brussels. On the Anspach memorial St. Michael is represented on horseback slaying the dragon. The sword will be made to blaze like a sword of fire, lights will be put in the saint's eyes and inside of the dragon.

"INSULATION OF OVERHEAD AND UNDERGROUND CIRCUITS HAVING A DIFFERENCE OF POTENTIAL OF 2,000 VOLTS AND OVER."*

BY CAPT. WM. BROPHY.

As you all know, the State Legislature passed a law applicable to the city of Boston, compelling the owners of all electric wires within a certain prescribed district to place them underground prior to the first day of January, 1900. This includes electric wires of every name and nature, with the single exception of the overhead trolley of the West End Street Railway Company. To the average man, the reason for this exception on the part of the body that sits under the "gilded dome" seems inexplicable. For my own part, I have never been able to fathom the motives that control the actions of our legislators at different times, and as a matter of fact I deem my life too short to attempt to do so. It is plain to me that if the electric light, power, telegraph, telephone, fire and police wires are dangerous enough to be removed from poles and other structures, and placed under the surface of the street, the bare trolley should find a similar resting-place.

Capt. Wm. Brophy.

If, as it is assumed, the aim and purpose of this law was to add to the safety of the public, by removing what is considered a serious menace thereto, it falls very far short of its purpose when it permits this class of wires to remain above the earth while all others are placed beneath it.

I now come to the question of the insulation of the wires for high potential circuits.

My earliest recollection of arc light dynamos dates back to those of one-light capacity, with a difference of potential of from 30 to 50 volts. No attempt was made at that time to run two or more lamps in series. After the lamp was improved so as to make it possible to operate several of them in series, the capacity of the dynamos was gradually increased from 1 to 5, 10, 15, 25, 30, 50, 60 and 65 2,000 candle-power lamps at 50 volts and 10 amperes, or 500 watts, increasing the difference of potential at the brushes or switchboard from 50 volts to 3,250, this being exclusive of the energy required to overcome the resistance of the wire, connections, etc.

For some years no attempt was made to increase the capacity of arc-light dynamos beyond 65 lights. Quite recently, however, 125-light dynamos have been constructed and put in operation. This means a difference of potential of 6,250 volts, independent of the resistance of the rest of the circuit.

I have thus far dealt with constant current dynamos and circuits wherein the difference of potential varies with the number of lamps in the circuit. But as you all know, we have to deal with the primary circuits from alternating dynamos as well, in which is maintained a difference of potential throughout their entire length of from 1,000 to 2,000 volts. While the voltage in this class of circuits does not increase with the increase of the capacity of the dynamos from 650 to 8,000 and 10,000 lights, yet this increased energy is sufficient to afford ample food for thought to those on whom devolves the duty of so insulating such circuits as to reduce the loss of energy to a minimum and prevent accidents to persons and loss by fire.

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*Abstract of paper read before the Electric Potentials Boston, November 25, 1895.

The same insulating supports, and practically the same insulating covering of the wires, that were used for overhead circuits of five arc lights are used on circuits of 125 lights at the present day. The same style of glass insulator that is used for telegraph circuits is used to-day for arc light circuits, with a difference of potential at the dynamo of between 6,000 and 7.000 volts, and for constant potential circuits with a difference of potential of 2,000 volts throughout their entire length.

The insulating covering of the wires differs in name only from that first used on the small 5 and 10 light circuits. That the insulation of high potential circuits has not kept pace with the increased amount of electrical energy maintained therein, no one can deny, and it is self-evident that perfect insulation will result in increased profits to electric light and power companies and increased immunity from loss and personal injury to the public.

How can this most desirable end be best attained? This is the problem to be met and solved. The manufacturers of lead-covered insulated wires and cables have succeeded in producing an insulation that meets the exacting requirements of the Boston Wire Department, viz., 20 megohms per mile per 100 volts. There is not an underground wire or cable used on high potential circuits in Boston the insulation of which does not exceed this; but the question of how long this high grade of insulation can be maintained is yet to be determined. The almost perfect insulation of underground wires and cables has already been accomplished, and the question now to be met and answered is, can the same grade of insulation be secured for overhead circuits?

My answer is, yes, if the same grade of insulation is used, and no, if the present grade of insulation and construction is continued. If the same grade of wires used in the underground circuits is used, however, I would not advise any one to adopt this plan, as the proper place for such conductors is underground; and while the cost when compared with that of overhead construction is very great, the amount of energy saved, that is now lost, would, I believe, pay a handsome dividend on the money invested, to say nothing of the immunity from loss and injury of the community and the absence of vexatious damage suits.

I believe that all high potential circuits should be placed underground, and I believe it can be done with ultimate profit to their owners.

But we have, and I fear will continue to have for some years to come, overhead circuits, and I come now to the question of how to construct and insulate them.

I hold that all high-potential circuits should be supported on wooden poles and cross-arms, and the wires of all low-potential circuits excluded from such poles; and I do not believe it best to place such wires on fixtures placed on roofs or other portions of buildings, but if they are so placed, they should be beyond the reach of persons standing or working on the roofs.

I believe the so-called insulating covering in use at the present time for high-potential overhead circuits to be worse than a delusion and a snare. I believe it would be better to hang out the danger signal at once, by using bare copper wire, than to continue the use of this flimsy fraud that affords no protection to human life or property, but lures innocent people on to injury and death. Knowing the worthlessness of the material, it becomes necessary to use the best form of insulating supports. The present style of glass insulators is not what is required. Many of these insulators are only so in name. The very best grade of glass or porcelain should be used, and the double or single petticoat pattern, the form best suited to the purpose being that which will offer the greatest amount of dry surface between the wire and the supporting pin. These insulators should be supported on wooden pins.

Iron poles on any part of high-potential circuits should not be tolerated in any civilized community. They are a relic of barbarism that should be relegated to the scrap heap, and any attempt to patch them up only serves as a thin disguise to the danger that lurks within them. Twenty-five to forty feet of wood between the iron and the ground means that much insulation, while one hundred feet of iron only means what the glass insulator, wooden pin and cross-arm afford. The waste of energy due to the iron poles on the long circuits, on which are placed 125 iron lamp poles, is simply enormous—so great that in rainy weather such circuits have to be cut in halves in order to send sufficient current through the lamps.

Where such circuits are placed on the modern iron and steel structures they become a source of danger to persons who have occasion to handle these or other wires on the same or other fixtures.

Such circuits should not be run between the branches or through the foliage of trees, but when it cannot be avoided, the highest class of insulated wire should be used, and this encased in lead or iron. Any attempt at protecting this insulation from abrasion by covering it with tape or cotton braid is useless.

All that I have said up to this time applies with equal force to direct and alternating current circuits; but there are certain features of the latter that require separate treatment.

As you know, a difference of potential of one. two or more thousand volts exists throughout the entire length of the primary circuit and between it and the earth, so that the danger from derived circuits to ground or from one side to the other is the same at a point one or more miles distant from the dynamo as it is at the brushes. Again, it is necessary for electrical and other reasons to run the wires in parallel and close together, in order that no other wires can be placed between them, and for convenience in making connections to the different transformers. Workmen and others can hardly pass between them without coming in contact with both of them, and for this reason I consider them far more dangerous than high potential series arc light circuits. As before stated, the covering of these wires affords little or no protection to those persons in dry weather, and none whatever during or immediately after rain storms.

If these circuits are to remain above ground they should be separated so that both cannot be reached at the same time by any person; but this would involve the changing of nearly every existing circuit and a considerable increase in the cost of constructing new ones. Rather than adopt this plan, a high grade of lead-covered insulated wires should be used, and when that is done the proper place for them is underground.

The transformers should be placed beyond the reach of every one, and the primary wires that lead to them. The best way to do this is by placing the former in a stout wooden box, kept securely closed and well ventilated, and using high grade lead-covered insulated conductors.

I believe the time is coming when all these circuits will be placed underground, and the transformers also. Instead of placing the latter on the outer walls and roofs of buildings and in some portions of their interior, they will be placed in suitable vaults beneath the streets and sidewalks, and each one will be of sufficient size to supply a large number of lamps or motors.

The danger to life from high-potential circuits comes from two causes—establishing a derived circuit from any one point thereof through the person to the ground and from the ground to some other point of the circuit, or by closing the circuit through the body.

The danger from fire is mainly due to imperfect insulation.

The placing of the wires of alternating circuits underground removes one source of danger, but adds another not heretofore considered. On such circuits a second ground is not necessary to injure or kill a person who accidentally connects any portion of one of these circuits to the ground through himself. A person standing on or touching with one hand an iron pole, and with the other a bare or poorly insulated wire, or the iron case of a transformer that is in contact with the primary coil contained therein, will, owing to the failure of the insulation, surely receive a severe or fatal shock, although the circuit be perfectly free from "grounds." The reason for this is that the copper conductor is one, and the ground the other, plate of a condenser; and these plates readily discharge through any path of low resistance that is offered from one to the other. This, unlike the Leyden jar, is continually charged, owing to the alternations of the current; and the energy thus produced passes through the body of the unfortunate person who forms the connection from wire to earth, and vice versa.

To this cause may be laid the loss of one life at least; and in this case the circuit on which the accident occurred was clear of "grounds," with the exception of the one established by the unfortunate victim through the medium of an iron pole on which one of his hands rested while the other grasped one of the primary wires leading to the idle transformer.

Tests of the circuit just previous to the accident proved it to be clear of any preceptible leakage to ground. This fact having been established, the question of how this man lost his life had to be answered. This answer was rendered after the following test had been made: A known resistance was inserted in a wire, one end of which was connected to ground, while the other was connected to one side of the circuit. The electromotive force was measured by means of a Weston voltmeter, and it was found that a sufficient amount of energy passed over the wire and through this resistance to instantly kill.

From this you can see the necessity for the best possible insulation of the wires of these circuits and the greatest care in placing transformers, in order to prevent a recurrence of similar fatalities.

I will close by expressing the hope and wish that this club—a semi-scientific organization—will never hesitate to warn the public of any real dangers that may exist in connection with the transmission of electrical energy. I consider it a crime to lull the public into a sense of false security. It is equally one to needlessly alarm it.

American Institute of Electrical Engineers.

There were 115 members and guests at the 101st meeting of the American Institute of Electrical Engineers on the evening of the 20th inst. The evening was devoted to a topical discussion of "Storage Battery Applications" which was as spirited and entertaining as it was timely and interesting. Communications submitted by A. E. Childs and A. L. Edgar of Boston, F. B. Crocker and N. W. Perry of New York and Carl Hering of Philadelphia formed the basis of the discussion, which was participated in by H. Ward Leonard, E. T. Birdsall, J. B. Entz, J. Appleton, C. Blizard, Townsend Wolcott, J. W. Lieb, Jr., and others. This was the first experience of the Institute in the line of topical discussions and the result in New York was highly gratifying. President Duncan deemed it advisable to call for an adjournment at 11 o'clock, though at that hour the participants were quite willing to prolong the discussion.

The subject was also discussed at Chicago and San Francisco the same evening.

G. E. EXPLOITING WORK.

OBJECT LESSONS—THE CHARACTER OF ESTABLISHED STATIONS.

CHAPTER III.

TRIALS AND TRIBULATIONS OF A G. E. CENTRAL STATION MANAGER.

Reports of the Superintendent of the Austin (Minn.) Station.

Austin, Minn., Nov. 30, 1893.

Geo. C. Duffie.

Dear Sir: Replying to yours of November 25, will say I saw Levis about my salary while in St. Paul and he said I could draw all that was due up to November 1st, but when I went to the cashier I found the check short for two months, because Johnson had me transferred to the Austin account. I have written Levis about the matter and up to date received no reply. We have had so much trouble of late, I could find no time to take up the subject of pumping the water. Will do so just as soon as possible. Hope the company will either pay my salary or discharge me, and I care but little which they do. *Johnson is a pusillanimous pup and dictator in that office*|

It was the understanding when I came here that my salary should go on the same at the N. W. office and on the pay roll of that company. I am still at work for the N. W. Co. by agreement and shall look to them for my salary. Any time however they wish to let me out, I have no protest to make and am willing to settle up and step out at any time. Very truly yours,

W. S. PIERCE.

Austin, Minn., Dec. 4, 1893.

Geo. C. Duffie.

Dear Sir: There are so many questions relative to this plant which ought to be considered, I have concluded to go to St. Paul Monday next, and hope you will remain in the city so I can meet you at the office. I think this plant ought to be relieved of my salary, and if the Co. can give me a satisfactory settlement I will hustle for myself. I am collecting and can not say more just at this time. Very truly yours.

W. S. PIERCE.

Austin, Minn., Dec. 5, 1893.

C. R. Hyde.

Dear Sir: It is all night and no day this way now. Our bank boards are here and this is the first night they have been in use. They work all right, and I hope the engineers will be able to run with these and not break so many lamps. By the old method the lamp breakage was terrific. We have borrowed about 12 tons of coal of the city, and have received two cars, 15 tons in each, making 30 tons in all. This you see will last but a little while, so there ought to be three or four cars more in the near future. As I have got my salary for November, I wish you would see if the N. W. Co. can credit my back salary for September and October on the books, or send me a note for the same, so it will not be drifting around loose. I wrote Levis but received no reply. Please forward the lamps as soon as possible, as we are running low. This all-night business is a hard proposition, during November and December at least.

Very truly yours, W. S. PIERCE.

Austin, Minn., Dec. 14, 1893.

C. R. Hyde.

Dear Sir: Please hurry up the shipment of carbons as we shall soon be out of all the good ones we have. *Also coal.* Our two 15 ton cars are played out, and unless we get more day after to-morrow we shall be forced to borrow again. We need 20 tons of coal every week now for the next six weeks. When we borrow Mount Olive and pay back in Wilmington we lose money. Tell Mr. Duffie I will take up the pumping proposition in the near future. The insurance company's man is here inspecting our boilers. Have scalded my hand and can not write so that it can be read. Very truly yours,

W. S. PIERCE.

Austin, Minn., Dec. 14, 1893.

C. R. Hyde.

Dear Sir: Enclosed please find bill of items on which I have advanced the money, together with the bills as vouchers for the correctness of the same. I have also advanced $60 freight on coal at this date, which I will hold till next month, inasmuch as we can not now collect our bill against the city. December will be a full month all around, then I will put in the bills for freight on coal. These small bills are partly for freight, and some belong to the street job, not gathered in before. Please send me check for this amount inasmuch as I am waiting longer on the coal bills. Yours very truly,

W. S. PIERCE.

Austin, Minn., Dec. 15, 1893.

C. R. Hyde.

Dear Sir: WE ARE STRANDED FOR COAL, and are borrowing again from the city. The water works use Mount Olive, and we have to pay back in Wilmington, ton for ton. This is a losing game, because Mount Olive burns like straw. Please fill us up with a hundred ton draft of coal, for this is the season in this business that takes a large amount during the month. We have ample storage room for 100 tons at one time, and December and January will take 80 tons each at least. *The moon has gone back on us,* because each and every night is cloudy, thereby forcing us to run street lights all the time.

Very truly yours,

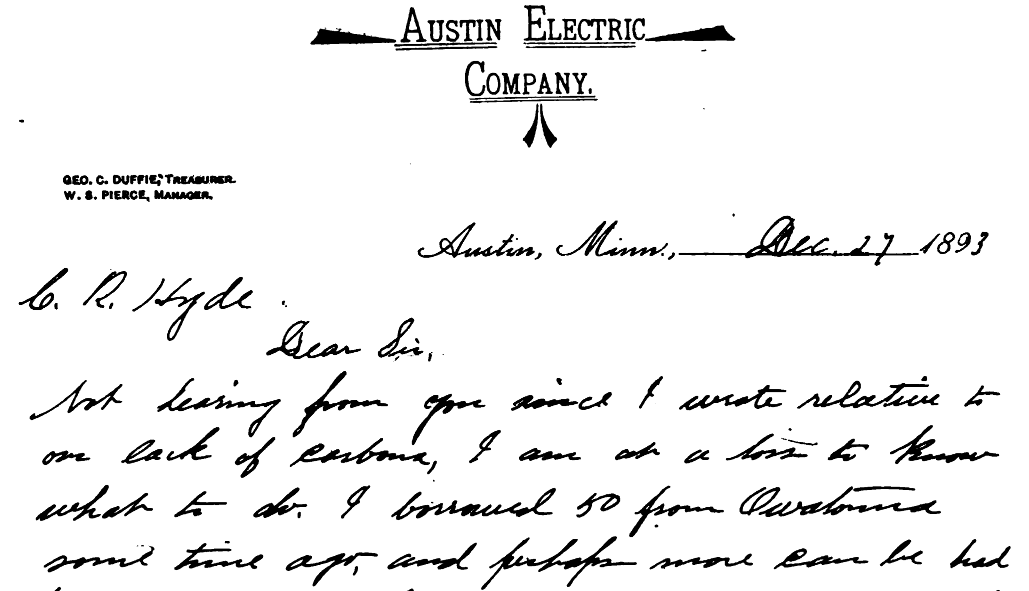
W. S. PIERCE.

Austin, Minn., Dec. 21, 1893.

C. R. Hyde.

Dear Sir: Unless the carbons reach us within the next three days, the arc circuit can not run. The 52 volt lamps are nearly all gone. Can not understand why it takes so long to get a shipment of carbons. The Co. I think had better throw up the sponge. Very truly yours,

W. S. PIERCE.



AUSTIN ELECTRIC COMPANY.

GEO. C. DUFFIE, TREASURER.
W. S. PIERCE, MANAGER.

Austin, Minn., Dec. 27 1893

C. R. Hyde.

Dear Sir,

Not hearing from you since I wrote relative to our lack of carbons, I am at a loss to know what to do. I borrowed 50 from Owatonna some time ago, and perhaps more can be had from that station. We can not run the arc lamps without carbons, and we have only just a few in stock. I can not understand the cause of the long delay. There are three things we can not get along without, that is coal, lamps and carbons. Please stir up the carbons and the 100 — 52 v. 16 c.p. lamps. What the electrical business is comming to is more than I can tell, but one thing is sure, firms here are so hard up that they kick on every bill, every meter, and many will throw up the sponge before the grass grows again. Let me hear from you by return mail as to the prospects. Very truly yours,

W. S. Pierce,

Austin, Minn., Dec. 28, 1893.

C. R. Hyde.

Dear Sir: Replying to yours of the 27th will say—We can get along till the 1st of Jan. with the 52 v. lamps we have, but such is not the case with carbons. The lamps should be ordered now, because we will have in another collection before they reach us, so they will not be waiting for the cash at all. This new idea about cash to my mind is strictly the business of the owners of this plant and not yours or mine. Perhaps the plan is to run on wind, however, unless we are able to create cash by smiting the rock of our wonderful resources with a pine stick and saying within our hearts, Cash, burst forth! Burst forth, cash! If there are any gods either great or small among the company who have this creative power, they are the blueberries who ought to be placed in charge here at once. The divine right of kings has been denied the present writer, and all I can do is to deposit all the cash collected and render a statement of the same. Here my power finds a limit. We now owe the city 34 tons of borrowed coal. We have this to pay and there are 30 tons on the track and 15 tons in the coal house. I shall use that on the track and pay the city when we get two more cars which I have ordered and which will be here soon after the 1st of January, so I might say we have 45 tons which are available. Beyond this we must rely on new orders. Well, friend Hyde, I can run on any policy outlined, either with wind or water, yet the runs are liable to enter the ground, and if so there is no room for a kick. Wishing you a happy New Year, I remain yours truly,

W. S. PIERCE.

Austin, Minn., Jan. 22, 1894.

C. R. Hyde.

Dear Sir: Enclosed please find receipted bills on which I have advanced the money up to date. All others I will turn over to Mr. Haskell, and these can be checked at some future time. Please send a check payable to my order for the inclosed vouchers, as I wish to turn over to Mr. Haskell a clean sheet.

Very truly yours, W. S. PIERCE.

Amount advanced $100.93.

The Standard Telephone Co.

MR. BARNES'S DEFENCE.

Continued Misstatements and Misrepresentations.

The Original Standard Prospectus.

We congratulate our esteemed contemporary, the *Electrical Review*, on its great triumph in securing from Mr. Thurlow Weed Barnes, president of the Standard Telephone Company, a "statement" in regard to the affairs of that company. It took the *Review* just one month and four days from the time ELECTRICITY made the original and conclusive exposure of this company's methods to get its courage up to the point where it dared to say anything; but it is better to be on the right side late than to be always on the wrong side, and our contemporary shows signs of some backbone at last.

ELECTRICITY welcomes all new recruits to the side of right, and accords to the *Electrical Review* the second place in the procession. This is honor enough.

Among the few things which Mr. Barnes says in his defence, we quote the following:

They say the Standard has no patents.

No responsible person will so assert, because the records of the United States Patent Office show to the contrary.

ELECTRICITY says again that the Standard Telephone Company has no patents of any value.

The records of the Patent Office are voluminous and complicated. The Standard Telephone Company would be dead before anything of this nature could be learned from the records alone. But it would not take Mr. Barnes ten minutes to give out the list—if he has it.

They say the Standard has no exchange in operation.

The Standard has an exchange in operation, and has had one for some time, at Kingston, N. Y., with over 250 miles of wire.

Mr. John H. Farrell, of Albany, one of the most prominent business men of the city, who is a director of the Citizens' Company, has stated to a representative of ELECTRICITY:

"The Standard Telephone Company has not, nor has it ever had, one dollar's worth of interest in the Citizens' Standard Telephone Company of Kingston."

They say the Standard Telephone Company has no manufacturing facilities and cannot supply telephones.

ELECTRICITY repeats the charge. The Standard Company has no manufacturing facilities to justify a capitalization of even $10,000.

They say the Standard has no switchboard.

The company refers to the written opinion of Myron Francis Hill, until lately examiner of patents in the United States Patent Office, who very summarily disposes of that canard. The Standard patents, Mr. Hill says, are "valid, fundamental and impregnable."

Mr. Hill has an *experimental* switchboard nearly completed in this city. It has not been tested. The question of patents is secondary, the main point being, will the switchboard work. Experts who have seen it say no. Mr. Hill is furthermore not an unprejudiced authority, but is an employè of the Standard Company.

They say that the Standard directors are bad men.

The same sheet that originated this allegation has for months been bringing the same charge against the directors of the General Electric, who are among the most prominent and honored capitalists in this country.

And if the Standard Company's investors fared no worse than the General Electric investors, every criticism is justified. Under ELECTRICITY'S exposures General Electric shares have fallen from 119⅞ to 25⅞. And we charge that Standard investors will fare much worse than General Electric investors.

They say the Standard telephone patents are valueless.

Marcellus Bailey, who drew the specifications for the original Bell telephone patent, says: "The Standard patents are as solid as the rocks of Gibraltar."

Mr. Bailey is also financially interested in the success of the Standard Company.

George William Moore, of Detroit, Mich., a very able lawyer, and General James McNaught, of New York, the great corporation lawyer, express the same opinion; so do other authorities, professional, expert and practical.

Mr. Moore is a one-third owner in the patents of Mr. W. R. Cole of Detroit, the Standard Company and Mr. Cole owning the other two-thirds. Who is the great corporation lawyer, Gen. James McNaught, who is now located in the Standard Telephone Company's offices?

A "wicked" circular, not dated, addressed to no one and unsigned, is said to have been issued by the Standard.

When asked if it were a fact, President Thurlow Weed Barnes, of the Standard Company, telegraphed to Philadelphia: "I never authorized nor issued such a circular, nor did the Board of Directors do so." When the same question was asked of General Clarkson, another official in the Standard, he said: "We never issued it. . . . We have gone into a big fight and expect a hard struggle, and this is part of it." Director R. W. Hunt, of Chicago, said: "No business man would issue such a circular." Director R. A. Parker, of Memphis Tenn., said: "The recent published attack upon the company did not, in any degree, weaken my confidence. . . . Your efforts deserve success, even if never attained."

The following letters remain unanswered:

[COPY.]

"ELECTRICITY,"
6 Park Place, New York. October 25, 1895.

HON. J. S. CLARKSON,
Fifth Ave. Hotel, New York.

DEAR SIR: I notice in a recent interview attributed to you, in the *New York Herald*, a denial of the authenticity of a Standard Telephone circular recently published in this paper, and would esteem it a favor if you will make such denial over your own signature, and forward to me.

Yours very truly,
(Signed) B. E. GREENE, Publisher.
(Dictated.)

[COPY.]

"ELECTRICITY,"
6 Park Place, New York. October 25, 1895.

THURLOW WEED BARNES, ESQ.,
President Standard Telephone Co., New York.

DEAR SIR: I notice that in interviews with various people connected with your company the authenticity of one of your telephone circulars, recently published in this paper, is denied, and I beg to advise you that you are at liberty to use whatever space in our columns is necessary to deny that the circular in question was prepared and issued by the Standard Telephone Company of New York.

Yours very truly,
(Dictated.) (Signed) B. E. GREENE, Publisher.

They say that the Standard does not own the McDonough patents.

The Standard does not depend for its existence upon the McDonough patents, but the Standard owns them amongst a great many others; the McDonough company is under the control of the Standard.

The Standard Company does not own the McDonough patents. It owns the controlling interest in the McDonough Company. The McDonough Company does not own the McDonough patents. It has a license under those patents for five States only. The Strowger Company of Chicago owns several State licenses also, and has already sold the territory of Philadelphia and New York City. It will cost any company more in litigation to decide who does own the McDonough rights in various localities than the patents are worth. Mr. Barnes knows this. So does Mr. J. Wesley Allison.

They say that certain prominent gentlemen left the Standard.

Since the formation of the Standard two or three gentlemen who intended to act with it withdrew. They are still stockholders in the company, however.

[COPY.]

GRIFFIN WHEEL COMPANY.
Car Wheels of Every Description.
Chicago, November 18, 1895.

MR. B. E. GREENE, Publisher "ELECTRICITY,"
No. 6 Park Place, New York, N. Y.

DEAR SIR: In regard to yours of the 16th inst., I beg to state that I have no connection with the Standard Telephone Company, although I was at one time elected as a member of the Board of Directors. Not approving of their methods of handling their business I resigned. Yours truly,

T. A. GRIFFIN.

So much for Mr. Barnes and his statements.

When the Standard Company went into business a prospectus was issued which we will now proceed to analyze:

[COPY.]

STANDARD TELEPHONE COMPANY.
Main Office: 68 Broad Street, New York.
In effect, January, 1895.

That the telephone is a most useful device, which has achieved wonders in enlarging our means of communicating human intelligence, is a self-evident proposition. In the homes of the rich, and in many business offices and public places to-day, the telephone is regarded as a necessity. From a little experimental scheme at the start, telephony sprang into one of the most tremendously successful enterprises of which the present generation has cognizance; its growth has been fabulous, and the profits of the comparatively few who were believers in it from the beginning—well, no one knows exactly what they have been, but it is certain that they have far surpassed the most glittering dreams of all who had faith at the outset.

In alliance with the organizations named within, the Standard Telephone Company, organized in 1894, proposes to do a general commercial and domestic local and long-distance telephone and telegraph business in the United States of America and in other civilized countries.

The company owns invaluable telephone patents, a list of which will be furnished on application.

[Every man who bought stock in the State companies after this circular was issued has a legal right to *demand* a list of the patents.]

Rights of way and other privileges are owned and controlled in many of the States and elsewhere. Standard telephones are superior in every way to the Bell or any other instruments. Successful tests have been made with them over distances of more than 1,000 miles, and electricians give assurance that as soon as the experiment shall be tried, conversation can be carried on easily from New York to Denver, not to say San Francisco. Over practical resistances equivalent to more than 3,000 miles, tests have been entirely satisfactory.

The first essential for a great telephone business is an instrument of the first rank, commercially successful, and such an instrument is owned outright by the Standard Company.

[This is ELECTRICITY'S main contention, that the first essential for a great telephone business is an instrument of the first rank. This instrument and the patents on it, if any, should be shown to every man who asks to see it; secrecy in this matter is proof of weakness.]

As to its validity, reference is made to the head counsel of the corporation, George William Moore, Esq., Detroit, Mich. As to its vast commercial superiority and universal practicability, reference is made to A. T. Nye, Esq., of New York, General Manager, formerly General Manager of the "Overland Telephone and Telegraph Company," organized in 1881.

From "magneto" concerns the telephone monopoly has nothing to fear, nor has the public anything to expect. Without a telephone which is a real telephone in fact, as well as in name, no new company can enter the field. Upon an instrument capable of meeting every test in actual, practical service against induction and over thousands of miles of wire, no matter what the conditions of the atmosphere—upon such an instrument only can a new concern be founded, if that concern is to live and live successfully. These conditions are exactly those which the Standard is prepared to meet, and meet not as an experiment but with appliances whose practical value has been demonstrated.

Many men of prominence and large business ability are actively associated with the organizations in the Standard system. Their names carry weight, especially in their own localities, and are an earnest of the intelligence and capacity with which the business of these companies will be conducted. The names of directors of State concerns, and other organizations, are on file at the office of the parent company, 68 Broad Street, New York City.

For the better development and conduct of its business, the Standard Company has adopted the "home rule" principle. The whole capital stock of allied corporations is issued to the parent concern for licenses granted to exclusive operation in specified territory. Stock of all sub-companies is full paid and non-assessable. The Board of Directors of each State concern will consist of thirteen persons, and these organizations are virtually branches of the parent company, as the last-named is a holder of stock in each company formed. The parent company agrees to defend all its patents. The business of State companies consists in the sale of territory and the organization and installation of local companies.

Too great caution cannot be exercised in entering the telephone field, to secure an instrument that is not only commercially and practically a demonstrated success over long distances, against induction, and in spite of any climatic condition, but is non-infringing. Since the expiration of the Bell patents, numerous telephone companies have been organized or are in course of formation. The only one of these which has made any headway stole one of the Standard's assets, and another patented asset from the "Bell." Suit has been begun, and they will be compelled to close out their business. There are only five known efficient telephones, two owned by the Bell Company and the three owned outright or controlled by the Standard. All other 'phones are infringements on these patents. The Standard Telephone Company has already been approached by several new organizations for licenses to use Standard 'phones, and as soon as our various State Companies' Boards have been organized, they will get all the business they care to handle, as people throughout the whole country show a determination to emancipate themselves from the present unpopular monopoly. It is proposed by the Standard to put rates at figures that will bring the telephone within reach of every store, shop, and office, and of every private family. To-day the telephone, like a horse and carriage, is a luxury which only a limited few can enjoy. Look, for example, at Brooklyn, a city of one million people, and less than 4,800 telephones in use! The business is in its infancy, and the Standard telephone is the best ever made. Resting for its superiority on the broad principle of the immediate application of electric power (the company owning this ground patent), the Standard telephone is absolutely certain, original, satisfactory and instantaneous.

In an enterprise where large responsibilities and undertakings are entered upon, it is well to look advisedly in the first place upon the question whether the undertaking is built upon fair business lines, and with a reasonable prospect of successful management and operation, and in the next place upon the question as to whether the men connected with the undertaking are men upon whom may be placed a large measure of public respect and confidence.

[If the above advice had been followed, not one dollar of money would have been paid for State rights in the Standard Company.]

The proposition that the telephone field is open, on account of the expiration of Bell patents, is not in any wise in question. The proposition that the Standard Company has instruments of enormous value, the superiority of which to all others is, in the opinion of experts, very marked, is also impregnable. These form the practical materials with which the Standard begins its career. As to the method in which the Standard proposes to operate, and the character and position of the men who constitute the new company: (1) The business will be carried on as explained in each locality by allied companies, under the control of local managers. For the purposes of the parent company, whose operations will be by no means confined to the United States, the world is parcelled out under upwards of twenty organized local corporations, each holding exclusive licenses to employ Standard devices in certain specified territory. (2) Herewith are given the names of the directors of the Standard Telephone Company, parent concern, and the names of twenty allied corporations, each of which pays for its license by the deposit of a certain portion of its capital stock in the treasury of the parent concern, with the territory and capitalization of each sub-company, and its principal place or places of doing business.

Full understanding of the position and intentions of the Standard Company can best be furnished by a glance at these pages, supplemented by a list of the men who are associated with each allied corporation.

The above prospectus is printed at this time to show the details of the plan. It is nine months old. Will Mr. Barnes please announce what steps he has taken to give stockholders any action on their money?

At Richmond a franchise has finally been granted by the common council to both the Standard and Home companies, with no exclusive privileges to either. The matter now goes to the Board of Aldermen where it will be finally settled.

LEGAL NOTES.

The Northwestern Electric Light and Power Company of Omaha, Neb., has brought suits against the New Omaha Thomson-Houston Electric Light Company and the Omaha Illuminating Company, in which damages amounting to $55,500 are claimed for infringement of the terms of a lease.

The Superior Court of Colorado has rendered a decision affirming the judgment of a lower court which awarded $2,800 to a man who had brought suit against the Consolidated Electric Light Company of Denver for damages sustained from accidental contact with a live wire. The court held that a corporation engaged in distributing electricity was bound to exercise extraordinary care and caution, its obligation in that regard exceeding that of a common carrier because of the dangerous character of the business.

In the quo warranto case of the Springfield Electric Light and Power Company vs. the City of Springfield, Ill., questioning the right of the city council to pass the ordinance granting the Capital Electric Company a franchise and contracting with them for lighting the city on the ground that it was contracting an indebtedness beyond that authorized by law, Judge Creighton decided the case in favor of the city, and the appellate court sustains the decision of the lower court.

A writ of certiorari has been sued out by the Edison Electric Illuminating Company of Brooklyn, to review the tax assessment on its personal property. Its assessed valuation last year was $304,000, and this year it has been raised to $1,070.650.

From Brush to Rail.

THE COURSE TAKEN BY THE ELECTRIC CURRENT IN PROPELLING STREET CARS.

Passengers on electric street railways know in a general way that the generators in the power house produce the current; that the trolley takes it from the wire and the motor underneath propels the car along over the street. Every motorman in charge of a car knows that by moving the handle of the controlling switch from point to point a successive gradation of speed of the car can be attained. But there are comparatively few motormen, and still fewer passengers, who understand or can clearly explain the functions and operation of the devices used in the operation of a car.

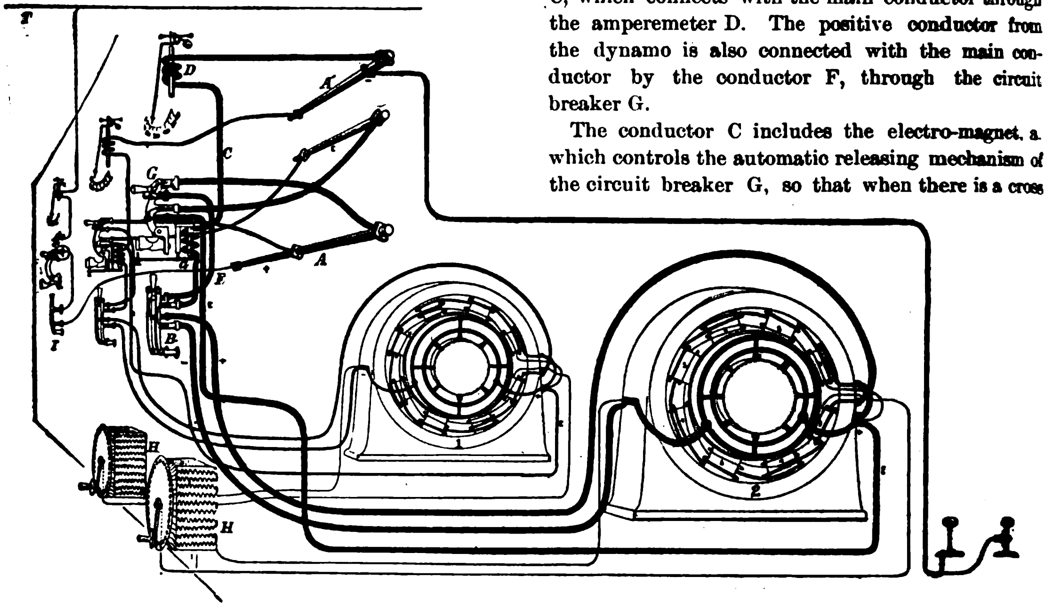


FIG. 1.—GENERATOR AND SWITCHBOARD CONNECTIONS.

In some recent numbers of the *Scientific American* here was published an illustrated description of the generating plant of the Fair Haven and Westville electric road, which was supplemented by a number of diagrams and descriptive text, both reproduced here, which will be of material assistance to all those wishing to become better informed upon the details of the electrical propulsion of street cars.

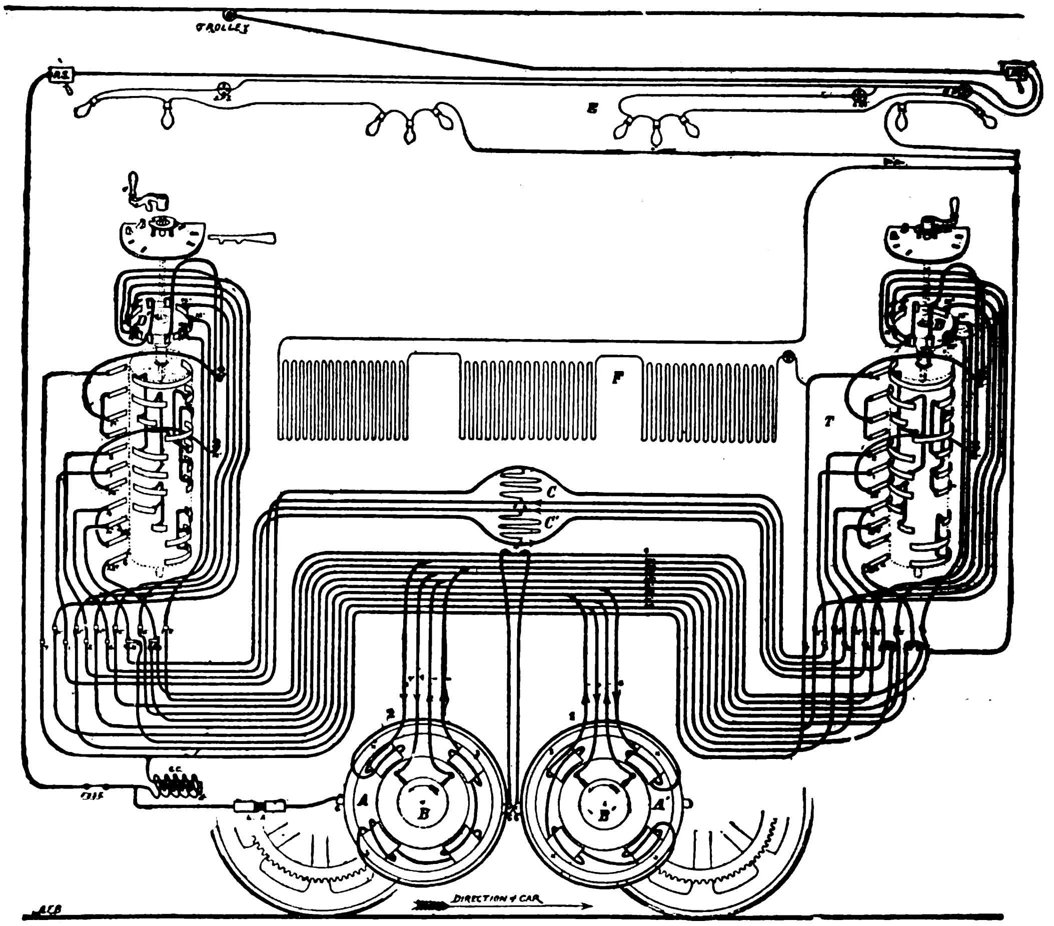


FIG. 2. —TROLLEY AND MOTOR CONNECTIONS.

In Figure 1 is shown the switchboard connections of two generators. A represents the positive main conductor and A′ the negative, while E E are the equalizing conductors from the two dynamos, the positive and negative conductors being designated by the usual signs + and —. The positive and negative conductors of dynamo 2 lead to the switch B, and connection is made by this switch with the conductor C, which connects with the main conductor through the amperemeter D. The positive conductor from the dynamo is also connected with the main conductor by the conductor F, through the circuit breaker G.

The conductor C includes the electro-magnet, a, which controls the automatic releasing mechanism of the circuit breaker G, so that when there is a cross or short circuit upon the line, the switch G is automatically released and the dynamos are thereby protected from injury. Two switches, two circuit breakers, and two amperemeters are here shown, one of each for each dynamo. The dynamos are each provided with a resistance box, H, which is connected up in the shunt circuit of the field magnet and is used to regulate the voltage in starting the dynamo. The dynamo is started with the switch B open, and when the required voltage has been reached the switch B is closed, thereby throwing the current into the main conductors, A, A′. Should the load increase so that the action is below the normal in *either* of the dynamos, the deficiency in the series winding of the field magnet is supplied by the equalizing conductor E, thereby bringing the voltage up and preventing one dynamo from acting against the other.

At I, in Fig. 1, is represented a panel having switches by means of which the particular branch of the road connected with the panel may be thrown into or out of the circuit. Each branch of the road has such a panel in the power station. The trolley wire, T, is connected with the positive conductor at the power station, and the rails are connected with the negative conductor at the power station. At the power station the rails are connected with the main conductor by a cable, as shown.

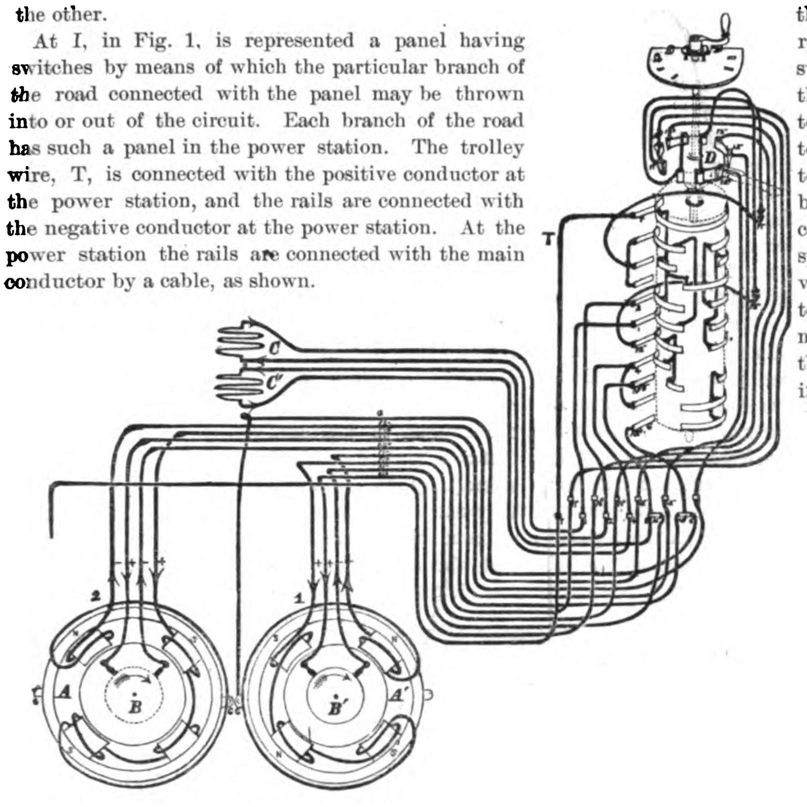


FIG. 3.—ARRANGEMENT OF REVERSING CIRCUIT.

Fig. 2 shows the details of the car wiring, motor connections, and lighting and heating circuits. To cause the car to stop or start, to go forward or backward, slow or fast, and to permit of operating it from either end, there is placed on each platform a box known as the "controller," having two hand levers at the top, one for reversing the motor, the other for varying its speed and stopping. The controller contains insulated contact springs forming the terminals of the various wires, and also a cylinder carrying a number of metallic segments for forming the various connections of the wires by contact with the different springs.

The connections, as shown in Fig. 2, are arranged for starting the car, i. e., with all the windings of the field magnet in series with the two armatures and the two resistances, C, C′. These connections can be traced by starting at the power switch, P. S. Between the power switch and the motors are located the fuse and the choke coil, cc, which latter is designed to impede a lightning discharge so as to cause the lightning to pass to the ground through the lightning arrester L A, ground connection G, motor box, car wheels and truck, rather than through the motors.

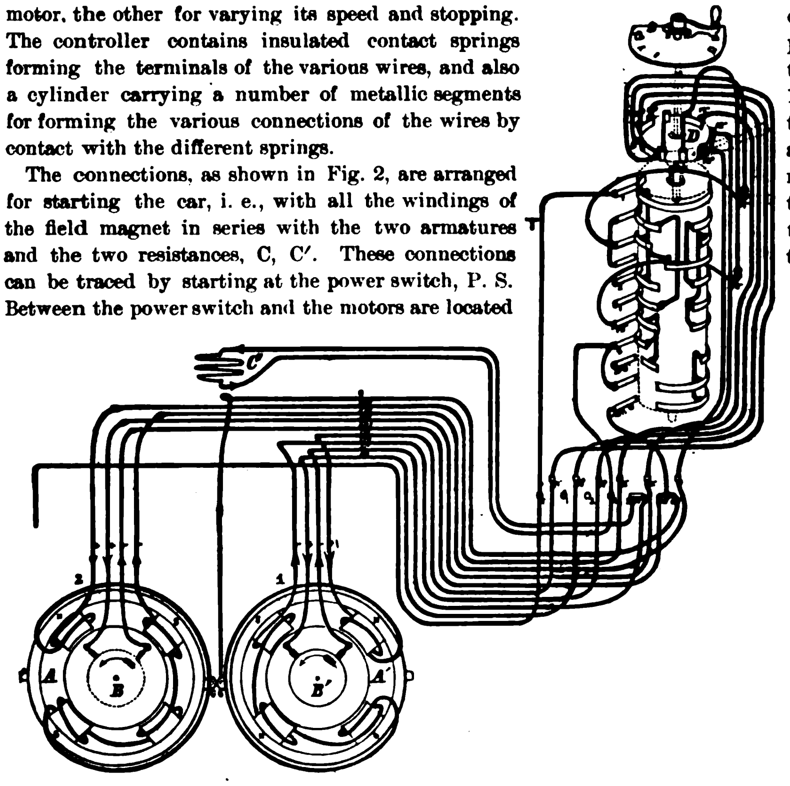


FIG. 4.—ONE-HALF OF RESISTANCE CUT OUT.

The current passes to the wire T, which is open at the rear controller, but which in the front controller touches the upper segment which communicates through wire 2 with resistance C, thence through wire 1 and the segment with one of the contacts in the reversing switch D. The current flows thence to the field magnet of the motor B′ through the wire F′—, and returns to the reversing switch through the wire F′+, thence through the wire A′+ to the armature of the motor B′, through the wire A′— to the resistance C′, thence back to the spring 4 of the controller, thence to the spring F^2—, through the reversing switch wire F^2— to the field magnet of the motor B, returning through the wire F^2+ to the reversing switch, thence to the armature of the motor B by the wire A^2—, returning by the wire A^2+ to the ground wire G, which communicates with the ground through the motor box, car truck, car wheels and rails.

Fig. 3 shows the arrangement of the controller and reversing switch when the motors are reversed. The current enters the trolley connection T as before, passing to spring 2, thence to the resistance C, spring 1, to the wire F′—, thence to the reversing switch D and wire F^2+, to the field magnet of the motor A′, thence back to the switch D, thence by the wire A′+ to the armature B′ of the motor A′, thence to the resistance C′ to the spring 4, through the segment of the controller to spring F^2—, thence by the wire F^2— to the reversing switch D, thence by the wire F^2+ to the field magnet of motor A, thence to the switch D, and back to the armature of motor B by the wire A, thence to the ground connection C.

It will thus be seen that while the current remains the same in the armatures of the motors it is reversed in the field magnets; this causes the armatures to revolve in the opposite direction.

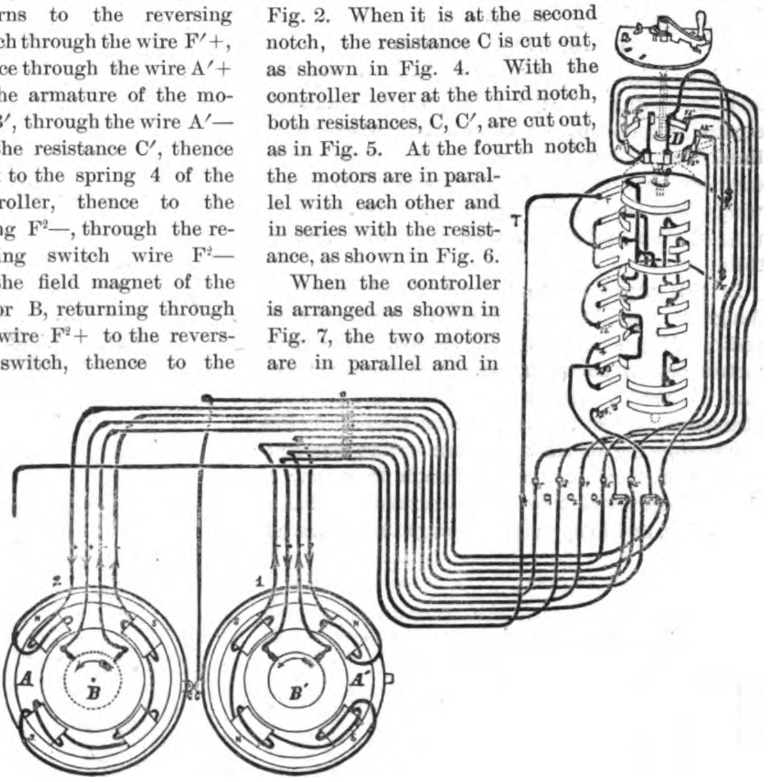


FIG. 5.—ALL RESISTANCE CUT OUT.

When the controller lever is at the first notch, the current is fully on, with both the field magnets, armatures and resistances in series, as shown in Fig. 2. When it is at the second notch, the resistance C is cut out, as shown in Fig. 4. With the controller lever at the third notch, both resistances, C, C′, are cut out, as in Fig. 5. At the fourth notch the motors are in parallel with each other and in series with the resistance, as shown in Fig. 6.

When the controller is arranged as shown in Fig. 7, the two motors are in parallel and in series with half the resistance. When the controller is arranged as in Fig. 8, both motors are in parallel, the resistances being cut out. At this position of the controller the motors assume maximum speed. In the accompanying diagrams the circuits shown in dotted lines are in parallel with like circuits shown in full lines, and these various successive changes produced in the circuit by the different combinations of connections through the movement of the controlling switch give all the graduations of power required for starting and for running at different speeds.

The generators and motors illustrated in these diagrams are of the Westinghouse type.

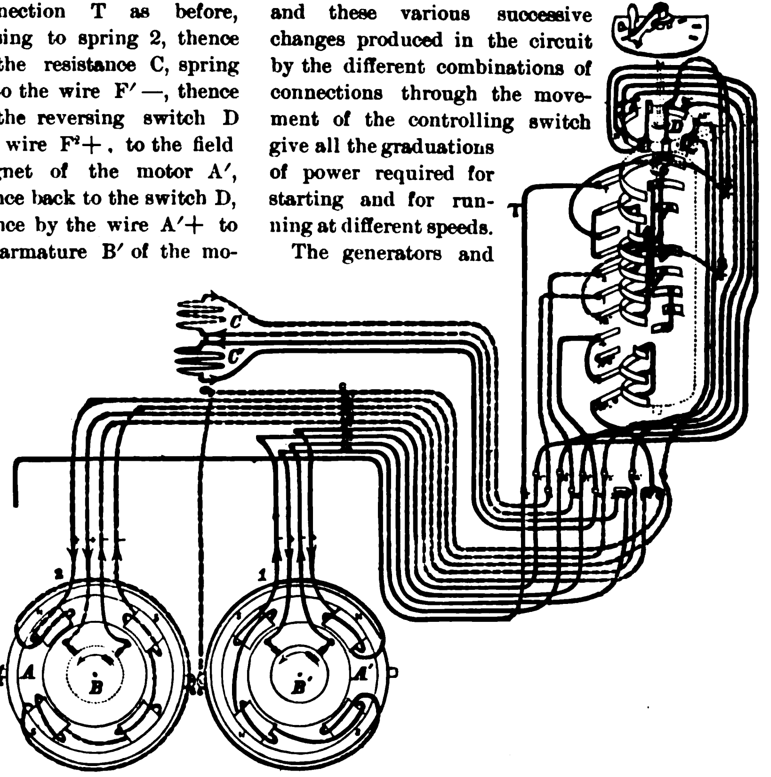


FIG. 6.—MOTORS IN PARALLEL AND IN SERIES WITH RESISTANCE.

The Railroad Commissioners of Maine have decided that the paralleling of steam lines by electric railroads is to be licensed only where a clear case of "public exigency" demands it. They hold that where such exigency exists it will be indicated by the receipts of the steam road.

The Storage Battery.[*]

A DISCUSSION OF ITS APPLICATIONS BY THE MEMBERS OF THE A. I. E. E.

THE STORAGE BATTERY FOR CENTRAL STATIONS

BY ARTHUR E. CHILDS.

It is an acknowledged fact that the great variations and fluctuations of the load on power circuits, especially those power circuits supplying trolley lines, are among the greatest difficulties which engineers have to contend against, and any appliances which will aid them to arrive at a satisfactory running of their station is looked upon with favor by them.

In this paper the term "variation" is used to designate the change of current induced by the adding of lights onto a lighting station, or the cars or motors onto a power station. The term "fluctuation" is used to indicate those rapid and necessary changes of current taking place on the outside line, due to stopping or starting of cars or throwing on or off of stationary motors. Although they may be thus differentiated, they bear a certain relation to each other, and in applying a storage battery a study of the conditions will quickly indicate the type of battery which will be more favorable in each case. By the "type" of battery is meant the slow discharge battery for a long period of service or the rapid discharge battery for a few hours or even less time of discharge.

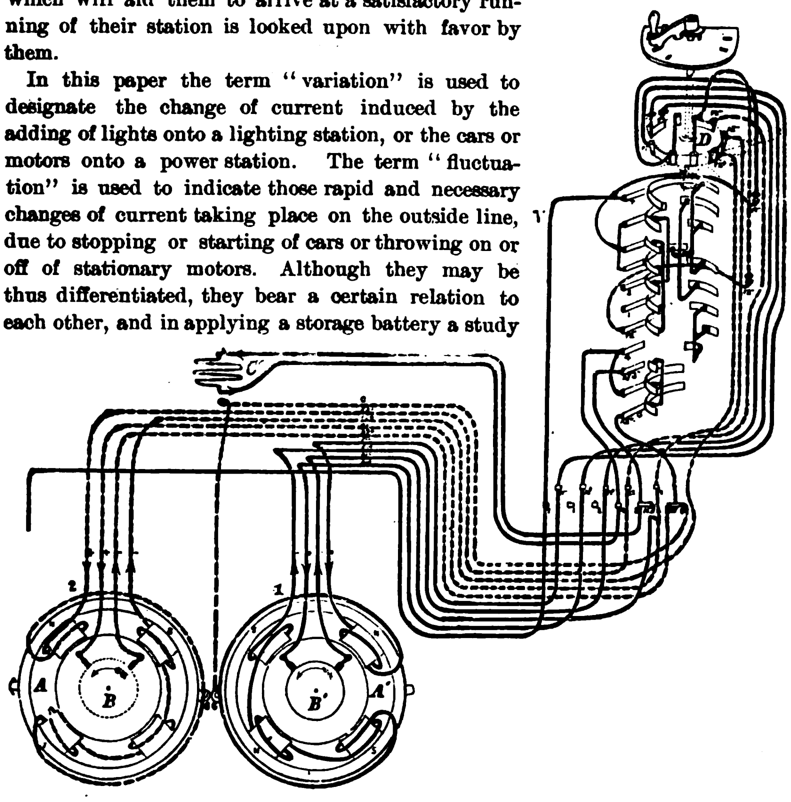


FIG. 7 (FROM BRUSH TO RAIL).—MOTORS IN PARALLEL AND IN SERIES WITH HALF THE RESISTANCE.

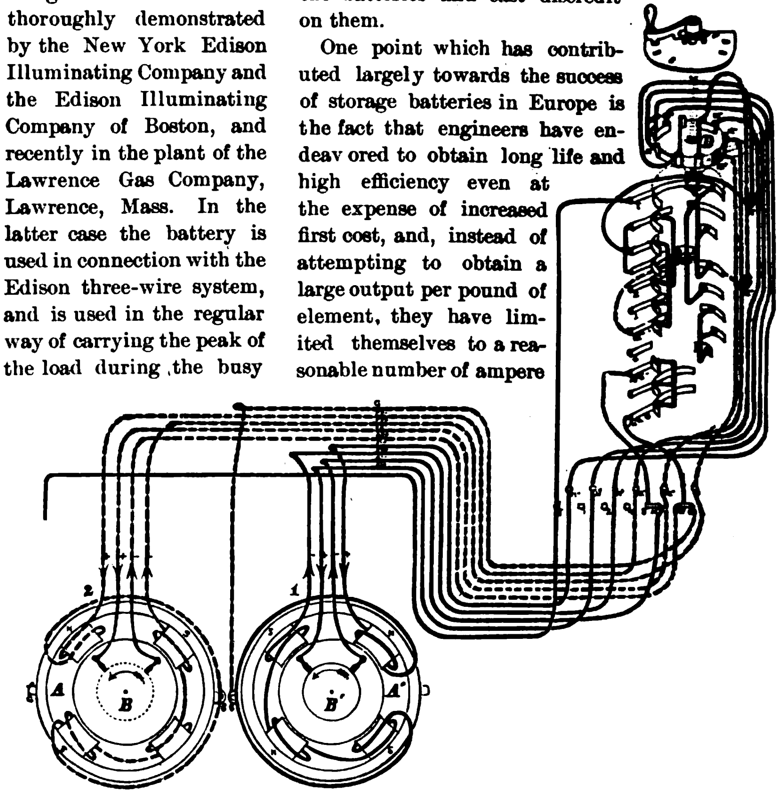


FIG. 8 (FROM BRUSH TO RAIL).—MOTORS IN PARALLEL, RESISTANCE CUT OUT.

It is not the purpose of this paper to discuss the characteristics of the electric lighting and power station curves, but to consider in a general way the application of storage batteries to the wiping out of the fluctuations and variations as they come upon the dynamos and engines. The introduction of a storage battery into a central station acts in a certain sense as a buffer between the external load and the dynamos, taking the shock of the variations without throwing the same on the engines. In this regard they have the effect of reducing the average percentage variation in load on the dynamo from a large amount to a very small one, making the operation of the machines more efficient. In fact, a storage battery acts as a regulator in this instance, maintaining as it does a constant voltage at the switchboard. As applied to power stations, and especially where water power is used, storage batteries are almost indispensable.

In the application of storage batteries to the power station of a trolley system, it is not unusual to find the variation in load as much as 50 per cent. below the average horse power, and even as great as 200 per cent. above the mean load. These enormous fluctuations take place in the course of a few minutes, and are an expense to the railroad companies in at least three ways. In the first instance, they require the use of a dynamo capacity very much in excess of that required where the station is operated at a constant load. In the second instance, these fluctuations reduce the life of the machinery of the station, producing a very large depreciation account. In the third instance, the efficiency of the generating plant is very much reduced.

When considering the application of storage batteries to illuminating plants, it is found that their value is equally as great as in the case of power stations, as the charging of the battery can be done while the plant is operating at light loads, thus making use of the power of their machines to great advantage. The value of an accumulator plant attached to an illuminating station has been thoroughly demonstrated by the New York Edison Illuminating Company and the Edison Illuminating Company of Boston, and recently in the plant of the Lawrence Gas Company, Lawrence, Mass. In the latter case the battery is used in connection with the Edison three-wire system, and is used in the regular way of carrying the peak of the load during the busy hours of lighting. A secondary use of this particular battery is that at noon, when the large mills on the Merrimac at Lawrence shut down, and entirely cut off the supply to the wheels of the gas company. During this period of absence of water the load of the lighting station is taken care of by the storage battery plant.

The storage battery can also be used as a valuable adjunct to both power and lighting stations at points in their systems where it is difficult to maintain the voltage at periods of heavy load. In these cases the feeders are usually not sufficient to carry the whole current direct from the station. But during the periods of small load the feeders can be utilized up to their maximum allowable drop in potential to charge battery sub-stations placed at these weak points. When the load at such points becomes greater than the capacity of the feeder, the battery comes into play and carries the load in connection with the station supply at that point, thus maintaining the voltage and doing satisfactory and valuable service. There must be hundreds of street railroads in this country that have just such weak points.

The extent to which storage batteries have been used in England and on the Continent is very great, and it will surprise many engineers in this country to know that there are more than 20 lighting stations and several thousand isolated plants in Great Britain alone using storage batteries. Further than this, there are in Germany 5,000 isolated plants and 15 railway power plants using storage batteries. In fact, 80 per cent. of all the central stations in Germany and Austria are equipped with storage batteries. In addition to the above, there are many stations in France, Italy, Holland, Belgium, Sweden, Norway, Denmark, Spain, and three in Switzerland.

A survey of the progress which storage batteries have made in European countries indicates no very great change in the principles of construction, but the results seem to be rather due to a thorough analysis and appreciation of the requirements of each case. This has resulted in a proper use of batteries and a correct recognition of the limitations of their usefulness. This fact alone has contributed largely to their successful application. The great difficulty in this country has been that engineers have not recognized a proper limit to the usefulness of a battery, but have, in many cases far exceeded their specified limitations, and in this way have injured the batteries and cast discredit on them.

One point which has contributed largely towards the success of storage batteries in Europe is the fact that engineers have endeavored to obtain long life and high efficiency even at the expense of increased first cost, and, instead of attempting to obtain a large output per pound of element, they have limited themselves to a reasonable number of ampere hours per pound. The result of this has been that the batteries in use in Europe have shown great endurance and solidity. The experience, however, which has been obtained with many American batteries has not been so promising as on the Continent, owing to the lack of proper appreciation of them.

The factors which tend to reduce the efficiency of a storage battery are due to a loss in voltage and in the quantity of current. These losses, however, are not so serious as they have been in the past, and manufacturers are at present able to guarantee a very high efficiency. In cells which were submitted to Prof. H. L. Callender, an ampere efficiency of 96.1 per cent. was recorded, the watt efficiency being 84 per cent. It must be borne in mind that a loss of 16 per cent. or even 20 per cent. in the efficiency of the battery does not mean the loss of the same percentage in the output of the station, as the battery usually supplies approximately, or even less, one fourth of the whole output in watt-hours, and it is, therefore, from that fraction of the whole output that the loss in the battery must be deducted.

In the matter of cost of maintenance of a storage outfit it is now usual for the manufacturer to guarantee a fixed annual percentage. This percentage varies from ten per cent. in small plants to a smaller percentage in large plants, depending, of course, on the conditions of operation and the use to be made of the battery, a study of which will soon determine what percentage can be guaranteed. In first-class plants, well installed and operated by careful engineers, the cost of maintenance can be reduced to the vicinity of 3.5 or 4 per cent. It is customary for the manufacturers to enter into a contract, in the case of large plants, guaranteeing that the cost of maintenance shall not exceed a certain percentage per annum for the period of contract. This can be carried out in two ways. Either the lighting or railroad company can pay the manufacturer the percentage specified, every year, and the manufacturer will inspect and keep the battery in first-class condition; or the company employing the batteries can inspect and order renewals themselves; in which case should the cost of maintenance exceed the percentage guaranteed, the manufacturer will not charge more than the specified amount. This is an exception rather than the rule, however, as the cost of maintenance is usually somewhat lower than that specified by the manufacturers, so that the company owning the battery is the gainer by the difference in percentage. By a thorough attention to details, both large and small, the percentage can be kept down to a very low figure.

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[*] Abstracts of communications read at the 101st Meeting of the American Institute of Electrical Engineers, New York and Chicago, November 20, 1896.

When an entirely new power plant is to be built, there is no doubt that by adopting the storage battery in the first instance the initial cost of installation will be less than for the plant not using storage batteries, and the cost of operation of the station will certainly be very much reduced when the station uses storage batteries. In the case of existing plants which have to be extended, it has been proved that a kilowatt-hour capacity can be added more cheaply to the station by the addition of storage batteries than by the addition of generating machinery, while, of course, the cost of operation is much reduced.

Referring to the primary cost of storage batteries, the cost per kilowatt-hour output is relatively greater for small cells than for large ones, since the cost of manufacture is reduced per kilowatt-hour in the larger sizes, whereas the jars and tanks which are used to hold elements do not decrease very much with the decrease in size of the elements. The cost of shipment and erection are, of course, slightly less per kilowatt-hour with the larger sizes than with the smaller ones, and on the whole the cost per kilowatt-hour with the larger cells is less than with the smaller sizes. It is stated by the Electric Storage Battery Company that they are now installing large plants of the Tudor type at a cost per kilowatt-hour of about $37 to $40, which cost, it is understood, can be reduced in the larger stations. The question of cost, however, is one which must be studied out in each case where it is proposed to install storage batteries, and a consideration of the cost of installation of storage batteries with their attendant reduction in operating expenses, will very soon bring to the mind of purchasers that it is cheaper to invest in accumulators than to invest in additional boilers, engines and dynamos.

USE OF STORAGE BATTERIES IN ELECTRIC LIGHTING.

BY DR. FRANCIS B. CROCKER.

The function of accumulators is to receive electrical energy at one time or place and to give it out at some other time or place. The principal uses to which they may be put in electric lighting are the following: To supply portable electric lamps; to take up fluctuations and thus steady the voltage or current; to furnish energy during certain hours of the day or night and enable the machinery to be stopped; to aid the generating plant in carrying the heavier load which usually exists for only an hour or two; to make the load on the engines more uniform by charging the battery when the load is light; to transform from a higher to a lower potential by charging the battery in series and discharging it in parallel, or *vice versa;* to subdivide the voltage and enable a three or a five wire system to be operated with a single dynamo; to supply current from local centers or sub-stations.

Portable Accumulators.—The accumulator is practically the only means of supplying electric portable lamps or those which are not connected to a dynamo even if they are stationary. The primary battery is expensive and troublesome to operate, and it has never been commercially successful for electric lighting except where only a few small lamps are required.

The serious drawback with portable accumulators is their great weight. For example, a standard size which weighs 100 pounds yields ten volts and five amperes, or 50 watts for ten hours, which is just sufficient to feed one ordinary incandescent lamp of 16 candle power. This weight would be prohibitive in most cases in which the only way to carry the battery was by hand, but it might be allowable for lighting railroad trains where the weight would not be so objectionable. Their great weight would also discourage in most instances the use of accumulators for supplying lamps in places which are not connected to a generating plant, the batteries being carried back and forth from a charging station.

Accumulators for preventing fluctuations, due to unsteadiness in the driving power, are often applied successfully. A dynamo driven by a gas engine, for example, may vary periodically in speed because of the explosive action of the gas in the cylinder, and a battery connected in parallel with the dynamo will have the effect of steadying the voltage. An accumulator is generally installed in connection with a small gas engine lighting plant to enable the engine to be stopped for a considerable portion of the time and save labor and attention, in which case the battery may also act to prevent fluctuations, but its principal function is the former one. A windmill electric lighting plant absolutely requires an accumulator or some other means of storing energy, not only to eliminate fluctuations in speed, which are constantly occurring, but also to bridge over the considerable periods of calm weather.

Accumulators to enable machinery to be stopped during certain portions of the day or night. The advantage of this application depends upon the fact that in almost every electric lighting plant there are long periods during the day and late at night when the number of lamps lighted is so small that it may not pay to run the generating machinery. It must also be remembered that the total investment is increased by the cost of the battery and its accommodation because the generating plant is perfectly able to carry the load put upon the battery, since, by hypothesis, this load is a light one. Hence the machinery might be run all the time, in which case the battery would be entirely unnecessary and sufficient rest of the machinery could be secured by using different machines for the periods of light load on successive days. These statements are based upon the supposition that the battery is not used to help the dynamos at the time of maximum load, since this case will now be considered separately.

Accumulators to aid in carrying the maximum load.—If accumulators are substituted for a certain portion of the dynamo capacity the question arises whether the substitution secures any advantage. In regard to first cost, authorities differ widely. These discrepancies probably arise from the confusion between K. W. and K. W. hour of output. Most accumulators have a normal time of discharge of about 10 hours, hence the cost per K. W. hour is only one-tenth of the cost per K. W. of output, and this would, of course, vary with any change in the time of discharge. In many cases it is specious and leads to mistakes to speak of K. W. hours, to appreciate which fact we have only to realize that the K. W. hour capacity of a dynamo is almost infinite since it might run for twenty years. The actual K. W. of output, or in short, how many lamps can be simultaneously fed, is the question in electric lighting. Moreover, in most cases, the time of discharge of an accumulator is unnecessarily long, and this is particularly true when it is used to help carry the heavy load which usually lasts only one or two hours. In this case the remaining hours of available discharge are of little or no use. If it be attempted to discharge more rapidly both the capacity and efficiency are seriously reduced, and in many types the condition and very life of the battery are injuriously affected by a high rate of discharge. What is needed for the maximum load or "peak of the load diagram" is an accumulator with a normal time of discharge of two or three hours and having a correspondingly smaller first cost, bulk and weight, that is, about one-quarter of those of the ordinary forms of battery. It is evident that the time of charging need not be made as short as that of discharging, if it happened to be more convenient to charge more slowly.

The use of accumulators to enable the machinery to be stopped, usually demands a time of discharge of from 10 to 14 hours, which agrees quite well with the normal discharge rate of the ordinary forms of battery, but even then the time is unnecessarily long, since the average rate of discharge would rarely exceed one-half of the maximum rate. Consequently the battery would either be incompletely discharged or the rate would have to be made excessive at certain times.

Accumulators to maintain uniform load on the engines.—Steam engines are very inefficient at light loads. This inefficiency, in fact, is one of the chief sources of loss in an electric lighting plant. The accumulator is the most important means of accomplishing this result, although there are often methods such as gas, thermal (hot water) and steam storage, all of which have been carefully compared by Mr. Nelson W. Perry in a paper before the National Electric Light Association, February, 1895, "Storage of Energy Essential to Economy of Working Central Stations." Judicious selection of the number and sizes of the engines would enable them to be worked at a considerable fraction of their full capacity nearly all of the time, and it would seem that the same care that would be required to manage the battery might enable this to be accomplished. Nevertheless the accumulator gives more flexibility to the plant, and where introduced it often seems to considerably increase the economy of the engines by making their load more uniform and nearer their full capacity. According to the figures given by Mr. Perry in the paper cited above, an electrical horse power costs $48.68 per annum when developed steadily, and costs $117.78 per annum with a variable load similar to that of an electric light station; that is, the latter costs about 2.4 times as much as the former. This ratio seems very high but is borne out by statistics,* which give a very large coal consumption for most electric light stations. Under these circumstances almost any method of making the engine loads more uniform should increase the economy of working. Doubtless an accumulator would benefit any plant in which an engine runs for any considerable portion of the time at less than half of its full power.

Accumulators used as transformers.—If the cells of a battery are arranged in series while being charged and in parallel for discharging, a high voltage current will be required for charging and a low voltage current will be given out. The total amount of energy measured in watts is the same minus the loss of 15 or 20 per cent. which always occurs in accumulators. The result is similar to that obtained by an alternating current transformer or motor-dynamo. Such a method of transformation of potential might be employed in connection with long distance transmission of energy, the current being sent over the line at high voltage and converted to low voltage by accumulators for local distribution. For potentials of several thousand volts which are commonly employed in transmitting long distances, the number of cells required would be so great as to make this of doubtful practicability compared with the ordinary stationary or rotary transformers, but it would give uniformity in load and other advantages which may be secured by the storage of energy.

Accumulators used for subdividing voltage.—This application is similar in principle to the preceding. The most important practical case is that in which a dynamo of 220 volts charges a battery of corresponding potential, a three-wire system being supplied from the battery, the neutral wire of which is connected to the middle point of the battery. This arrangement avoids the necessity of running two dynamos and allows the battery to be placed in a substation near the districts to be supplied, so that it is only necessary to run two conductors to that point instead of three. The same principle may be applied to the five-wire system.

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*See Report of Committee on Data to National Electric Light Association.

Accumulator sub-stations.—The plan of installing battery plants at local centers which are charged from the main station enables some of the conductors to be saved in a three or five wire system, as already stated. It also makes it possible to reduce the size of these conductors because the current which flows over them can be kept practically constant. The batteries at the various sub-stations may be connected and charged in series or in parallel. The former plan would require far less copper in the conductors, since the voltage is multiplied by the number of batteries in series and the current is the same as for a single battery. On the other hand, this high difference of potential would exist between the first and the last batteries of the series, and if one of these became grounded, any person connected to the earth and touching a wire supplied by the other battery would receive a shock due to the total voltage. This would demand that the maximum difference of potential should not exceed 500 volts, or, in other words, four batteries of 110 to 125 volts each might be charged in series and could be connected to the lamp circuits at the same time. This would practically amount to a five-wire system using accumulators to subdivide the potential as explained. If the batteries were entirely disconnected from the lamp circuits while being charged, the latter would be free from danger of the high pressure which might therefore be 1,000 or 2,000 volts if desired, the batteries being charged during the day and supplying the lamps at night. For continuous working, two batteries would be necessary. Accumulator substations not only save copper in the feeders but also reduce the cost of and loss of voltage in the distributing conductors because the batteries can be placed near the lamps to be supplied with current.

Accumulators used for two or more of the above named purposes.—As a matter of fact the employment of the accumulator for several of these purposes is the most common practice. By thus combining these different applications the plant may be rendered not only more economical but also much more flexible. For example, the battery may be utilized to help out the generating machinery at times of heavy load or when the latter is partially or wholly disabled. It often happens that it is difficult to produce or maintain sufficient steam pressure owing to poor draught or other circumstances, in which event a battery enables the boilers to be temporarily relieved of some or all of the drain upon them while the pressure is being raised to the proper point. It may also be necessary or desirable to shut down the machinery or a portion of it for a few minutes to make some repair, adjustment or change of arrangement, connection, etc.

It is also possible to feed some of the circuits from the battery while the others may be supplied at a higher or lower voltage by the machinery. In these and many other ways an accumulator may be a very convenient adjunct to an electric lighting system. The fact that it is so radically different from the machinery in its nature and action makes it very unlikely that the entire plant will be crippled at any one time, since the two sources of current are not exposed to the same dangers.

PERSONAL.

Mr. C. C. Warren, of Chicago, has been in the East for several days completing arrangements for the sale of his new alternator, described in ELECTRICITY several weeks ago. Mr. H. J. Medbery, of Mechanicsville, N.Y., has associated himself with Mr. Warren, and will have charge of the sales department.

Mr. Joseph Lockwood, of Detroit, was in the city last week.

Among the old-timers who came to New York to attend the dinner of the Magnetic Club last week were Messrs. Morris Mead and Samuel A. Duncan, of Pittsburg. Mr. Mead reports good progress in getting the wires underground in his city, and says the job will be completed in the business districts before the close of next season.

GENERAL NEWS.

What is Going On in the Electrical World.

St. Paul, Minn.—Agitation is growing here in favor of establishing a municipal lighting plant.

Fayette City, Pa.—Among other improvements proposed for this town is an electric light plant.

Fairfield, Ill.—A private company intends to ask for a franchise to erect an electric light plant here.

Trenton, N. J.—The lamp committee of the city council has decided to advise the council to advertise for bids for electric lights.

Valparaiso, Ind.—Articles of incorporation have been drawn up for a company which is to build a road from this place to Porter.

Asheville, N. C.—The West Asheville & Sulphur Springs Railway have asked the board of aldermen for a franchise to build a trolley line connecting with Biltmore.

Sing Sing, N. Y.—Warden Sage of Sing Sing prison has decided to abolish the use of kerosene lamps in the cells occupied by the convicts and substitute electric lights.

Portsmouth, Va.—M. W. Mason will apply for a franchise for an electric street railway here if the Portsmouth City Railway Company fails to carry out the provisions of its franchise in the time set.

Akron, Ohio.—The ceremony of driving a silver spike near Newburg on the 16th inst. completed the Akron, Bedford and Cleveland Electric Railroad, probably the longest trolley line in the world—40 miles.

Plattsburg, N. Y.—A preliminary survey has been made of the proposed route for the electric street railway. As soon as the trustees grant the franchise the company will prepare to start work on the line.

New Brunswick, N. J.—This city has had its first "trolley party" and the participants—100 young men and women—found so much enjoyment in the affair that it promises to lead to many other similar parties.

Santa Ana, Cal.—Steps are being taken to establish a new incandescent lighting system here. The former system became inactive about a year ago, since which time the residents and merchants had to go back to gas and oil.

Cripple Creek, Col.—The Cripple Creek Electric Company has formed for the purpose of building and operating a double track electric road to take in all the surrounding hills and reach all the mines of importance in the district.

Bristol, Pa.—The directors of the Newtown, Langhorne & Bristol Electric Railway Company have awarded a contract to G. H. S. Brabaker, of Lancaster, to build the track from Langhorne to Eden this winter. The line will be continued to Bristol in the spring.

New Albany, Ind.—The property holders of Boone township have agreed to vote a 2 per cent. tax for three years in aid of the proposed electric road between this city and Leavenworth. Other townships through which the road will pass are likely to do the same.

Chicago.—Over 15,000 joints of the new "castwelded" variety have been put in along the rails of the Chicago City Street Railway Company during the past summer and fall. Only 16 of all these thousands have been broken by the contraction due to cold weather.

Phœnix, N. Y.—A new electric light company with a capital stock of $15,000 has been formed here and will apply for incorporation. The promoters are: Robert S. Sloan, Oren F. Gaylord, Elisha B. Powell, of Oswego, and S. Dana Greene and Edward S. Taft, of Phœnix.

Bellefonte, Pa.—Arrangements are being made by the recent purchasers of Penn's Cave, in this county, to build an electric road to connect the cave grounds with the Lewisburg and Tyrone Railroad at Center Hall; also for the illumination of the cave with electricity.

San Jose, Cal.—It is considered certain that by the time the subscription list is closed, November 28, a sufficient sum will be pledged to warrant the construction of the electric railroad from San Jose to Saratoga. The board of trade is taking an active interest in the project.

Buffalo, N. Y.—The State Railroad Commissioners have decided to meet at the common council chamber in this city on the 3d of December for a hearing on the application of the new Buffalo Traction Company to establish another electric railway system in Buffalo and its suburbs.

Fredericksburg, Va.—The common council has authorized the committee on lights to contract with the Rappahannock Electric Light & Power Company for lighting the streets with arc lights for three years at $60 per light per annum. The city has been paying a higher rate heretofore.

Kansas City, Mo.—The West Side Improvement Club has passed resolutions in favor of giving the franchise for an electric street railway on Wyandotte street to the Missouri, Kansas & Texas Trust Company. The Metropolitan Street Railway Company was a rival applicant for the franchise.

Marine City, Mich.—The report that farmers have organized with shotguns to prevent the building of the electric railroad to this city is denied. The road is a sure thing, as the grading has been completed from Chesterfield to within three miles of this city, and a large gang of men are at work.

Pittsburg, Pa.—Sealed proposals will be received at the office of the city controller until 2 P. M. December 3 next, for lighting the city with electricity and gasoline for a term of four years. Blanks for bidding and further information can be obtained at the general office, Department of Public Works, Pittsburg.

Rahway, N. J.—Rumors are afloat that a number of citizens, headed by a Newark capitalist, are negotiating with the Union and Middlesex Traction Company and the Rahway Electric Light & Power Company for the purchase of the plant. The company is now in the hands of Receiver C. N. Boynton of Sewaren.

Elkhart, Ind.—The Indiana Electric Railroad Company, operating the street railroad system in Goshen and Elkhart, has executed a mortgage for $500,000 in favor of the Royal Trust Company of Chicago. The money will be used in the construction of an inter-suburban line between the two cities and for equipment.

Rochester, Minn.—At a special meeting of the city council the contract for enlargement of the electric light plant was let to the National Electric Company of Eau Claire, Wis., which, together with the J. G. Robertson Ideal Engine Company, of St. Paul, will do the construction for $3,330. The work must be completed by Jan. 1

Oswego, N. Y.—The new management of the Oswego street railway are arranging to get control of the Fulton & Oswego Falls street railway and extend the Oswego line to Fulton. The Fulton line will be converted into an electric system with power houses in both Fulton and Oswego. George N. Burt is president of the new company.

Denver, Col.—Electrician Hunt, having declared in favor of a multipolar machine for lighting the capitol, has stirred up a breeze among the manufacturers of other styles of generators, who claim that their machines are just as efficient and demand that the board shall call for bids open to the makers of all kinds of machines.

Niagara Falls.—It is now definitely settled that work on the power plant for the Canadian Niagara Company will begin within four months. It is to be pushed along with all haste so that power can be furnished within the prescribed time. The plant on the Canadian side of the river will be considerably larger than that on the American side.

Shelburne Falls, Mass.—The electric railway survey has progressed as far as the Colerain line. The committee will report to the board of trade as soon as the survey is completed and an estimate of the cost of construction obtained. It is understood that the selectmen of both Shelburne and Buckland favor allowing the cars to cross the iron bridge at the "Falls."

Windsor Locks, Conn.—The building of an electric railway from Windsor Locks to enter Rainbow or Poquonnock is again being discussed. A charter for the company was obtained from the Legislature of 1893. There is also a proposition to consolidate the Windsor Locks Water Company, the electric lighting company and the proposed tramway company into one.

Saratoga, N. Y.—The property of the Saratoga Gas and Electric Light Company has been sold by the referee, James L. Scott, on a judgment obtained in favor of the New York Security and Trust Company. The property was bid in by Lafayette B. Gleason, representing a committee of the bondholders, for $100,000. The judgment amounted to $300,000.

Boston, Mass.—The gross earnings of the West End Street Railway for the year ending September 30, 1895, were $7,746,170, compared with $6,823,879 the year before, an increase of $922,292. Operating expenses were $5,633,163, compared with $4,807,083 in 1894, an increase of $826,080. This reduced the net earnings to $2,113,007, an increase of $96,211 for the year.

St. Louis.—The authorities have decided that the Board of Public Improvements shall at once proceed to draft and send to the Municipal Assembly an ordinance providing for laying the wires in the city underground.—The St. Louis, Keokuk and Northwestern branch of the Burlington route has adopted the Hall automatic electric block signal system on its line between St. Louis and West Alton.

St. Joseph, Mo.—The plant of the St. Joseph street railways has been released from the hands of the receiver, and a new corporation, known as the St. Joseph Railway, Light, Heat and Power Company, has been organized to own and operate it. Vast improvements are to be made in the system in the spring, when the lines will be extended and the rolling stock improved; new rails will replace the old ones on many of the lines.

Bath, N. Y.—Representatives of a syndicate of railway owners have been here looking over the ground and making investigations as to the business aspects of the town in connection with the project of building an electric railway to the Soldiers' Home and to Hammondsport. They intimated that the company would begin active operations as soon as a charter was obtained.

Norwalk, O.—Clark Rude, of Sandusky, backed by substantial capitalists, will construct an electric road from Sandusky to Bellevue and Monroeville, by way of North Monroeville. The right of way has been obtained, and there is no doubt that the road will be built in the spring. This road will be extended to Norwalk and the south part of Huron county to connect with the Big Four.

***Lockport*, N. Y.**—F. H. Reed, one of the principal owners of the local trolley system, in an interview a few days ago said that a company to build an electric road to *Olcott* will certainly be organized inside of a month. He added that the enterprise will start out with ample capital, the bulk of which will be supplied by New York parties, and intimated that it may be more extensive than running to Olcott.

Sacramento, Cal.—The Central California Electric Light & Power Company (the North Yuba Canal Company) was the only bidder for the franchise for running an electric wire line along the county road between the city limits and the Placer county line near Antelope, *and the* supervisors accepted the bid. The object of the company is to complete its line from Newcastle to this city for the transmission of electricity for light and power.

Washington, D. C.—The directors of the District of Columbia Suburban Electric Railway will make an effort this fall to have Congress charter that portion of the road lying between the District of Columbia line at Rives station and the intersection of Fifteenth and H streets with the Baltimore and Washington pike. Such a charter was granted by the last Congress, but the bill did not reach the President in time to become a law before adjournment.

Great Falls, Mont.—The Boston and Montana Copper Company is contemplating extensive additions with the purpose of increasing its capacity. An expert electrician has been figuring on transmitting the equivalent of 2,500 horse power in electricity to the refinery, which would about double its present electrical power. Contracts for dynamos and other electrical machinery aggregating large sums have recently been let to an Eastern electrical manufacturing company.

Oakland, Cal.—The Southern Pacific Company proposes to change its San Pablo avenue cable line into an electric road, and is considering a system presented by the agent of an Eastern company by which the cars can be run without an overhead system. Under this plan the car takes electricity from the rail, but only one length of rail is charged at a time. As the car leaves one length of rail and goes upon another it turns levers which shut the current off the length behind and turns it upon the one in front.

Ecorse, Mich.—The township board has granted a franchise for an electric railway to Hyacinthe C. Burke, of Ecorse, and Charles W. O'Brien and Stanton Marke, of Detroit. The proposed road is named the Ecorse Central Electric Railway and the route of the main line is on Fort street, from the bridge over the Rouge, through the township to the Monguagon township line, a distance of eight miles. One of the two branch lines will run to the city limits of Wyandotte and the other to the Rouge River Improvement Company's lands. The franchise is for thirty years.

Baltimore.—The second electric locomotive for the Belt Line tunnel has arrived, and the third is expected to be finished before the end of the year. President Mayer states that by that time the electrical equipment will be completed and the entire freight and passenger service through the tunnel will then be hauled by electric motors. He adds that "in view of the successful operation of the motor in service since August 4, no doubt is entertained of the entire success of the undertaking, making railroad tunnel service, heretofore so undesirable, as agreeable to the traveling public as that in the open."

Fort Wayne, Ind.—J. J. Shippard, of Cleveland, a bondholder of the Fort Wayne Electric Railway, who was reported to have purchased the road, denies the purchase but states that there is to be a change in the capital and general course of the road. "The capital stock of the company," he says, "is to be increased to $2,000,000, or $500,000 more than the original amount subscribed. There is to be a reorganization of the company, but the present stockholders will retain their shares. The road will be known as the Fort Wayne Consolidated Electric Railway Company. The greater part of the stock will remain in the hands of the Fort Wayne people, and there will be no change in the directory, except that Mr. R. T. McDonald will be one of the new board."

Brooklyn, N. Y.—The report of the committee of the Brooklyn Bridge trustees in regard to the proposals of the Westinghouse and General Electric Companies for electric shunting or switch engines was unanimously approved by the board. In the report the committee recommended that the proposals be returned with the permission for each company to equip a train at their own expense and in accordance with the specifications already issued, and with such power and heating appliances as they shall deem advisable, under the direction of the chief engineer and superintendent, and subject to such tests as to efficiency and economy as he may direct, and if such trains shall be satisfactory a contract be entered into.

Albany, N. Y.—The aldermen have at last, after months of discussion, passed the electric light ordinance. The contract term is made five years and the maximum price for each light is fixed at 36 cents a night. The ordinance now goes to the mayor for approval.—The State Board of Regents have granted an unregistered charter to the National School of Electricity, New York.—It is understood that the Erie Canal Traction Company has entered into a contract with the Erie Construction Company to install a system for canal-boat propulsion from Buffalo to Albany at an expense of $2,250,000, and that the work will proceed as the work upon the enlargement voted for in the late election progresses. The Erie Canal Traction Company is the owner of the franchise authorized by recent legislation to be given to the Cataract General Electric Company, the rights of that company for towing purposes only having been assigned to it.

New York.—John D. Crimmins of the Metropolitan Traction Company gave a reporter last week some information in regard to the purposes of his company in connection with the street lines at present under its control and others that will eventually become a part of its extensive system. "Our canvassers are now at work along Tenth avenue," he said, "getting the consents of property owners to a change from horse to electric power. The Eighth Avenue line will probably be equipped at the same time with electric motors and the Sixth Avenue line will soon follow. How soon Lexington Avenue will be fitted by this most advanced method of street traction, the sub-trolley system, will be realized, when it is known that workmen are already engaged in Lexington avenue, at 105th street, putting in the electric plant to be used at an early date on that avenue from 105th street on. Of course, the problem of putting electric motors on the Broadway cars is an important one, but we feel that we have done and are doing the best in our power for New York so far as that great thoroughfare is concerned, and when our University place line on the west and the new Elm street system on the east side of Broadway shall have been completed and electrically equipped, the Broadway problem will be much simplified. At present there's not room for another street car in Broadway without interfering unduly with the traffic of the city."

TELEPHONE AND TELEGRAPH.

Decision Against Western Union.

A decision was rendered by the United States Supreme Court last week which holds in effect that the Union Pacific Railroad Company had no right to make a lease practically giving the Western Union a monopoly of its lines for telegraph purposes. It is held that the United States has a right to maintain a bill in equity to compel the Union Pacific to maintain its own lines of telegraph. This obligation is as strong as that which compels it to maintain its tracks. The claims of the United States for reimbursement for messages charged since 1881 are disallowed because of the impossibility of separating those which should have been free to the Government and those for which the Western Union was entitled to charge. The effect of the decision will be to annul the contracts between the two companies. It also establishes the principle that no telegraph company can, by contract with a railroad company operating one of the post roads of the United States over which interstate commerce is conducted, acquire an exclusive right to such railroads for telegraph purposes. The Union Pacific Railroad Company is required to maintain a telegraph line as well as to maintain its tracks under the law granting it Government aid.

The Law of Jurisdiction.

Chief Justice Fuller of the United States Supreme Court, in rendering the decision denying the motion to dismiss the appeal of the Bell Telephone Company from the decision of the Circuit Court of Appeals, thus disposed of the question of jurisdiction which was raised by the Bell Company:

"In this country, where there is no kingly prerogative, but where patents for land or inventions are issued by the authority of the Government and by officers appointed for that purpose, who may have been imposed upon by fraud or deceit, or may have erred in their power, or made mistakes in the instrument itself, the appropriate remedy is by proceedings by the United States against the patentee. We cannot impute to Congress the intention of narrowing the appellate jurisdiction of this court in a suit brought by the United States as a sovereign in respect of alleged miscarriages in the exercise of one of its functions as such, deeply concerning the public interests, and not falling within the reason of the limitations of the act."

Increased Facilities.

The Mason-Maxwell Telephone Manufacturing Company, Richmond, Va., makes the following announcement to the trade:

"We wish to notify you that the business of the Mason Telephone Company will hereafter be carried on by the Mason-Maxwell Telephone Manufacturing Company. All the directors of the old company are directors in the new, but we have added new blood and more capital, which greatly increases our facilities for prompt and satisfactory service. We will in the future absolutely guarantee all goods sent out by us, and our increased output will enable us to give better goods for less money than ever before.

"We trust that our dealings in the future may be as pleasant as in the past, and increase to the advantage of all concerned."

The Pacific Cable.

Joseph Chamberlain, Secretary of State for the Colonies of Great Britain, has agreed to appoint a commission to arrange the details of the construction of the proposed Pacific cable. The imperial Government, Australia, and Canada will each appoint two delegates upon the commission, which will proceed with its work as soon as possible.

A telephone circuit is to be constructed along the lines of the trolley car system in Hartford, Conn., and its suburbs, so that the conductors may communicate with the power house and the car despatcher in case of accident or delay. A telephone wire has been strung on the trolley poles, and at every eighth pole there will be a switch for making connections. Each car will carry a transmitter. The device is the invention of W. C. Fielding of Hartford.

The line work of the Orange County Telephone Company at Middletown, N. Y., is completed. When the instruments are received the exchange will be put in operation.

Edward Abner, president of the Occoquan-Woodbridge Telephone Company, has announced that his company has abandoned the idea of erecting an exchange at Alexandria, Va.

At Newcastle, Pa., the local agent of the Bell Company has been instructed to cut the price of telephones down $3 less than any rate the new Citizens' Company may make.

The Saginaw Valley Mutual Telephone Company has been granted a thirty year franchise by the common council of Flint, Mich.

H. L. Kerr, representing McGhie & Moore, of East Liverpool, O., proposes establishing a telephone exchange at Sistersville, W. Va.

The new exchange of the Northwestern Telephone Company at Oshkosh, Wis., with 300 subscribers, will be in operation within a short time.

The Home Telephone Company has been granted a franchise at Alexandria, Va., on the condition that after eight years iron poles be used.

The local Bell Company has announced that it will put in a 'phone in every business place and home in the city of Niles, Mich., the customer to have the use of the instruments free of charge.

The Commercial Cable Company intends to erect on Broad and New streets, adjoining the Stock Exchange, New York city, a million-dollar office building to be 21 stories high.

The Board of Street and Water Commissioners of Newark, N. J., has passed the franchise of the Newark Telephone Company on first reading.

The police commissioners of Albany, N. Y., have under consideration plans for a police signal system.

A telephone line is to be built between Belleville and Red Bud, Mo.

COMMERCIAL PARAGRAPHS.

"Nature smiles through Sunbeams" and "A dollar's worth of light for a dollar," the mottoes of the Sunbeam Incandescent Lamp Company, are quite as well known to the electrical reading public as the Sunbeam lamp is known to the electrical buying public. Those who have spent two dollars for one dollar's worth of light, by the purchase of poor lamps, have later come to bear witness to the fact that neither of the expressions is inappropriately applied.

The New York & Ohio Company has issued a card to lamp users which is calculated to demonstrate that "the expense does not end with the lamp itself, and is not the cost of the lamp, but the quantity and quality of light that should be given first consideration. A good lamp may be cheap at one dollar; a poor lamp may be very expensive even if it should cost nothing."

The Bishop Gutta-Percha Company, 420–426 East 25th street, New York, has issued a pamphlet devoted to a description of its products.

The second annual grand ball of the employees of the Safety Insulated Wire & Cable Company was held at Murray Hill Lyceum, New York City, on the evening of the 26th inst., under the direction of W. H. Dykeman, Thomas J. Adams, Bernard Martin, Walter E. Holloway, P. A. Galvin, Arthur Lennon, Robert E. Lee and N. J. DeLuna.

Name Plates.

The value of having the manufacturer's name and address plate affixed to the specialties he supplies has long been appreciated, and for some time past there has been difficulty in having such plates made. A well known and long established engraver and designer, whose artistic work is known everywhere, has established a department for the exclusive designing and making of these name and address plates. His name is August Becker, of 55 Oliver street, Boston, and he possesses the most complete facilities for that kind of work, his staff of designers and engravers being qualified to produce work of the highest merit. These name plates are suitable for dynamos, motors, transformers, switchboards, meters, rheostats, engines, etc., etc., etc. Mr. Becker already executes this class of work for many of the leading electrical and engine manufacturing concerns; and all others requiring anything of the kind, should not fail to communicate with him for prices, designs, etc.

A Comprehensive Catalogue.

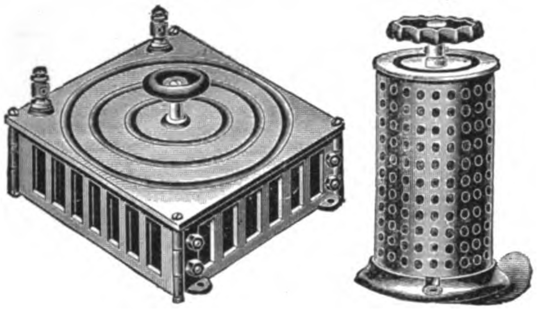
The illustrated catalogue just issued by the Metropolitan Electric Company, Chicago, is a veritable encyclopædia of everything electrical. It is composed of 760 pages, freely illustrated, handsomely printed and attractively bound. Considerable space is devoted to data, tables and other information of value to engineers, station managers and others. The book is well calculated to become a valuable addition to every purchasing agent's library.

The Graphite Rheostat.

A novel form of rheostat called the "Graphite" has recently been placed on the market by the Graphite Rheostat Company, Chicago. The accompanying cuts illustrate its appearance when finished. Although the general form of its case is similar to that of the ordinary wire rheostat, its construction bears no resemblance. The sliding arm and row of contacts are wanting in this rheostat although the hand wheel on the face is turned in the same manner.

Through the sides of the frame pass rods, and upon these rods are mounted the small slate slabs. Between the plates are iron cylinders, the whole being firmly held together by the shorter rods at the sides. These iron cylinders are filled with a specially prepared graphite. From the slate plate project rods which enter the cylinders. A rack moved by a pinion carries the cylinder over these rods. At the base of each cylinder is a brass button on the end of a bolt. When the cylinders are carried up so that the rod touches the brass button the entire resistance is cut out and there is a clear path for the current established. As the cylinders reach that point the switch in the corner is tripped and the rheostat is cut out of circuit.

Suppose it is desired to place a resistance in the circuit. By turning the hand wheel the rods leave the brass buttons at the base and at the same instant the switch is opened, throwing the rheostat in circuit; the current will then pass in series through the small sections of graphite in the cylinders. By turning the wheel farther, drawing out the rods, the sections are increased in length and the resistance in circuit increased in a proportionate amount. It will be seen from this that the amount of resistance is capable of an infinite number of variations. The number of contacts on the largest rheostat is small in comparison. This advantage will be found of value in the accurate regulation of generators, in dimmers, etc.



FIGS. 1, 2.—THE GRAPHITE RHEOSTAT.

The material used in this rheostat is not affected by heat or cold, so that there is no danger of a burn out. There being no sliding arm and contacts to wear out makes it a durable piece of apparatus. The case is of iron and of a form that gives good ventilation. The method of construction permits the making of rheostats of any resistance an easy matter. Resistance cylinders of a fixed resistance can be supplied.

This form of rheostat can be used with electro-medical apparatus and for similar purposes, in the charging of storage batteries where current of an exact amount and voltage is desired, as a motor starting box or a rheostat for the regulation of dynamos. Its construction, as will be noted, is exceedingly simple. There are no soldered connections; no wires to become brittle and break; no contacts to accumulate dirt. In Fig. 2 is shown a resistance cylinder of a different form, in which the same method of construction is employed. The case and hand wheel are nickel plated.

The Hatch Storage Battery.

The Hatch Storage Battery Company, 421 Chestnut Street, Philadelphia, is introducing a new storage battery which is claimed to be the "best and cheapest made, and which supplies all the requirements of a storage battery for all purposes." The porous diaphragm of the battery is made of unglazed earthenware. These pottery diaphragms have receptacles on their faces into which the active material is filled, while on their reverse sides they are grooved, so as to admit of a free circulation of the electrolyte of the cell. These diaphragms, loaded with active material, are then placed back to back, with the grooves crossed, and thus prepared are assembled as an element, to which the electrodes are applied. The two outer conducting sheets or electrodes are supported in position by rigid backs of glass or other suitable material, and the element thus assembled is firmly bound together with flexible rubber bands, made expressly for the purpose, thus providing an elastic element to allow for the expansion and contraction of the active material during charge and discharge.

The form of construction adopted in the Hatch Storage Battery overcomes, it is claimed, all difficulties which have heretofore beset what is commonly known as the "Grid" type of element, and in a most simple manner, while providing a battery which is cheap, light and durable, and at the same time the electrical efficiency is equal, if not superior, to the best known "Grid" batteries.

Don't Copy Their Ads.

Mr. Charles Austin Bates in the last number of *Printer's Ink* has some interesting remarks on the subject of originality in advertisements. An advertisment of the Standard Electric Company, which had appeared in certain electrical papers, was reprinted with some other good advertisements in *Printer's Ink*, and there attracted the attention of one Forrest Morgan, who immediately went into spasms, claiming that the advertisement was borrowed from one he wrote some two years ago and was spoiled in the borrowing. Mr. Bates then comments: "Mr. Morgan is exciting himself unduly. The ad. which he wrote begins, 'The latter end of the contract is vastly more important than the front end.' The ad. of the Standard Electric Company begins, 'The end of a contract, like the end of a wasp, merits respectful consideration.' Now I don't suppose that either Mr. Morgan or the writer of the other ad. is the first or only man who ever thought of that same thing. I suppose that similar expressions have been used in print and in writing and talk ten thousand times. It is nonsense for a man to claim originality in anything of this kind, or to say that somebody else is stealing his ideas. The similarity between these two ads. is not so very startling. It merely shows that two people have thought of the same thing in connection with a contract. I know that I have seen the idea used a number of times before, and the man who originated it has probably been dead some thousands of years. This continual howl and disturbance about originality is a thing well calculated to fatigue any man of experience in the advertising business. Mr. Morgan says that he thinks this ad. was borrowed and spoiled in the borrowing. As a matter of fact, if it was borrowed it was improved. There's but one end to a contract. There is a beginning and an end, and the beginning is not an end. There is no such thing as a latter end and a front end of a contract. I may be giving this subject more attention than it deserves, but this question of originality bobs up every once in a while. It is nonsense for a man to try and be original. He can't be original no matter how hard he works, and so long as he can make use of another man's ideas without hurting that other man there is no reason under the sun why he shouldn't do so." The ad. in question was not stolen, but was based on a previous advertisement reading: "Our contract does not obligate the purchaser to buy apparatus or supplies exclusively of us for a term of years," etc.

INCORPORATIONS.

The Beatrice Electric Company, Beatrice, Neb.—to operate street railway; operate electric light, heat and power plants, etc. Capital stock, $100,000. Promoters: John N. Horback, Paul W. Horback, Victor C. Lantry, John E. Smith, Albert S. Maxwell.

The Leechburg Electric Light and Power Company, Leechburg, Pa.—to supply light, heat and power by electricity to the public. Capital stock, $16,000. Promoters: J. D. Orr, Leechburg; W. W. Staub, E. F. Austin, Pittsburg, Pa.

The Quebec "Official Gazette" announces the incorporation of the Fraserville Electric Power Company. Capital stock, $25,000.

The American Audible Block Signal Company (incorporated in W. Va.), Buffalo, N. Y.—to acquire, etc., patents relating to systems of electric and other signals pertaining to railroads, etc.; selling, leasing, etc., same. Capital stock, $500 minimum, $5,000,000 maximum. Promoters: Cyrus J. Wheelock, C. W. Hammond, John T. McLaughlin, Frank S McGraw, John F. Cochrane, Buffalo, N. Y.

The Fort Wayne Consolidated Railway Company, Fort Wayne, Ind.—to operate the electric street railway system at Ft. Wayne. Capital stock, $2,000,000. Directors: John H. Bass, M S. Robinson, James M. Barrett, John J. Shepherd, Andrew Squire, Charles Gerke and Samuel L. Morris. The State's fee for the incorporation was $2,002.

The Bedford Electric Light Company, Bedford City, Va.—to manufacture electric light and supplies and furnish same. Capital stock, $25,000. Promoters: T. D. Berry, J. A. Clarke, C. E. Harris, Bedford City.

The Marysville Gas and Electric Company, Marysville, Cal.—to deal in light, power and heat. Capital stock, $500,000. Promoters: D. E. Knight, A. C. Bingham, Mary A. Knight, Thomas Syversten, Marysville.

The Albany, Helderberg and Schoharie Electric Railway Company, Albany, N. Y.—to build and operate an electric railway between Albany and Schoharie village, a distance of about thirty miles. Capital stock, $300,000. Directors: Jonas H. Brooks, John W. Van Valkenburgh, Robert J. McCauley, Albany; J. M. Erwin, New Salem; C. E. Deitz, Thomas J. Wood, Berne; Jacob Kelsch, Hiram Schoolcraft, Gallupville; E. Twitchell, C. C. Kromer, O. A. Snyder, Schoharie; Harrison Finkle, Greenbush, N. Y.

The Eclipse Electric Lamp Company, Buffalo, N. Y.—to make and sell electric lamps, etc. Capital stock, $100,000. Directors: Thomas F. Crean, Brooklyn; H. H. Fulton, Elmira; W. C. Page, New York; William Crosby, Buffalo; William Marison and Andrew Marison, Montclair, N. J.

The Chemung Gas and Electric Light Company, Elmira, N. Y.—to make and sell gas, electricity, etc. Capital stock, $200,000. Directors: C. G. S. Thomas, Arthur S Pinkham, Paul C. Safford, Frank McKelvey, John Doyle, George T. Carhart, and Albert E. Ettinger, all of New York City.

The East River and Atlantic Ocean Railroad Company, Brooklyn, N. Y.—to build and operate an electric line connecting the Nassau Electric Railway and the lines of the Brooklyn Traction Company's system. Capital stock, $3,000,000. Incorporators: P. H. Flynn, Silas B. Dutcher, J. C. Brower, F. C. Cochen, W. J. Studwell and G. S. Studwell.

The Johnson-Lundell Electric Company, New York—to manufacture and deal in dynamos and electrical apparatus to produce light in New York City. Capital stock, $500,000. Directors: Edward H. Johnson, Robert Lundell, Frank S. Hastings, Harry E. Robinson, Martin J. Quinn and Edward Beers, of New York City.

The Schenectady Illuminating Company, Schenectady, N.Y., has filed a certificate of an extension of its powers to furnish light, heat and power in the towns of Rotterdam, Glenville and Niskayuna, in Schenectady County. The capital is $100,000, and the trustees are John Kruesi, Charles A. Leb and George W. Jones.

The Skeen Electric Switch and Signal Company, St. Louis, Mo.—to manufacture electric switches, etc. Capital stock, $5,000. Promoters: A. T Gast, Chas. E. Joy, C. H. Witthofft, Ferdinand Gast, St. Louis.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

NOVEMBER, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	3.30 A. M.	1	5.30 A. M.
2	No light.	2	No light.
3	"	3	"
4	"	4	"
5	5.20 P. M.	5	7.40 P. M.
6	5.20 "	6	8.40 "
7	5.20 "	7	9.50 "
8	5.20 "	8	11.10 "
9	5.20 "	10	12.20 A. M.
10	5.20 "	11	1.00 "
11	5.20 "	12	1.30 "
12	5.10 "	13	2.50 "
13	5.10 "	14	4.00 "
14	5.10 "	15	5.20 "
15	5.10 "	16	6.00 "
16	5.10 "	17	6.00 "
17	5.10 "	18	6.00 "
18	5.10 "	19	6.00 "
19	5.10 "	20	6.00 "
20	5.10 "	21	6.00 "
21	7.30 "	22	6.10 "
22	9.00 "	23	6.10 "
23	10.20 "	24	6.10 "
24	11.00 "	25	6.10 "
25	11.20 "	26	6.10 "
26	...... "	..	....
27	12.20 A.M..	27	6.10 "
28	1.20 "	28	6.10 "
29	2.20 "	29	6.10 "
30	3.20 "	30	6.10 "

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED NOVEMBER 19, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

549,920. Underground Trolley System. Charlie E. Hubb Streator, Ill. Filed May 23, 1895.

550,057. Closed-Conduit Electric Railway. Herluf A. F. Petersen, Milwaukee, Wis. Filed Oct. 29, 1894.

550,059. Trolley. Francis J. Pribyl, Hazleton, Pa. Filed March 9, 1895.

550,102. Underground-Trolley System. Cornelius J. Hamilton, Philadelphia, Pa., assignor of one-half to James Lilley, same place. Filed April 26, 1895.

550,132. Electric Appliance for Railways. Herluf A. F. Petersen, Milwaukee, Wis. Filed March 19, 1894.

550,220. Electric Car or Locomotive. Rudolf Eickemeyer, Yonkers, N. Y.; Rudolf Eickemeyer, Jr., executor of said Rudolf Eickemeyer, deceased. Filed April 8, 1891.

ELECTRIC LIGHTS AND APPLIANCES.

550,215. Electric-Arc Lamp. Edouard Cannevel, Paris, France. Filed April 20, 1893. Renewed July 22, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

550,008. Self-Propelling Vehicle, Boat, etc. George A. Washburn, Cleveland, Ohio. Filed March 6, 1895

550,044. Rheostat for Use in Electric Motor Circuits. Rudolf Eickemeyer, Yonkers, N. Y.; Rudolf Eickemeyer, Jr., executor of said Rudolf Eickemeyer, deceased. Filed Jan. 14, 1893.

TELEPHONE AND TELEGRAPH APPARATUS.

550,204. Toll-Collecting Telephone Apparatus. Geo. K. Thompson, Malden, assignor to the American Bell Telephone Company, Boston, Mass. Filed Aug. 21 1895.

BATTERIES.

549,899. Plate for Storage-Batteries and Process of Making It. Francis J. Clamer, Philadelphia, Pa. Filed Dec. 20, 1893.

550,039. Galvanic Battery. Edward S. Boynton, Brooklyn, N. Y. Filed Feb. 21, 1895.

550,167. Electric Battery. Thomas Froggatt, London England. Filed May 1, 1895.

MISCELLANEOUS.

549,906. Automatic Electric Fire-Alarm. Harry A. Edgecomb, Mechanic Falls, Me. Filed Jan. 5, 1894.

549,919. Electrical Indicator. John W. Howell, Newark N. J., assignor to the Edison General Electric Company, New York, N. Y. Filed Jan. 2, 1892.

549,995. Underground Conduit. James F. Cummings, Detroit, Mich., assignor to the Cummings & Engelman Conduit Company, same place. Filed March 4, 1895.

550,018. Electrical Steering-Gear. Frank L. Dyer and Leonard H. Dyer, Washington, D. C. Filed Oct. 4, 1894.

550,042. Electric Fan. Philip Diehl, Elizabeth, N. J. Filed May 11, 1891.

550,096. Fuse-Box or Cut-Out. Augustus C. Carey, Lake Pleasant, Mass. Filed April 13, 1895.

550,192. Electric Protective Appliance. Alfred H. McCulloch, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Jan. 24, 1895.

550,205. Electric Time-Signaling Apparatus. James T. A. Todd, Fort Worth, Tex. Filed Feb. 11, 1895.

550,210. Railway Signaling Apparatus. Benjamin Wyckoff, Asbury Park, N. J. Filed March 13, 1895.

550,229. Cycle-Alarm. Robert M. McDonald and Alexander McDonald, Dalmuir, Scotland; said Alexander McDonald assignor of one-third to Edwin Packard Brooklyn, N. Y. Filed April 6, 1895.

ELECTRICITY.

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ELECTRICITY

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EDITORIAL NOTES.

Safety of Overhead Circuits.

There are a few persons interested in some branches of the electrical trades who may look upon Capt. Wm. Brophy, chief of the Boston Wire Department, as an alarmist. His declaration: "I believe the so-called insulating covering in use at the present time for high potential circuits to be worse than a delusion and snare," will doubtless provoke criticism in certain quarters. However much persons may differ with him, it cannot fairly be charged that Capt. Brophy has spoken unadvisedly, or that he has sought to needlessly alarm the public as to the dangers of overhead high potential circuits. It is simply and plainly his contention that if the practices which have obtained in the highly successful work of insulating underground circuits be applied to overhead construction, a condition approximating perfect safety can be attained.

Capt. Brophy never speaks evasively, neither does he make statements having no foundation in fact. Every well posted constructing or contracting engineer, and every central station man of experience, knows that there is not in existence a high potential overhead circuit which will maintain in all conditions of weather an insulation resistance of 20 megohms per mile per 100 volts. This is one of the requirements of the Boston Wire Department for underground circuits, and that it is not exacting or impossible to be attained is attested by Capt. Brophy, who says: "There is not an underground wire or cable used on high potential circuits in Boston the insulation of which does not exceed this."

The Safety Insulated Wire and Cable Company, which has over 100 miles of cable in Boston streets, the Habirshaw and Standard Companies, and the National Conduit Manufacturing Company, which has supplied all the conduit for the city, ought to feel gratified with Capt. Brophy's testimony to the efficiency of their work: "The almost perfect insulation of underground wires and cables has already been accomplished, and the question now to be met and answered is, can the same grade of insulation be secured for overhead circuits?"

By using so-called insulated wires on high potential circuits, distribution companies admit that such circuits are dangerous. The ordinary braided insulation used for this purpose, as every one knows, deteriorates very rapidly with age and in a very short time becomes absolutely worthless for the purpose for which it was intended. Capt. Brophy but expresses the opinions long held by many of our ablest engineers when he says: "It would be better to hang out the danger signal at once, by using bare copper wires, than to continue the use of this flimsy fraud that affords no protection to human life or property, but lures innocent people on to injury and death." The bare trolley wire has inspired a certain amount of respect which has been lacking in the case of the so-called insulated circuits.

The conditions which exist to-day are due to purchasers and the public and not to the manufacturer or engineer. The public has demanded cheap light and power. To supply it the generating company has sought to reduce the plant investment by constructing a cheap distribution system. That as high a, if not higher, degree of insulation in overhead as in underground circuits can be secured is certainly possible, but to accomplish this money must be spent for material. Wire manufacturers have long been able to produce, and anxious to sell, wires and cables of almost any insulation resistance, but most purchasers have held that anything will do for overhead lines so long as it passes for insulated wire.

Capt. Brophy's opinion as to the wisdom of burying all high potential circuits is shared by more people than it was six or eight years ago, when even central station managers protested that their companies would be bankrupted by such a requirement. To-day experience has taught them better, and the tendency is in all the larger cities to bury the wires. The captain says: "I believe that all high potential circuits should be placed underground, and I believe it can be done with ultimate profit to their owners."

This is the truth in a nutshell. The interests of the public and of the lighting and railway companies do not clash. Every lighting company which has its wires underground has found it a profitable investment, and the few railway companies which have been compelled to bury their feeder wires, after a bitter struggle against it, have become converted, and would not go back to entire overhead construction if they could. Their service is better, and operating expenses and repair account are enough less to justify the extra investment.

The question of insulation for either aerial or underground work is simply one of cost. No reasonable man will for an instant suppose that a wire which is sold for a few cents per pound above the cost of ingot copper will possess or maintain the same qualities of insulation to be found in a wire the insulating material of which alone costs four or five times as much as the copper. So long as purchasers continue to demand cheap wire, the wire manufacturers will supply it, but safe overhead circuits will never be constructed with it.

Central station men have no just cause to complain of Capt. Brophy's exacting requirements, or strictures, whichever they may choose to term them. A distribution system constructed according to his specifications will mean increased initial cost, it is true, but the economy, reliability and regularity of subsequent service will repay the outlay with interest. The wire manufacturers are quite as ready and willing to make a good, high-priced insulation as a cheap and poor one. Engineers would feel that their long-continued and well-directed efforts to secure the highest standard of excellence in all branches of the art have been not without fruit if purchasers would rise above the considerations of first cost. And finally the public, that great and exacting body which most of all needs to be considered when it is appealed to to supply a return for invested capital, would, if the distribution of electric energy were made free from all elements of danger, accord to the supplying companies a more liberal support.

One of the unfortunate features of the rapid development of the electrical industry in this country, surpassing any other new industry in the history of the world, has been the vast sums of money invested in merely tentative work. We have now had enough of this. Let us have the best.

* * *

Efficiencies of English Lamps.

Some weeks ago we published the results of an elaborate test which had been made of the leading Continental incandescent lamps, observing at the time that the results of this test showed the product of the foreign manufacturers to be vastly inferior to our own. The test of English lamps, as given in another column, certainly confirms the statement already made.

The average candle power of the sixteen 8 C. P. Continental lamps used in the first test was but 7.25. To develop that illumination an expenditure of 4.77 watts per C. P. was required. The average of eighteen 16 C. P. lamps was but 13.04 C. P., requiring an expenditure of 4.56 watts per C. P.

In the English test the 8-C. P. lamps show a slightly higher candle power but lower efficiency than the Continental, the average of the former being 7.81 C. P. and the latter 4.9 watts per C. P. In the manufacture of 16 C. P. lamps the English makers seem to have more nearly approached the American standard than do the Continental manufacturers. The average candle power of the 16 C. P. lamps used in the English test was 14.21; the efficiency 4.27 watts per candle.

Comparing the above mentioned tests with one recently made of American lamps by Prof. Thomas of the Ohio State University, the superiority of the American product in both sustained candle power and efficiency becomes apparent. This test was made under conditions closely approximating everyday central station practice, and showed that after a period of 600 hours burning the average candle power of a group of 16-C. P. lamps was 16.35, while the efficiency was 3.83 watts per C. P.

It would seem that the demand for lamps of high economy does not exist in Europe, or if it does exist the manufacturers evidently are not able to supply it. Competition has done much in America to improve the quality of lamps, but to central station managers belong much of the credit. They early saw the advantages of higher economy than was possible to be obtained from the types of lamps which were guaranteed to burn for 1,000 hours or a multiple of that number, and at an unknown watt efficiency. They persistently demanded a lamp that would develop a maximum candle power at a minimum expenditure of energy. The lamps now manufactured come up to this high standard, to which the European and Continental makers have not attained, if indeed they have attempted to do so.

MR. JAMES HOTSTUFF RHOTEHAMEL, president of the Columbia Incandescent Lamp Company, was the first purchaser of space for the grand electrical exhibit to be held in this town next spring, thereby earning this free advertisement. The last man to sign will not be so well treated.

Under the Searchlight.

Views and Opinions on Timely Topics.

"What's In It For Me?"

CHAPTER III.

In ELECTRICITY for October 16 appeared a brief sermon, under the above title, on the general subject of bribery of purchasing agents, the evils of the system, and the various moral questions involved. In that sermon it was charged that L. H. McIntyre, formerly general manager of the People's Traction Company, Philadelphia, had established corrupt relations with nearly every concern of which he bought supplies and apparatus. Among other concerns mentioned was the Peckham Truck Company, from which company McIntyre confessed having drawn a regular retainer while he was the trusted agent of the railway company, supposed to look out for its best interests in all his purchases. It was further stated that the subtle influence of the Peckham Truck Company over McIntyre was so powerful as to induce him to throw off about 125 trucks of another maker after ten months' use and substitute therefor more Peckham trucks, although repairs on the discarded trucks had been practically *nil* while repairs to the Peckham trucks had been considerable during the same period.

The main question at issue, however, was that of bribery, and not one of the merits of the trucks.

A few days later Mr. Peckham published as an advertisement a letter from Mr. Wm. H. Shelmerdine, who was a director of the People's Traction Company at the time under discussion, denying the correctness of our statements—*not as to bribery*, but as to repairs on trucks. Mr. Shelmerdine said:

> . . . The situation is exactly the reverse. That is to say, the Peckham trucks cost us comparatively nothing, while the Brill trucks proved much more expensive in maintenance.

On November 16 we published this letter in full, and reiterated our charges, making, however, no accusations against Mr. Shelmerdine, who was not in position at the time to know anything of the subject which he now discusses. In the November 16 article we addressed the following to Mr. Peckham:

> Is the charge that trucks made by your company happened, in one instance, to be improperly made more damaging to your reputation than the charges as to your relations with Mr. McIntyre? Is it less honorable for you to bear the responsibility of mistakes made by your mechanics than to rest under the charge that while L. H. McIntyre was a salaried employee of the People's Traction Co., vested with the authority of purchasing all apparatus, he, as "consulting engineer," received large sums of money from your company contemporaneously with this purchase of trucks from your company? . . .
>
> Any reasonable amount of space, say two pages, is at your disposal for a letter of this kind, and there will be no charge.

Not having heard from Mr. Peckham, we take it that he does not care to explain the relations of his company with Mr. McIntyre.

Every statement made by us in the original article was based on actual fact. Our information was official and authentic. Proof was always at hand.

In our advertising pages this week will be found some interesting letters bearing on the subject, two of which are here reproduced:

THE WILKES-BARRE & WYOMING VALLEY TRACTION CO.,
WILKES-BARRE, Pa., Nov. 16, 1895.

HENRY C. MOORE, Esq., *President Trenton Passenger Ry. Co., Trenton, N. J.*

Dear Sir: I expect shortly to have occasion to purchase some trucks and am considering the Peckham and Brill trucks. I presume you are aware of the controversy that has been going on regarding repairs of these two types of trucks which were used on the People's Passenger Railway of Philadelphia, and knowing you were president of the road at the time Mr. McIntyre exchanged these trucks for the Peckham trucks, I am anxious to learn whether Mr. Shelmerdine has stated the facts correctly in his published letter as to the relative working of the Brill vs. Peckham trucks, his statements having been disputed to me. I write to ask if you can throw any light on the matter as the affair transpired during your term of office in that company.

Thanking you in advance, I am yours very truly,

JOHN GRAHAM, Gen'l Mgr.

THE TRENTON PASSENGER RAILWAY CO. (Consolidated).
TRENTON, N. J., Nov. 21, 1895.

Mr. JOHN GRAHAM, *Pres. and Gen'l Mgr. Wilkes-Barre & Wyoming Valley R. R., Wilkes-Barre, Pa.*

My Dear Sir: I am in receipt of your favor of November 16th, stating your intention to purchase some additional trucks, and that you are undecided whether they shall be Peckham or Brill. . . .

As to the question of repairs on the Brill trucks, I did not purchase any repair parts from the Brill Company, nor were any repairs made to the trucks other than the adjustment of brakes caused by the wear of the shoes and the repair of the pilots, which was caused by the ordinary operation of the road.

As to the Peckham trucks there were several changes made in the mechanism of the trucks in order to hold up the ends of the cars.

Hoping this information will answer your purpose, I am yours very truly,

(Signed) HENRY C. MOORE, President.

Further comment is for the present unnecessary, except to refer briefly to a few remarks in the last issue of the *Street Railway Review*:

> When electrical journals stray into the street railway field they frequently make mistakes which are both amusing and harmless, so evident are the errors to everybody in the railway business. But when a journal comes out in its editorial columns and publishes statements which are not only absolutely false but bear a strong flavor of an advertisement in the guise of reading matter it should not pass without denial.

Then follows a letter from Mr. Shelmerdine which is practically the same as the one printed by us on November 16.

ELECTRICITY never strays. We occupy all fields, and hold the commanding position. But if more sense is not soon exhibited in the conduct of the *Street Railway Review* the only field that publication will occupy will be the journalistic graveyard. If the editor of that publication has an occasional lucid moment, we recommend him to study the correspondence printed above, and at the same time give us his views on the subject of bribery. Can a purchasing agent who accepts bribes give honest service to his employers?

And if Mr. Peckham has any further "reply" to make, we also urge him to take up the subject in its full breadth. Let him tell the public how much his company has paid to McIntyre and others, and whether or not he considers a business built up by the methods referred to the best kind of a business?

* * *

An Honest Critic.

A Southern Journal's View of "Electricity's" Telephone Campaign.

(From the Memphis Herald.)

> ELECTRICITY claims that this company [The Standard Telephone Company] has practised fraud in many ways and that its chief capital is the $300,000 filched from gullible "promoters." Of course there is always the possibility that ELECTRICITY may have been bought up by the Bell monopoly to fight a rival. In these days, a good deal of financiering is done in newspaper offices as reprehensible as that which is carried on in wild-cat telephone companies. It is not easy at this distance to distinguish the hired libeller from the honest journalist.
>
> In favor of ELECTRICITY it can be said that it has fought the Bell monopoly and labored for an independent telephone service. Another thing may be said for ELECTRICITY: if that paper is a hired libeller, it the most skilful and consummate counterfeiter on the globe. Every line and between the lines bear the mark of honesty and courageous sincerity.

We thank our contemporary for the expression of an honest opinion.

ELECTRICITY is laboring to promote the growth of a stable, conservative electrical industry in all branches. America has been cursed with the exact opposite of this since the formation of the Edison Electric Light Company in 1879. We want to see a solid independent telephone business. The only way to secure such an addition to the industry is to drive out the paper concerns, the frauds and shams. And nothing could go further to prolong the monopoly of the Bell Company than the continued existence of such concerns as the Standard Company, destroying the confidence of investors and inspiring a feeling of hostility in all municipalities against all independent telephone projects.

We commend to the editor of the Memphis *Herald* a careful perusal of Mr. Thurlow Weed Barnes's "defence."

Nothing in the way of outside criticism could go *so far* to convince the public that the concern has no basis on which to begin business or to ask for local franchises.

* * *

American Street Railway Financing.

A Foreign View.

The London *Electrician* for November 15, in an editorial review of Mr. E. E. Higgins's "Street Railway Investments," says:

It is decidedly interesting to learn exactly whence came all the money necessary for "power-houses," "car-barns," "welded-tracks," "radial-trucks," "vestibule-cars," and 25 H. P. "T.-H. W. P. single-reduction" motors, not to mention trolley poles and wires, feeders and copper "earth-returns." On p. 28 of Mr. Higgins's excellent compilation we have it all in plain English:

> "In facing the problem of adopting electricity as a motive power the managers of horse-railway properties, both in this and in other classes, soon learned that it was necessary to provide nearly enough money to entirely rebuild and re-equip their roads de novo. The actual selling value of their tangible assets shrank to insignificant proportions. Electric motors were too heavy for the old cars, and the latter had no selling value; the introduction of heavy electric cars made it necessary to reconstruct the road-bed and to sell the old rails at scrap prices; the old barns and car houses were usually sacrificed; and fortunate was the manager who could obtain for his horses even one-third of their original cost. Nevertheless, the old security holders had to be provided for, and naturally enough, the new investment was added to the old, and the capital liabilities were made to represent what was really the cost of building duplicate roads plus the cost of extensions. If this had been all; if new securities could have been sold at par; if the prices for apparatus and construction work had been on an entirely cash basis; and if the promoters had not generally required large profits, the percentage returns on the new capitalization, even with the duplication of investment account above described, would probably have been in nearly every case increased, particularly in the larger places. Unfortunately, however, there were many cases where these exceptionally favorable conditions did not obtain. The most common form of financing these enterprises was to issue mortgage bonds having a par value somewhat greater than the valuation placed upon the old properties, plus the estimated requirements for making extensions and equipping by electricity. Stock was then issued, frequently for about the same par value as the bonds, although the proportions varied according to the fancy of the promoters. The theory of the latter was that the sale of the bonds at a moderate discount would provide all the necessary money for the entire work, and that the net income would largely exceed the fixed charges, so that substantial dividends could be earned on the stock."

Well, we are very desirous of seeing electric traction develop in this country, but not on these terms nor anything like them. Perhaps we in England have reason to be thankful that, owing to the municipal purchase clause, financial hocus-pocus of this order is out of the question, and that owing to the small mileage of our existing tramways, the larger portion of our *in futuro* electric tramways will not be converted horse lines, but entirely new ones.

* * *

G. E. Wants All.

More Trouble at Winona.

(From the Minneapolis Journal.)

Winona, Minn., Nov. 21.—The receivership of the Winona General Electric Company is likely to terminate in a foreclosure sale. During the summer and fall, the bondholders had reached an agreement to reorganize the company, and the United States Court, which meets here next month, was to have been asked to approve this plan. Now, however, the Northwest General Electric Co. has filed claims aggregating $41,000, which they insist take precedence of the bondholders' claims. This is denied by the bondholders, and a foreclosure sale will be had to determine the priority of claims. The company went into the hands of a receiver last February, and its bonded indebtedness is $270,000.

In ELECTRICITY for July 17 and 24 there was printed a complete history of the Northwest General Electric Company's operations at Winona.

The deal comprehended a consolidation of lighting and railway interests. The thorough analysis of all official schedules of property, etc., made by us showed that the Winona General Electric Company was launched with an investment account as follows:

Winona City Railway Company	$198,808.80
New Improvements	60,000.00
Paid for Light Company	35,000.00
	$288,808.80

Upon this foundation of two worthless companies, under the consolidation, $500,000 of stock was issued and $400,000 of bonds planned to be sold in Boston. Only $270,000 of bonds were actually issued, however.

The property of the lighting company inventoried about $35,000 at first cost. Agents of the Northwest General Electric appraised it at $25,000, but the owner wanted $35,000. Mr. Byllesby said: "Ten thousand dollars is only a small matter anyway in a scheme of this kind; pay them what they want." The $35,000 was paid. Furthermore the property had actually been offered to the Northwest General Electric Company, only a few months earlier, for $25,000, as is shown by the following:

[COPY.]

WINONA ELECTRIC LIGHT COMPANY.
T. T. Hayden, J. H. Jenkins,
R. T. Doud, C. L. Bonner.

Winona, Minn., April 26, 1890.

W. G. De Celle, Esq.

Dear Sir: Mr. Hayden has just handed me your letter of the 22d, with the request that I answer it.

I do not know of anything further to say than was contained in my letter to Mr. Bonner a short time since, and the contents of which you are probably familiar.

The plant as it now stands cost us a little over $25,000, and we are willing now to sell it at that figure. Our contract with the city expires about April 1, 1891. The business as it now stands is worth $4,500 or more per annum. Referring to the terms of payment in case a trade should be made, it seems to me that as the proposition is on a cash basis, if you want anything different you are the parties to name it. Yours very truly,

J. H. JENKINS.

P. S.—The Van Depoele plant cost $17,000; the Edison plant cost $8,000.

It is somewhat difficult to see how the General Electric Company expects to get its claim in ahead of all the bonds, as $100,000 of the issue is held in trust to retire an equal amount of bonds of the original Winona City Railway Company, now held by the United Electric Securities Company and issued previous to the purchase of the property by the Northwest General Electric Company.

At any rate, a foreclosure sale will be a good way to determine the actual value of the property on which Messrs. Byllesby and Coffin planned to issue $900,000 of securities.

EFFICIENCIES OF ENGLISH INCANDESCENT LAMPS.

The London *Electrical Review* recently published the results obtained from efficiency tests of some of the leading English incandescent lamps. Of these tests our contemporary says: "The lamps were bought over the counter in the ordinary way without anything being said as to the object of the purchase. Six lamps of 8 C. P. and six of 16 C. P., all intended for use on a 100-volt circuit, were subjected to a trial at this pressure which lasted 600 hours. The necessary measurements from which the efficiency was determined were made by suitable instruments, whose accuracy was periodically checked against standards. From weekly observations the varying efficiencies were obtained, and from the figures for commencement, at the end of 350 hours, and for 600 hours, as given by a contemporary, we have plotted the curves which accompany this article. Three sets of curves are given for each size of lamp; these show respectively the watts actually taken, the actual candle-power of the lamp throughout the period of experiment, and the watts per candle-power.

"We have deduced the means for each diagram, and the curve marked 'mean' will be found to exhibit a peculiarity, in that it is in all cases very nearly a straight line. Taken the 16 C. P. lamps, the Sunbeam requires the highest power, the old Edison-Swan coming next. Below the mean fall the new Edison-Swan and the Robertson; but these change their relative positions as time goes on. Coming to candle-power, it may be noted that both old and new Edison-Swan and Robertson show higher C. PS. than the mean, the new Edison-Swan having a curious bend in the curve (1) as it first rises and then falls. The Sunbeam curve falls markedly with duration of test. Taking what is, perhaps, the most useful of the three diagrams, that of watts per C. P., we find the order of merit quite distinctly indicated, and where the Robertson lamp loses ground in virtue of its lower average C. P., it here gains owing to the small watts per C. P. It is somewhat curious that none of these latter curves intersect or cross one another.

"That 8 C. P. lamps are intrinsically different in their characteristics from those of higher C. P. is made clear by an inspection of the corresponding three diagrams for the smaller size. Not only is the relative order changed, but curves before nearly straight are here bent, and those before passing twice through one value of C. P. are now found doing so only once. The curves practically speak for themselves, and may be taken as relatively correct.

"One important fact can be deduced from these results, and it is worth while to call attention to it. The term 'lamp' is nowadays generally held to mean one of 8 C. P., and it is the custom to express central station loads in terms of the equivalent number of such lamps on their circuits. For this purpose a 'lamp' means a power of 35 watts. From the mean of the averages of the English lamps tested, it appears that 38 watts per 8 C. P. lamp is about the proper figure, so that the statistical 'lamp' is, if anything, more economical and not less so than its practical variety. On this basis 28 lamps are equal to one kilowatt, and for approximate calculations the indicated horse-power of the engines in a central station may be taken as twice the maximum total kilowatt output. The general results of the lamp tests cited show that a 16 C. P. lamp consumes power at the rate of 60 watts, and gives an average of 14.21 C. P. at an expenditure of 4.27 watts per C. P., while the 8 C. P. requires 38 watts and gives an average of 7.81 C. P. at an expenditure of 4.9 watts per C. P. These efficiencies are considerably below the figures usually given, but there are no good grounds for doubting their correctness."

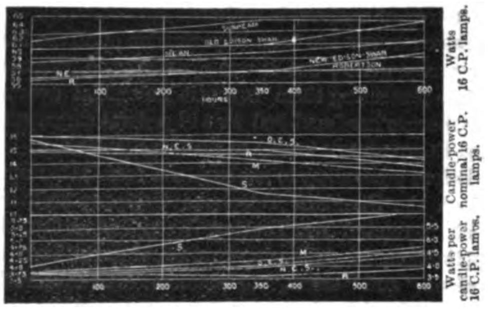


FIG. 1.

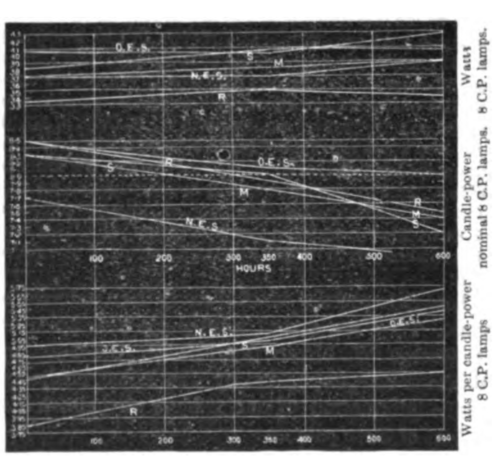


FIG. 2.

The Standard Telephone Co.

MR. BARNES'S SECOND DEFENCE.

Nothing but a Straw Foundation—String Telephones to the Front—The Patents Disclosed.

In the second "defence" made public by Mr. Thurlow Weed Barnes, president of the Standard Telephone Company, appears the following sentence:

"I am willing to be regarded as a countryman for sending any answer to your former letter."

This would be a strange confession for a man at the head of any stable enterprise to make; coming from the president of a company like the Standard Telephone Company, its humor appeals to everyone. Mr. Barnes has indeed exhibited the ingenuousness of a countryman from wayback. If his company had anything to sell, it would have been business sense to have that fact printed just as many times as possible. Having nothing to sell, it was the essence of greenness for him to expose the emptiness of his enterprise as he has done.

ELECTRICITY expresses obligations to Mr. Barnes for his remarks, and to the *Electrical Review* for bringing them out.

In his second letter Mr. Barnes has removed the veil of secrecy, and any intelligent man can now judge for himself what his company has to offer. He has given everything away, and any further attempt at secrecy or mystery is useless.

ELECTRICITY has been in possession of all the facts for many weeks, but it was deemed good judgment before presenting them to await an official avowal. Mr. Barnes has furnished this in general statements, and ELECTRICITY is able to furnish the details.

Before proceeding to analyze the foundation upon which the Standard Telephone Company built, we wish to remind Mr. Thurlow Weed Barnes that the application, in public controversy, of such terms as "clout" and "sneak" to business rivals is scarcely in accord with the code of newspaper ethics with which he was supposed to be familiar.

However, as before stated, Mr. Barnes has unwittingly exposed the "basis" on which the various companies have been incorporated with an aggregate capital of $300,000,000. It has been known all along that the parent company had no property except patents. It is for the rights under these patents that they have already taken in over $300,000 from State companies, giving to each subscriber for $1,000 in the State company $25,000 to $50,000 stock in the parent company as a bonus.

Mr. Barnes first refers to the Cole patents as follows:

> Now for the next remark, as to what patents we have under which it is thought that dividends can be earned. No doubt you have seen the sneak circulars of the irresponsible "Maxwell," who flooded the country with them, offering "$10 reward" to any one who would "furnish a complete list of the Standard patents." Suppose we now simply said patents granted originally to W. R. Cole, of Michigan. Don't you think they possess enough value to warrant agreeable anticipations? If you do not, we differ in opinion. But in any event, pray spare yourself on this point, for the Cole patents are not the only patents controlled by the Standard, a "complete list" of which was not furnished, even under the inducement of a reward of $10!

These Cole patents have already been referred to by us. They are owned jointly by the inventor, Mr. George W. Moore (counsel for the Standard Telephone Company), and by the latter company. For the information of our readers we publish the full text of these patents:

WILLIAM R. COLE, OF DETROIT, MICH., ASSIGNOR TO HIMSELF AND FRANK G. SMITH AND GEO. W. MOORE, TRUSTEES, OF SAME PLACE.

MICROPHONE-TRANSMITTER.

Specification forming part of Letters Patent No. 352,806, dated November 16, 1886.

Application filed May 27, 1886. Serial No. 203,387. (No model.)

To all whom it may concern:

Be it known that I, William R. Cole, of Detroit, in the County of Wayne and State of Michigan, have invented new and useful improvements in Microphone-Transmitters; and I do hereby declare that the following is a full, clear and exact description thereof, reference being had to the accompanying drawing, which forms a part of this specification.

This invention relates to certain new and useful improvements in the construction and operation of microphone transmitters that will be very sensitive to the human voice, while it will not be materially affected by outside influences or by jars and concussions, and at the same time be simple in construction and adjustment.

In the drawing, wherein my invention is shown in sectional elevation, A represents a wooden base having a central orifice through which the sound-waves pass to cause vibration of the diaphragm B, which is secured to a rubber ring, B, in the usual way.

C is a flexible bar, preferably of metal, with an electrode, D, secured at each end thereof.

E is a metallic contact point secured to the center of the bar and resting upon the center of the diaphragm.

F F are electrodes, one being fastened to the end of each of the adjusting screws G G, which are supported by brackets H H, which are secured to the rear face of the base A.

I I are small guide-plates to support the bar C. This bar C is placed parallel with the diaphragm, and preferably in a horizontal position.

The operation of this device is as follows: When the diaphragm is caused to vibrate, a pressure is brought to bear against the bar C (which is slightly curved toward the diaphragm) through the metallic contact-point, the vibration of the diaphragm to spring, straighten, or curve, thus bringing different pressures to bear upon the electrodes at the ends of the bar, such varying pressures being caused by the varying strength of the sound-waves and their influence upon the vibrations of the diaphragm. The electrodes F F are made adjustable by the set-screws, in order to secure the required adjustment.

Fig. 2.

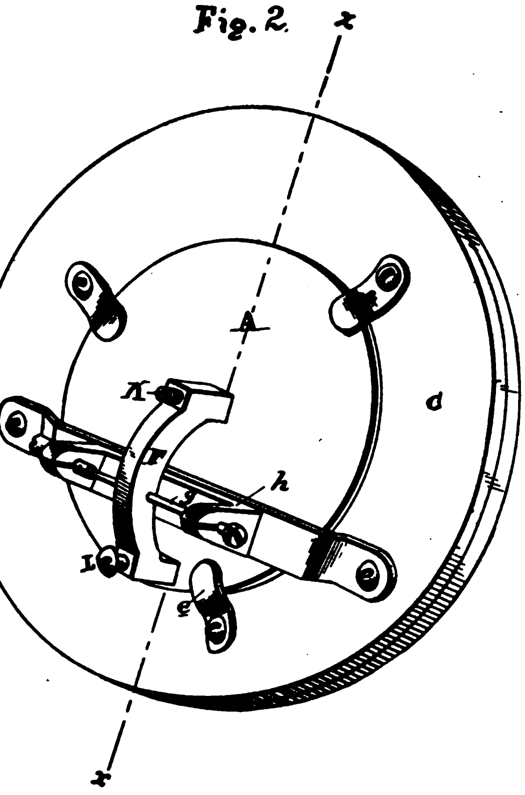
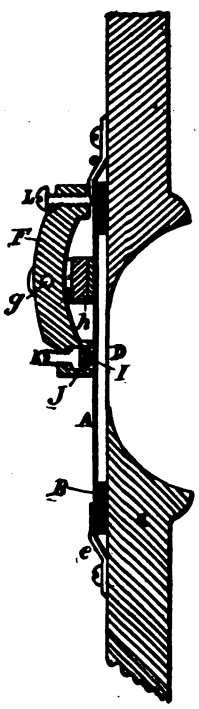


Fig. 1



It is not absolutely necessary to have an electrode and adjusting-screw at each end of the spring-bar, as one electrode and screw at either end of the bar, with the opposite end resting against a post, will answer very well; but it is preferable to have the two, as described, as the current in passing through is varied much more. The contact point E is simply to prevent the spring-bar from resting to too great an extent upon the diaphragm. The current passes in through the bracket or post H at one end, and through the electrodes and out at the opposite end.

While the spring-bar is preferably made of metal, other suitable materials may be employed—such as whalebone, for instance—having a fine wire connected to it and connecting the electrodes D D. The guide posts or supports I I may be dispensed with, and the spring-bar may be supported by notches in the electrodes F F, in which case the ends of the bar should slightly project through the electrodes D D, to form a bearing to rest in the notches.

What I claim as my invention is—

1. In combination with a diaphragm, a horizontal curved spring-bar with an electrode at one end, such bar lying in a plane substantially parallel with the rear face of the diaphragm and with its center in contact with said diaphragm, substantially as described.

2. In combination with a diaphragm and spring-bar having an electrode at both ends thereof, one or more adjustable electrodes carried by adjusting screws and arranged in contact with the electrodes on said bar, substantially as and for the purposes specified.

3. In combination with a diaphragm, spring-bar and electrodes at each end of said bar, as described, guide posts or plates supporting such spring-bar, substantially as set forth.

4. A microphone transmitter consisting of the following elements: a base, a diaphragm, a curved spring-bar centrally in contact with such diaphragm and carrying electrodes at both ends of such bar, and one or more adjustable electrodes, the parts being constructed, supported, and arranged with relation to each other substantially as and for the purposes described.

W. R. COLE.

Witnesses:
H. S. SPRAGUE.
CHAS. THURMAN.

WILLIAM R. COLE, OF DETROIT, MICH., ASSIGNOR TO WM. R. COLE, FRANK G. SMITH, AND GEO. W. MOORE, TRUSTEES, OF SAME PLACE.

TELEPHONE.

Specification forming part of Letters Patent No. 352,735, dated November 16, 1886.

Application filed May 27, 1886. Serial No. 203,386. (No model.)

To all whom it may concern:

Be it known that I, William R. Cole, of Detroit, in the county of Wayne and State of Michigan, have invented new and useful improvements in Telephones; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to certain new and useful improvements in receiving telephones; and the invention consists in the peculiar construction and arrangement of the parts by means of which a very sensitive and efficient instrument is produced, more so than those now known and used. In most of the instruments for this purpose only one pole of the permanent magnet is used, and consequently with a great loss. In cases where the two poles are or have been used, they are or have been bridged or connected together with the electro-magnet, thereby causing a partial loss of the effect of the magnetism upon the diaphragm.

In the accompanying drawings, wherein my invention is shown in vertical elevation, A represents the diaphragm, which may be supported in any suitable and known manner.

B is a permanent magnet.

C is an electro-magnet or helix.

D is an adjusting-screw working within a slot, E, in the permanent magnet.

It will be observed that in my construction one pole of the electro-magnet is made fast to one pole of the permanent magnet, thus making it continuous to the other pole of the electro-magnet. This pole is placed a short distance from the free end of the permanent magnet and made adjustable, so that if the permanent magnet is too strong it can be moved farther away, so that the undulations of the current will produce the best effect upon the diaphragm.

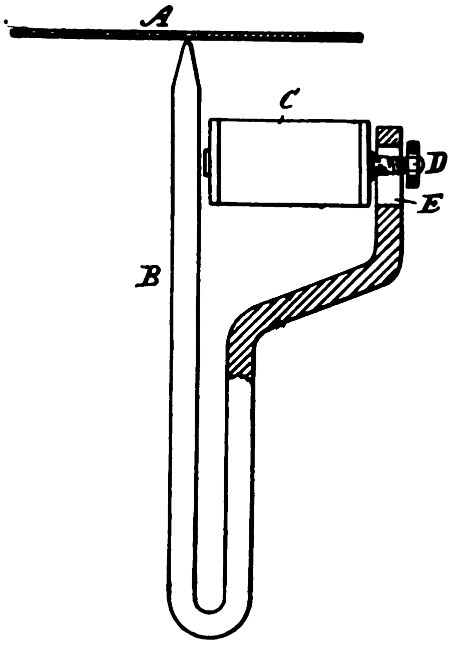
The free end of the permanent magnet B is brought almost to a point, as shown, so as to concentrate all the force thereof to the center of the diaphragm. I find by experience that this, together with the electro-magnet placed as described, has a very powerful effect upon the diaphragm, which enables me to use a stiffer diaphragm than is ordinarily employed and with a better effect.

I am aware that it has been proposed to attach an electro-magnet to one pole of a permanent magnet, and provide means for moving said electro-magnet with the arm or pole of the permanent magnet to which it is attached to or from the diaphragm, and hence do not claim such construction. I deem it important that the electro-magnet be adjustable on the pole of the permanent magnet to which it is attached, for the purposes hereinbefore set forth.

What I claim as my invention is—

1. In a receiving-telephone, a permanent magnet having one of its poles free and arranged at right angles to the diaphragm of said telephone and the other pole attached to one of the poles of an electro-magnet, arranged with its axis parallel with said diaphragm, substantially as described.

2. A receiving-telephone consisting of the combination of the following elements: a diaphragm and a permanent magnet having one of its poles free and its opposite pole adjustably secured to one of the poles of an electro-magnet, as and for the purposes specified.



3. The combination, with the diaphragm A, of the permanent magnet B, having one of its poles free and arranged at right angles to said diaphragm, and the electro-magnet C, attached to the other pole of said permanent magnet, arranged with its axis parallel with the said diaphragm and adjustable to and from the same on its pole of the permanent magnet, substantially as and for the purpose specified.

WILLIAM R. COLE.

Witnesses:
H. S. SPRAGUE,
CHAS. THURMAN.

WILLIAM R. COLE, OF DETROIT, MICH., ASSIGNOR TO HIMSELF, FRANK G. SMITH AND GEORGE W. MOORE, TRUSTEES, ALL OF SAME PLACE.

TELEPHONE-TRANSMITTER.

Specification forming part of Letters Patent No. 351,250, dated October 19, 1886.

Application filed March 3, 1885. Serial No. 157,689. (No model.)

To all whom it may concern:

Be it known that I, William R. Cole, of Detroit, County of Wayne and State of Michigan, have invented a new and useful improvement in Microphone-Transmitters; and I do declare that the following is a full, clear and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification.

The nature of this invention relates to certain new and useful improvements in telephone-transmitters, the object of which is to give a strong undulatory current without any break in the connection, so that the articulation may be clear and distinct, and to obviate the frying and metallic sounds produced in transmitters where the connection is not absolutely maintained.

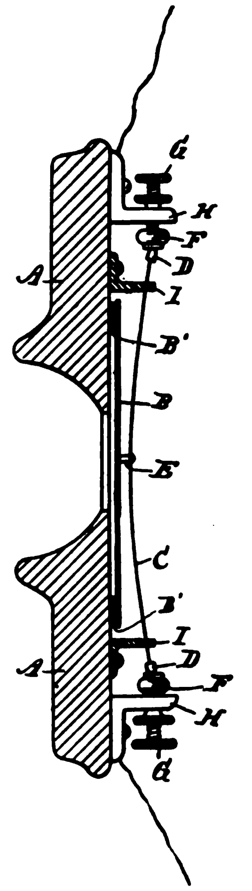
Fig. 1 is a longitudinal section on line *x x* of Fig. 2, showing the various parts. Fig. 2 is a perspective view of the same.

In the accompanying drawings, which form a part of this specification, A represents a metal diaphragm; B a rubber ring upon which the diaphragm rests.

C is a wooden base on which the rubber ring is held.

D is a mouthpiece.

e e are clamps for holding the diaphragm in its place.



F is a polarized magnet hung on trunnions *g*, which trunnions are pivoted between lugs of yoke *h*, which bridges over the diaphragm and is securely fastened to the base C, leaving a space, so that it does not interfere with the vibrations of the diaphragm.

I is a platina point secured to the center of the diaphragm.

J is a carbon button.

K is a brass or other unmagnetizable metal screw that forms a socket for holding the carbon button, and is also used for adjusting the same.

L is an adjusting screw of unmagnetizable metal, to prevent the magnet from tipping forward and engaging the diaphragm.

In operation the carbon button is adjusted to allow the magnet to attract toward the center of the diaphragm until the required amount of pressure is brought to bear upon the platinum point. The small screw L is then adjusted so as not to interfere with the vibrations, but so as to prevent the magnet from changing its position under heavy vibrations. The carbon button never leaves the platinum point, thus preventing oxidization, and the articulations are clear and distinct. The vibrations of the diaphragm upon the carbon button increase or decrease the attraction of the magnet at either end, thus varying the undulatory currents as required.

What I claim as my invention is—

1. In a telephone-transmitter, the combination, with the diaphragm, a yoke bridging the same, trunnions pivotally supported by said yoke, and a permanent magnet supported by said trunnions, of a carbon, and screws for adjusting the pressure of the carbon upon the diaphragm, substantially as described.

2. In a telphone-transmitter, the combination, with the ring C, rubber ring B, diaphragm A on said ring B, and clamps holding said ring and diaphragm to the ring C, of the yoke bridging said diaphragm and provided with lugs *h*, trunnions *g*, journaled in said lugs, magnet F, supported by said trunnions, carbon J, and adjusting-screws K L, all substantially as and for the purposes specified.

WILLIAM R. COLE.

Witnesses:
H. R. RANKIN.
M. MCNAMARA.

Discussing these patents in the order of their dates, we find that No. 351,250, of October 19, 1886, is open to criticism on the following grounds. In the first place the friction of the polarized magnet in its trunnions must of necessity militate greatly against the efficiency of the apparatus, tending to dampen down the vibrations of the diaphragm. Second, the inertia of the polarized magnet would necessarily be so great as to render it impossible for it to respond to even the vibrations of the fundamental tones, and still more impossible for it to respond to the harmonics. Third, so far as the magnetic attraction of the magnet F for the diaphragm A has any effect, it would be to tie the former to the latter so as to compel the one—a body of high inertia with one natural period of vibration—to vibrate in unison with a spring diaphragm whose inertia is negligible, having practically an infinite number of natural periods. The two are inconsistent, and the result must be that with such a transmitter the articulation would be indistinct and the reproduction of the *timbre* or quality of the tone faulty. Telephone men would, from a glance at the drawings, pronounce the instrument faulty and far inferior to other existing types. Nor is the construction such as to evade existing patents. It is clearly an infringement of the Berliner patent; but throwing that aside, it was up to the expiration of the fundamental Bell patents an infringement of those also. It could not therefore have been used up to that time, and if the Berliner patent were out of the way would not be used now, simply because it is a very inferior instrument.

Patent No. 352,735, of November 16, 1886, is for a receiving telephone. This, like the former, could not be used until the expiry of the Bell patents, because it was an infringement, and would not be used now simply because it would not work.

The principle upon which it is constructed is such as to preclude the possibility of efficient working. The assumptions of the inventor are in the first place erroneous. The polar surface on the free end of the magnet will not be at its extremity, as assumed, but directly opposite the free end of the electromagnet. There will, it is true, be a shunt magnetic circuit from the point of the permanent magnet through the air gap to the diaphragm, and thence through the long air gap to the base of the electromagnet, but the reluctance of this shunt circuit would be so enormously greater than that of the other circuit that the merest fraction of the total number of lines of force would take this path. It is these lines of force only that would affect the diaphragm, and consequently even if the variation in current were a maximum its effect on the diaphragm would be but a fraction of that produced in the ordinary Bell receiver, which is now public property.

Further, the exciting coil is on the wrong end of the magnet for best results. For effective action the polar surface next the diaphragm must be capable of responding instantly to the slightest changes of magnetizing force. For this purpose it should be of the softest iron and be surrounded by the magnetizing coil. The effect of placing the soft iron core and coil at the further end of the permanent magnet, as is done by Mr. Cole, is to render the changes at the other end sluggish and blurred and to antagonize the first principles of telephonic art. It will be seen that a worse designed receiver than this one could scarcely be conceived, since all of the magnetic laws are set at defiance.

Patent No. 352,806, of November 16, 1886, is for a microphone transmitter. It will be seen that in this the inventor endeavors to convert the to-and-fro motion of the diaphragm into motion at right angles to this by means of the toggle joint. It is evident, however, that the amplitude of the motion of the electrodes F will be but a very small fraction of that of the diaphragm vibrations. There is therefore a distinct loss instead of a gain by this arrangement. Further than this, the spring bar C, not being a diaphragm supported at all points around its periphery, will naturally respond to only one frequency of vibration, viz., its natural period—all other vibrations must be forced and will therefore tend to dampen down the waves. The patent does not mention that any of the electrodes are of carbon. Of course if they are of metal this would in itself constitute a fatal defect, but whatever the material this patent, like the two previous ones, could not have been used prior to the expiration of the Bell patents. If the Berliner patent is sustained it cannot be used now, but if the Berliner patent be declared invalid it will not be used because it is far inferior to other instruments well known to the public and open to their use.

It will also be observed that all of the patents are exceedingly limited, covering details only, and these details, as pointed out, are of no practical value whatever.

If advertised in the telephone world for one month and sold at public auction, the Cole patents would not bring $5 a piece.

We quote again from Mr. Barnes:

> Finally, will I name the sub-companies controlled by the Standard? Why should I, simply because you ask that I should do so? I fail to see by what right you, or any other editor, put forth questions of this sort, and failing to get what is regarded by you as a satisfactory reply, straightway seek to assume that you have not been treated with due consideration. Suppose I should answer: The Standard controls the "*McDonough*" and the "*National.*" That would not necessarily tell the whole story.

Indeed this would not tell the whole story. In our issue for November 27, ELECTRICITY stated the facts as regards the McDonough Company and the McDonough patents:

> The Standard Company does not own the McDonough patents. It owns the controlling interest in the McDonough Company. The McDonough Company does not own the McDonough patents. It has a license under those patents for five States only. The Strowger Company of Chicago owns several State licenses also, and has already sold the territory of Philadelphia and New York City. It will cost any company more in litigation to decide who does own the McDonough rights in various localities than the patents are worth. Mr. Barnes knows this. So does Mr. J. Wesley Allison.

Well posted telephone men must have smiled when they read Mr. Barnes's official claim to ownership in the National Telephone Company of New Jersey.

Mr. R. L. Lawrence, Esq., receiver of the Consolidated Telephone Company, sold the patent assets of this company to various individuals who afterwards organized the National Company. The patents owned by the latter company are illustrated below, with brief descriptions giving the inventors' claims. Copies of all the patents have been in our possession for several weeks. Nothing could go further to prove Mr. Barnes a countryman than his mention of these patents.

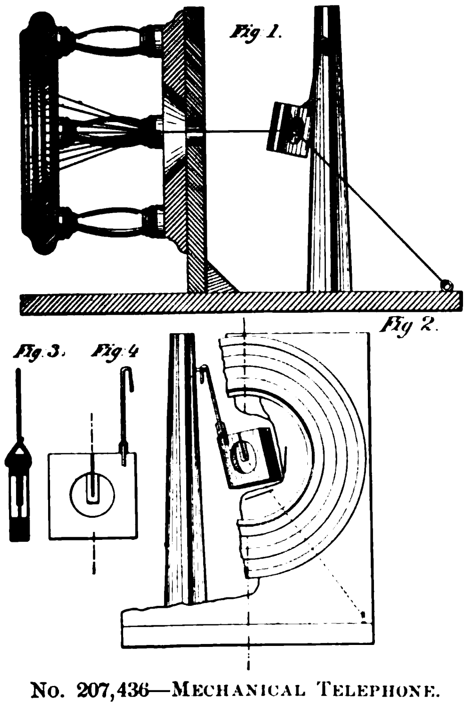
PATENTS OF THE NATIONAL TELEPHONE COMPANY OF NEW JERSEY.

No. 207,436—SCHUYLER S. PARSONS, FRANCIS R. SHAW, AND GEORGE N. DANIELS, OF CHATHAM CENTER, O.

Improvement in Mechanical-Telephones.

Dated August 27, 1878.

This invention relates to improvements in acoustic telephones, so that in place of the usual muffled tone a clear sounding of the diaphragm is obtained, and the confused ringing tone in common telephones done away with; and the invention consists of a diaphragm of cloth or other textile fabric that is mounted in an open wooden case. The transmitting-wire branches out into a number of smaller wires that are jointed to the main wire and attached to the diaphragm. The main wire is hung to insulators, which are made of sheepskin that is placed in a frame with a central opening, the frame and sheepskin being slitted, and the latter re-enforced at the slit.



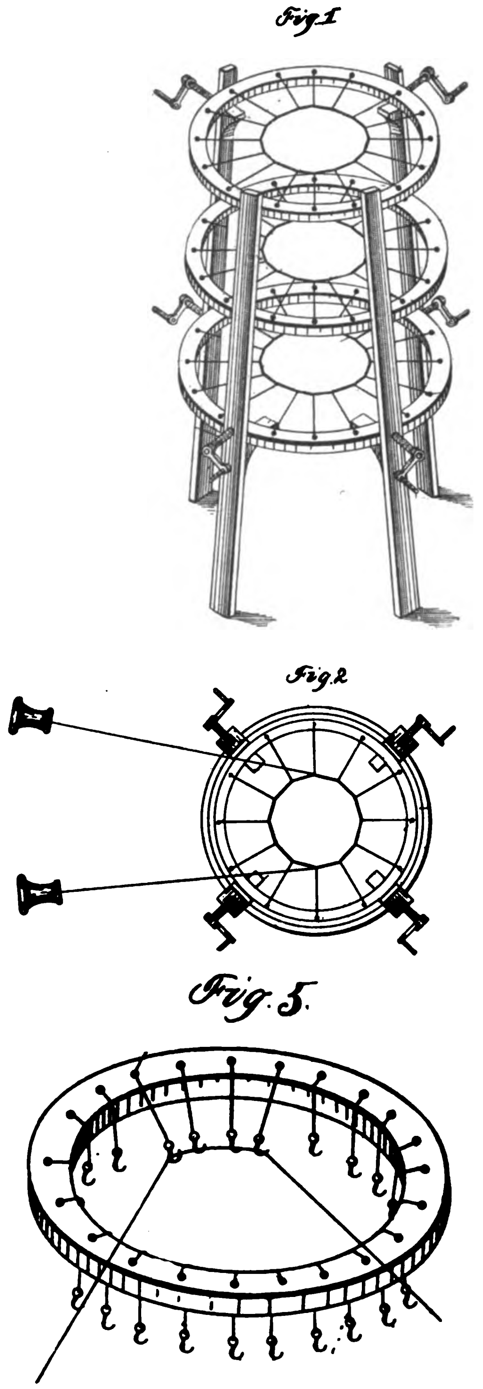
No. 207,436—MECHANICAL TELEPHONE.

No. 266,056—GEORGE F. SHAVER, OF ERIE, PA.

Mechanical-Telephone Exchange.

Dated October 17, 1882.

So far as I am aware, a system of mechanical telephone lines with a central station has heretofore not been established, and for this reason the use of such telephones has been very limited. It is well known that mechanical telephones are very efficient as sound-conveyers; but as their use has been limited to a single wire or line they have not gone into as general use as they would have done had they been considered as capable of operation in a general system with a central station as are electric telephones. The means which are essential in order to establish a system of mechanical telephone wires with a central station are naturally as follows: means for hanging the wire so as to turn abrupt angles without affecting the conduction of sound, so that all the lines can be carried to a common point or station, and so that any one of these converging lines may be connected with any other one in such a manner as to make the communication perfect from any one line to another; also, means whereby three or more of the lines can be connected together, so that a person at the end of one line can communicate with persons at the ends of two or more lines at the same time. A system of wires having these means would be adequate for all general requirements. Much of the success of such a system must depend upon the line-hanger or angle-hanger, for without this being efficient the central station could not be approached and entered by but few lines in cities or large towns; but the device by which various of the converging lines can be connected (which device, in electrical telegraph or telephone parlance, is known as the "switchboard," and therefore may with propriety be so named here) constitutes the really essential features of a central station.



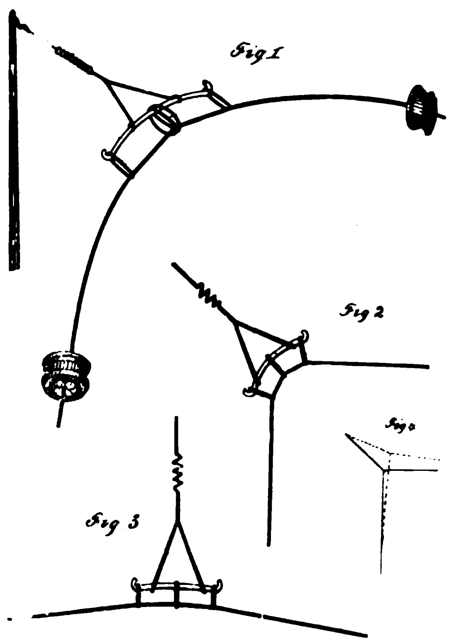
No. 266,056—MECHANICAL-TELEPHONE EXCHANGE.

No. 278 750—GEORGE F. SHAVER, OF ERIE, PA.

Angle-Hanger for Mechadical-Telephone Lines.

Dated June 5, 1883.

This invention relates to devices for suspending the wires of mechanical telephones, and it consists in providing a new and improved angle-fastener.



No. 278,750—ANGLE HANGER FOR MECHANICAL-TELEPHONE LINES.

In suspending the wires of mechanical telephones it is necessary that they be so adjusted that they will remain taut during the various changes in the temperature. This is a difficult thing to do, especially when the line has to change its direction. It is not difficult to draw a straight line taut and keep it so, but when the line has to pass around corners of streets and make various other angles and curves it becomes very difficult to put it up taut and keep it so.

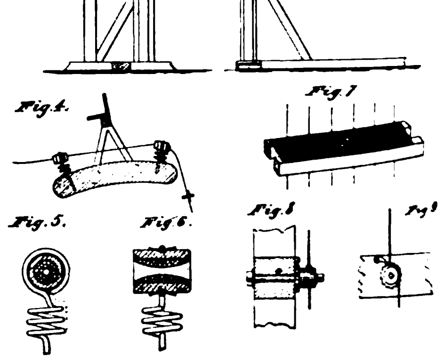
The object of this invention is to provide an angle-fastening which will overcome fully, or as nearly so as possible the abovenamed obstacles and defects.

No. 328,243—GEORGE W. MOORE, OF NORTH EAST, PA., AND JOHN N. CULBERTSON, OF BUFFALO, ASSIGNORS TO THE CONSOLIDATED TELEPHONE COMPANY, OF NEW JERSEY.

Acoustic-Telephone Exchange.

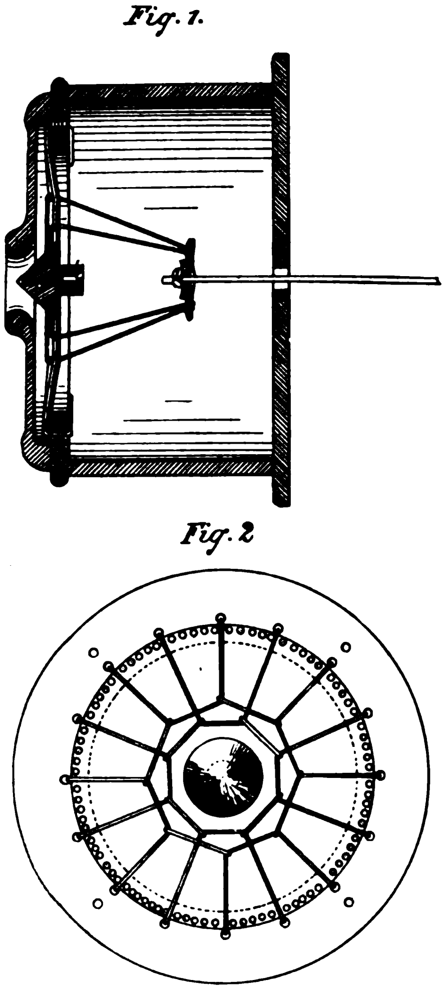
Dated October 13, 1885.

This invention relates to certain improvements in acoustic telephone exchanges in which a number of sound-tra



No. 328,243—ACOUSTIC TELEPHONE EXCHANGE

mitting wires converge, and in which means are provided whereby any two of said wires can be connected together



No. 342,395—Mechanical Telephone.

so as to transmit the sound from the telephone at one end of the wire through the exchange to the telephone at the end of another wire.

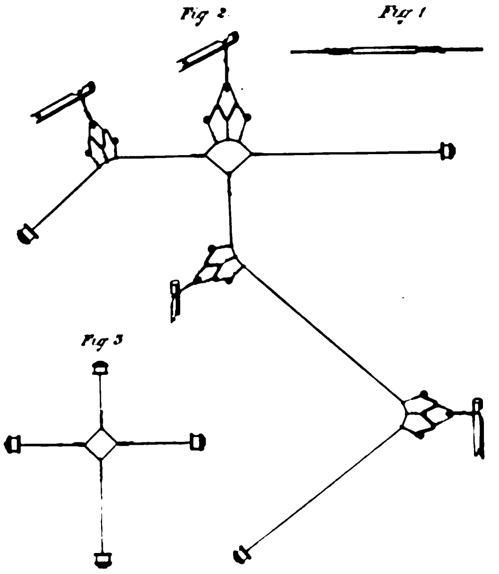
The object of our invention is to provide ready means for establishing communication between the exchange or central office in which the wires converge and the telephones at the end of such wires, and also to provide ready means for connecting any two of the converging wires.

No. 342,395—GEORGE F. SHAVER, OF NEW YORK, N. Y.

Mechanical Telephone.

Dated May 25, 1886.

The invention relates to improvements in mechanical or acoustic telephones; and it consists, first, of the attachmen of the line-wire to the diaphragm by means of supplemental wires arranged in a double truncated cone, or two truncated cones; second, in the use of a weight or weights fas-



No. 352,577—Line Connection for Mechanical Telephones.

tened to the diaphragm to lessen its vibration, and, third, of a sound-deflecting device attached to the receiving side of the telephone.

No. 352,577—GEORGE F. SHAVER, OF NEW YORK, N. Y.

Line-Connection for Mechanical Telephones.

Dated November 16, 1886.

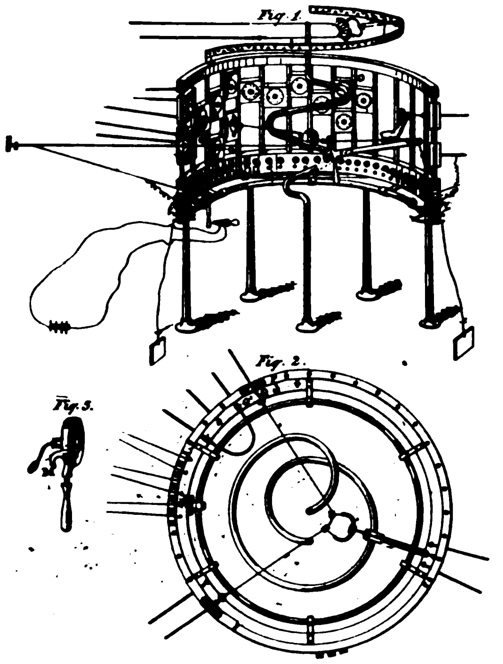
The object of my invention is to provide means whereby one or more branch wires in mechanical telephones may be connected with the main wire, and all the wires may be kept at the same or substantially the same tension, so that the vibrations conveyed to distant telephones will be of substantially the same strength.

No. 354,942—GEORGE F. SHAVER, OF NEW YORK, N. Y.

Mechanical-Telephone Exchange.

Dated December 28, 1886.

The invention relates to improvements in mechanical-telephone exchanges from which radiate a number of wires for telephonic communication, and wherein any two wires



No. 351,912—Mechanical-Telephone Exchange.

may be connected, so that communication may be made from the farther end of any one of said radiating wires to the farther end of any other.

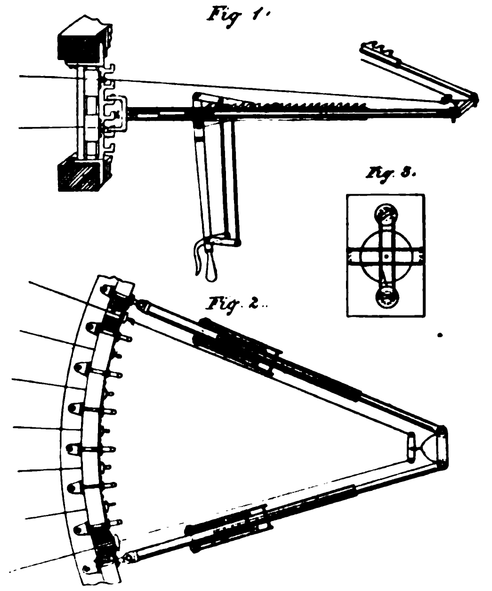
The object of my invention is, first, to provide an easy means of making such connections; second, means for keeping the wires taut when connected; third, providing means whereby many pairs of wires may be connected at the same time without interference; fourth, providing means whereby the operator may easily connect his telephone with any line-wire and tighten the wire. I attain these objects with the mechanism illustrated in the accompanying drawings hereinbefore mentioned, in which similar letters refer to similar parts throughout the several views.

No. 365,868—GEORGE F. SHAVER, OF NEW YORK, N. Y., ASSIGNOR TO BENJAMIN P. WHEELER, OF SAME PLACE.

Mechanical-Telephone Switch.

Dated July 5, 1887.

In mechanical telephones when a person in one place desires to communicate with some one at a distance it is necessary to make a connection between the wires leading



No. 365,868—Mechanical-Telephone Switch.

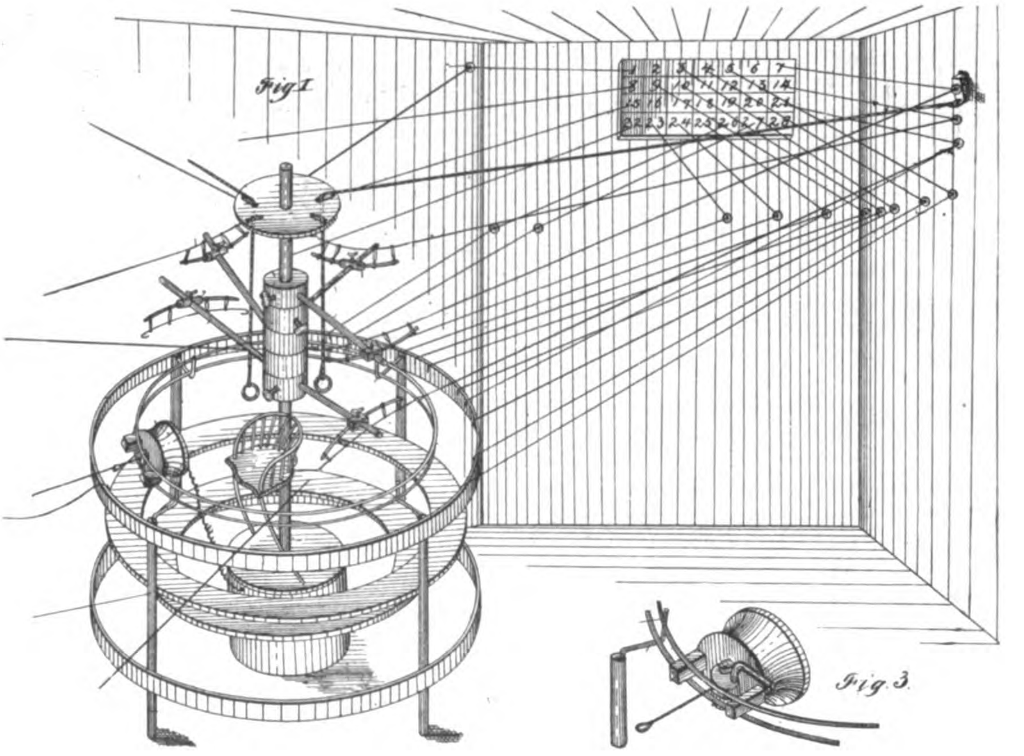
to the two places which shall make them act as one continuous wire. For this purpose the various wires of a telephone system are all led into a central or switching office, where their terminals are arranged and supported in a convenient position for connecting any two of them at will, giving them the proper tension for use.

No. 298,243—GEORGE F. SHAVER, OF ERIE, PA., ASSIGNOR TO THE CONSOLIDATED TELEPHONE COMPANY, OF NEW JERSEY.

Mechanical-Telephone Exchange.

Dated May 6, 1884.

This invention relates to mechanical telephone exchanges; and it consists in providing certain new and useful improvements in the apparatus necessary for establishing communication, when desired, between the various converging lines; also, in providing improved means for signaling to and from the central office or exchange and the several patrons; also, in several minor details relating to the ad



No. 298,243—Mechanical-Telephone Exchange.

justment of the wires, etc., which will be fully explained hereinafter.

The history of string telephones is enshrouded in the mists of antiquity, and ELECTRICITY confesses that it cannot give the date of their first introduction. Egyptologists have found relics of systems as good as Mr. Shaver's in the tombs of the Pharaohs. But we know of no researches which have discovered a telephone exchange equipped with this system.

It has been established beyond a peradventure that mechanical or string telephones were in use in Spain over 500 years ago. There is nothing electrical about the device. Mr. Shaver's patents cover simply a ridiculous elaboration of the lovers' telegraph system—or two tin cans connected by a string, with which every schoolboy is familiar.

Mr. Barnes has added little to his own reputation, or that of his company, by declaring the patent assets of the National Telephone Company to be part of the assets of the Standard Telephone Company. But in his two letters he has contributed something of permanent value to the comic literature of telephony.

Regardless of the influential men connected with the enterprise, the Standard Telephone Company is proved to be, on Mr. Barnes's own statement, a ridiculous windbag. The misguided gentlemen who have gone into State companies, and contributed their thousand dollars apiece, have been grossly swindled. The Standard Telephone Company has never had anything whatever in the way of patents or patent rights of any value. The company has never possessed the possibilities of a successful telephone business. Yet we do not see from our limited knowledge of law how any of the men who have paid their thousand dollars apiece can recover anything from the Standard Telephone Company or Mr. Thurlow Weed Barnes. Receipts for the money paid have all been signed by Allen T. Nye personally, and these receipts were evidently made up under the best legal advice. All the money received has been deposited in the name of Allen T. Nye personally, and there is little doubt, considering legal responsibility independently of moral ethics, that Mr. Nye was entitled to the money.

ELECTRICITY will have few additional comments to make on the affairs of the Standard Telephone Company. It has been proven to be by its own official statements all that we charge. It has had from the beginning no basis for business, and we doubt if the parent officers have had any intentions of doing a telephone business. As the company has truly said in its first prospectus, "The first essential for a great telephone business is an instrument of the first rank." No such instrument has been disclosed to the public, and we will only add that the Standard Telephone Company has now been in the field for nearly one year. If they had begun to do any legitimate business, one of their first purchases would be that of telephone cables and wires. We are prepared to state that the aggregate purchases in this line of the Standard Telephone Company have not amounted up to date to one thousand dollars' worth.

Mr. Thurlow Weed Barnes has confessed himself a countryman, and this statement cannot be questioned. The best thing that he could do now is to retire from all connection with the Standard Telephone Company, and to leave to Mr. Allen T. Nye the burden of all explanations as to the affairs of that company from its beginning to its end—and the latter is not far off.

Address Wanted.

A correspondent of ELECTRICITY desires to learn the present address of Mr. Frederick H. Angel, formerly an insulated wire salesman.

Dangerous Dynamos in Jersey.

(From the Jersey City News.)

One of the large dynamos in the Jersey City Electric Light Company's Works, at Wayne and Fremont streets, exploded last evening a few minutes before 7 o'clock.

THE NEW YORK INDUSTRIAL BUILDING.

Where the Grand Electric Light and Railway Exhibit of 1896 Will be Held.

DETAILS OF CONSTRUCTION AND ARRANGEMENT.

Intense interest has already been aroused in regard to the great electrical exhibit to be held in this city next spring under the auspices of the National Electric Light Association.

The National Electrical Exposition Company, having direct control, has been incorporated for the purpose.

The officers of this company are Harrison J. Smith, (Superintendent of the Edison Illuminating Company of New York), President ; Wm. F. Weiss, (Vice-president of the New York Steam Company), Vice-president ; George F. Porter, Secretary and Treasurer.

The executive committee, which is the governing power of the company, is composed of H. J. Smith, C. O. Baker, Jr., R. B. Corey, H. L. Lufkin, E. F. Peck.

The board of Directors consists of H. J. Smith, C. O. Baker, Jr., John A. Seely, R. B. Corey, W. A. Stadelman, H. H. Harrison, H. L. Lufkin, W. F. Weiss, J. W. Godfrey and E. F. Heck.

It is believed by all familiar with the enterprise that the exhibit will surpass in interest any heretofore held, not excepting that at the World's Fair That the entire trade may be made acquainted with the extraordinary opportunities offered for a grand display, ELECTRICITY has been at pains to secure full information regarding the facilities in the building where the exposition is to be held.

To provide a permanent structure, completely appointed, as a suitable place for holding trade expositions of all kinds, was the primary object of the projectors of the New York Industrial Building, otherwise known as the Grand Central Palace. For this purpose an immense area of floor space, all perfectly lighted both day and night, is an essential. Such a building, to best serve its purpose, must be centrally located. The structure must be substantial in construction and proof against dangers by fire. That all these requirements are met by the New York Industrial Building is admitted, and that it has fulfilled all the expectations of its projectors is attested by the large number of trade displays which have been made within its walls. The furniture trades have contracted for space for the tenth exhibition to be held next January. Four flower shows, four food shows, and numerous other expositions have

NEW YORK INDUSTRIAL BUILDING—A CORNER OF AUDITORIUM.

from time to time been held here. The International Permanent Exhibition Company for some time past has maintained a permanent industrial and commercial exhibit which has been largely instrumental in creating for the exhibitors a profitable and increasing trade with Spanish-American and other foreign countries.

The American Manufacturers' Exhibits consist of samples of goods, machinery and agricultural implements suitable for export, to which the manufacturers of the United States desire to attract the attention of foreign buyers.

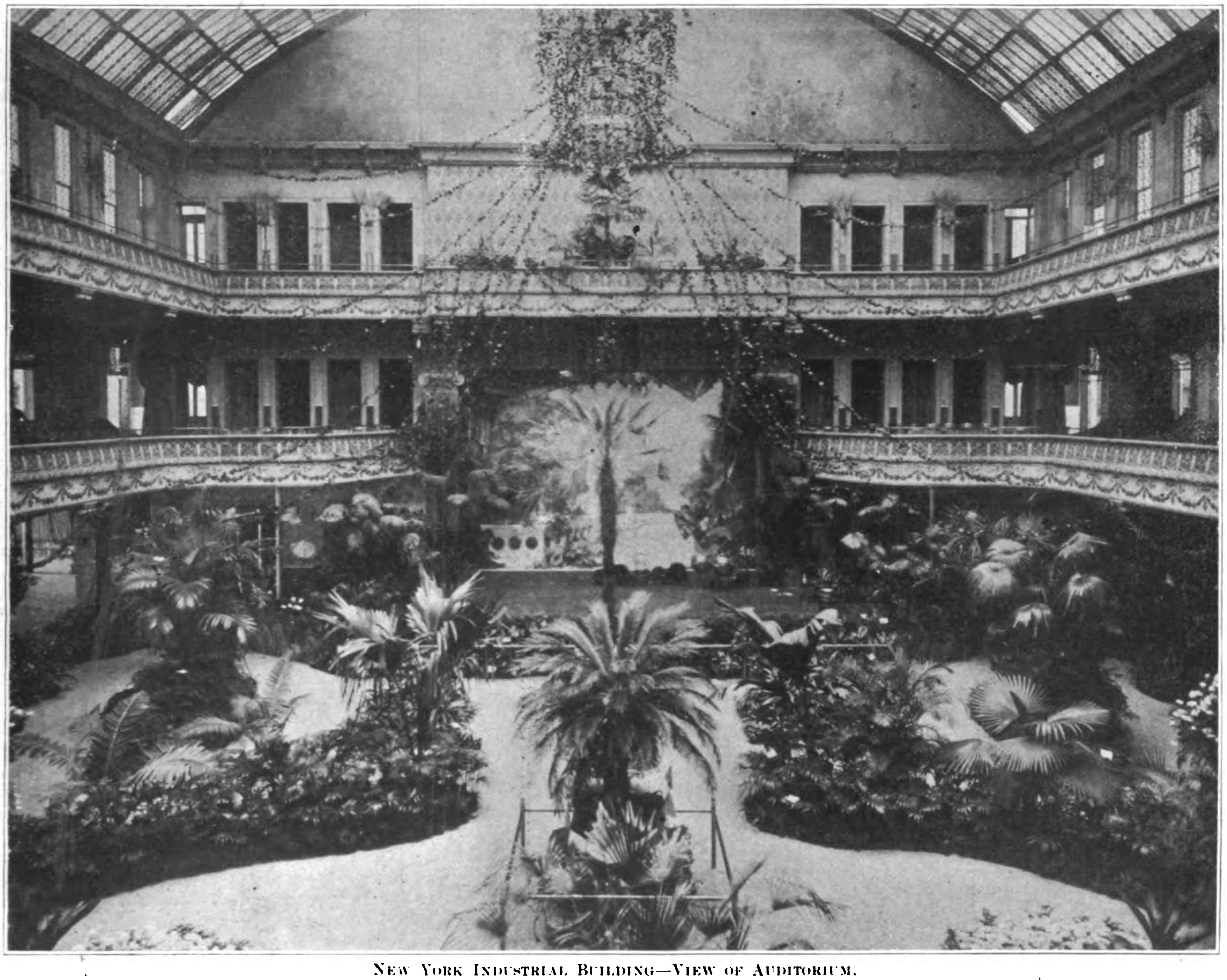
Among the great American industries there is none that shows a more marked advancement than railway appliances.

That all these improvements may be more fully brought to the attention of the buyers of the world, a special department for the display of railway appliances, both steam and electric, has been established. For this purpose, a space on the ground floor of this building on the 43d street side, 56 feet wide by 200 feet long, has been set aside to be so arranged with tracks and electric power that street cars may be fitted up and shown as in actual use, and any appliance requiring power may be operated, thus enabling prospective buyers to make practical tests of the merits of same. Not only are foreign buyers attracted, but the trade at home have a convenient place where they can inspect all important inventions.

While the International Permanent Exhibition Company is not organized to do a commission business, it will act as agent for its patrons for the introduction of their goods in foreign markets.

Detailed information will be furnished manufacturers, upon inquiry, concerning commercial opportunities and the demand for specified products in any locality, together with reports upon prices, duties, etc.

Adjoining the Grand Central Station of the New York Central & Hudson River Railroad, the Industrial Building is easily accessible from all parts of the city. The entire block bounded by Lexington avenue, Depew Place and 43d and 44th streets is occupied by this structure, which is seven stories in height. The building has an air of substantiality, so rarely found in structures devoted to exhibition purposes. The style of architecture is simple, though entirely in harmony with the details of construction and the surroundings. The outer walls are built of red brick, the inner of hollow fire brick. The superstructure of floors is constructed entirely of iron. The only inflammable material in the building is the wooden flooring and that is laid over a bed of cement. The extraordinary thickness of walls and the employment of heavy structural iron throughout the building make of it a marvel of stability and strength.



NEW YORK INDUSTRIAL BUILDING—VIEW OF AUDITORIUM.

The ground space covered by the building is 200 x 275 feet, and including its roof garden and auditorium it affords over 425,000 square feet of floor surface. Every foot of this is perfectly lighted—by natural light by day and by innumerable electric lamps and gas jets by night. Plenty of pure air is kept in constant circulation throughout the entire structure, and this with the excellent arrangements for heating gives it every requisite for a place for public exhibitions and entertainments. Four mammoth elevators —two steam, one hydraulic and one electric, having a total carrying capacity of 250 persons, run from the ground floor to the roof. The electric elevator was installed by the Sprague Electric Elevator Co.

The ground floor of the building is entered through a high arched corridor fronting Lexington avenue. To the left of the entrance is a restaurant and café, excellently managed, the cuisine of which is comparable to any in the city. Meals are served a la carte or table d'hote and at reasonable rates. On this floor are the offices of the building, reception rooms and one of the leading branches of the New York Palace Company.

THE EXPOSITION SPACE.

The second floor, or main auditorium, is admirably adapted to exposition purposes, combined with social, business and public functions, which have become distinguishing features of the meetings of the National Electric Light Association. There are over 55,000 square feet of floor space available on this floor, which by a most ingenious plan can be subdivided to suit.

The central section of this grand auditorium, which will easily accommodate 8,000 people, is surmounted by a glass dome 65 feet high and containing 12,000 square feet of glass, and its construction is such that it is one of the strongest and most perfect light-giving domes ever built. This makes the hall peculiarly available for day use, and at night prevents overheating, which is most desirable in a great ballroom or where other large concourses of people come together. The floor is smooth, and solid as the eternal hills, and the heating, lighting and ventilating appliances are perfect.

The third, fourth, fifth, sixth and seventh floors have been designed solely for exposition purposes. It is here that the greatest difficulties of construction have been overcome. The third floor has 40,000 square feet of surface available, and the fourth, fifth and sixth have each the same surface, making a grand total for exposition purposes, with the auditorium, etc., added, of over 425,000 square feet, which can be partitioned into sections of any desired dimensions.

PALM AND ROOF GARDEN.

One of the most attractive features of this building is the Palm and Roof Garden. The seventh floor has been utilized for this purpose. The floor is of cement and is absolutely fireproof. Over the glass dome, which gives light to the auditorium on the second floor, is the immense air shaft, and over this, from side to side, are steel beams. To these are affixed steel blades which are raised during the day to admit light to the dome, and at night they are lowered and overlap each other, making a floor as smooth, even and firm as that of the rest of the roof. It will then form part of the mammoth roof garden, which will cover 50,000 square feet and which will accommodate from 8,000 to 10,000 visitors. From it a magnificent view of portions of New York, Brooklyn, the harbor, and Long Island can be obtained. This roof garden is divided into three parts. On the Lexington avenue wing is the Roof Hall or Winter Garden. This is a covered auditorium well heated and well lighted. It is decorated with palms and other ornamental shrubs, and occupies a space 60x200 feet. It is covered with a dome 38 feet high with not a column to impede the sight. The stage is on the 43d street side.

GRAND CENTRAL R.R. DEPOT
N.Y. INDUSTRIAL BLDG.
F.A.Ringler Co N.Y.

NEW YORK INDUSTRIAL BUILDING—VIEW FROM LEXINGTON AVENUE.

THE LIGHTING PLANT.

The electric plant of this completely appointed exhibition building is one of the largest isolated plants in New York City. To avoid the heat which must necessarily be present in a basement power plant a separate building, situated on the corner of Depew place and 44th street, is used as a power and light generating station. The boiler room is below the street level and is fitted with four return tubular boilers of 150 H. P. each and the necessary feed water appliances. The dynamo room adjoins the boiler room but is on the ground floor of the building.

The engine equipment consists of one 300 H. P. and one 150 H. P. Fishkill Corliss, manufactured by the Fishkill Landing Machine Company, Fishkill, N. Y., and one 100 H. P. Skinner engine manufactured at Erie, Pa. The 300 H. P. engine drives two 80 K. W. Fort Wayne belted generators of the Wenstrom type. These are belted in tandem from a counter shaft. Three 45 K. W. Edison generators are driven by the 150 H. P. engine. A fourth 45 K. W. Edison generator is belted separately to the Skinner engine. The switchboard is of marbleized slate and is equipped with Weston instruments in the main and old-type Edison-Bergmann instruments in the feeder circuits. The mains are carried across 44th street by underground conduit and taken to the distribution center in the basement of the Industrial Building.

The division of units in the power station forms an equipment which is practically a duplicate plant Although but about 4,000 lamps are wired in the. building the generating plant has a capacity for over 6,000. The disabling of one engine would not necessarily cripple the plant, as the maximum load of the lamps now connected could safely be carried by the other engines. To provide for the rather remote contingency of a complete failure of the private plant, arrangements have been provided for connecting the complete interior wiring of the building to the street mains of the Edison Illuminating Company.

The wiring of the building has been done on the three and two wire systems. Brass-covered interior conduit, Grimshaw white core wire and the Edison-Bergmann type of porcelain cut-outs, etc., have been used. The arrangement of lights is such that a uniform illumination is secured over the entire floor space of the mammoth building. On the main or auditorium floor the lamps are clustered on artistic fixtures around the supporting columns and attached to three and five light brackets on the wall.

The auditorium proper, which is overlooked by balconies on the third and fourth floors, is lighted by seven cluster reflectors composed of 100 24-C. P. lamps each. The height of these fixtures is made adjustable by means of a hoist drum. There are over 2,000 lamps installed on this floor. Around the balcony walls, supporting columns and over the stage platform are group and cluster fixtures and rows of border lights which augment the effect of the central row of chandeliers, flooding the auditorium with a light as bright and mellow as that of noon-day. Scattered about the building are a number of low potential arc lamps situated at such points as tend to produce the best effects. It can truthfully be said that for purposes of exhibition no public building of New York City, or elsewhere, is better equipped with lighting facilities.

The complete electric plant was installed under the supervision of Mr. Marcus Nathan.

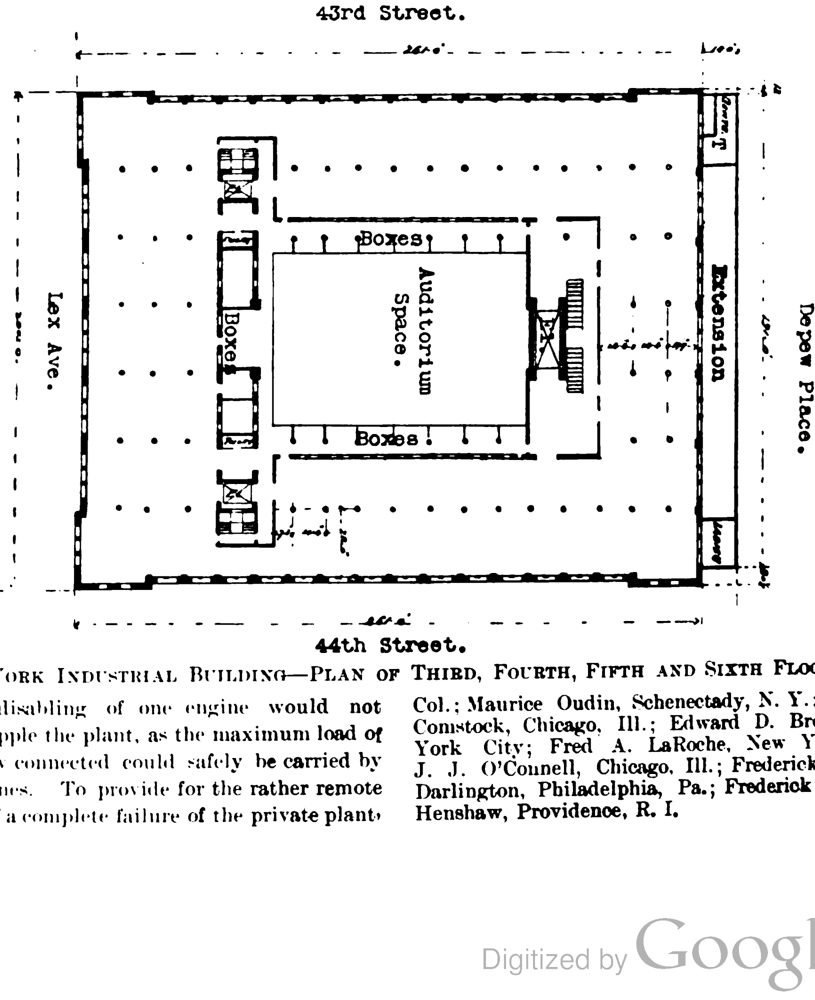
American Institute of Electrical Engineers

At the regular monthly meeting of Council held at the rooms of the Institute on November 20th the following associate members were elected:

Wm. D. Ball, Chicago, Ill.; Eskil Berg, Schenectady, N. Y.; Chas. L. Brown, Chicago, Ill.; Clinton C. Burr, Pittsburg, Pa.; Paul G. Burton, New York City; Julian Du Bois, Albany, N. Y.; Eugene Friedlaender, Duquesne, Pa.; Clarence P. Gott, New York City; Nevil Monroe Hopkins, Washington, D. C.; Albert S. Hubbard, New York City, Ellicott Maccoun, Munhall, Pa.; Fred'k William Phisterer, Ithaca, N. Y.; Erich Rathenau, Berlin Germany; Alfred K. Warren, New York City; Henry Storrs Webb, South Bethlehem, Pa.

The following associate members were transferred to members:

Arthur Hartwell, Pittsburg, Pa.; Julius Martin, New York Navy Yard; Joel W. Stearns, Jr., Denver, Col.; Maurice Oudin, Schenectady, N. Y.; Louis K. Comstock, Chicago, Ill.; Edward D. Brown, New York City; Fred A. LaRoche, New York City J. J. O'Connell, Chicago, Ill.; Frederick William Darlington, Philadelphia, Pa.; Frederick Valdemar Henshaw, Providence, R. I.



NEW YORK INDUSTRIAL BUILDING—PLAN OF THIRD, FOURTH, FIFTH AND SIXTH FLOORS.

VARIATION IN ELECTRICAL CONDUCTIVITY OF METALLIC WIRES IN DIFFERENT DIELECTRICS.*

BY FERNANDO SANFORD.

In a paper published in 1892, entitled "Some Observations upon the Conductivity of a Copper Wire in Various Dielectrics,"† I called attention to the fact that, with the copper wire used by me in the experiments referred to, the conductivity varied in different liquid and gaseous dielectrics by an amount approximating in some cases to 0.2 of one per cent. of its air resistance at the same temperature.

In a later paper, entitled "A Necessary Modification of Ohm's Law,"‡ I referred to a similar observation made upon the conductivity of a silver wire.

NEW YORK INDUSTRIAL BUILDING—GENERAL BUSINESS OFFICES.

The apparatus used in the experiments referred to in the above-mentioned articles consisted of a copper tube 120 cm. in length and 2.5 in internal diameter, closed at the ends with copper plugs provided with stopcocks. To the inside end of one end plug was connected a copper wire 1 mm. in diameter, which was stretched lengthwise through the center of the tube, and passed out through an insulating plug in the center of the other end plug. The resistance of the wire and tube was measured at various temperatures when the tube contained air, and again when the tube contained other liquid and gaseous dielectrics. A side tube midway between the ends of the long tube served to admit a thermometer, by means of which the temperature of the dielectric inside the tube and near the wire was measured.

Some fifteen different liquid and gaseous dielectrics were used, and, in general, the conductivity of the wire was found to vary from its air conductivity at the same temperature by an amount which was different for each dielectric used, and which was constant for any particular dielectric.

The accuracy of the observation was attacked upon both theoretical and experimental grounds (see especially *The Electrician*, London, of January 13, 1893, and Professor Henry S. Carhart in the *Physical Review*, Vol. I, p. 321), and though it had been verified by me with several different wires, and though I had collected considerable material bearing upon the nature of the phenomenon, I have thought best to publish nothing further upon the subject until the observation had been verified by some one outside of my own laboratory.

I have recently received a memoir by Professor Grimaldi and Dr. Platania, of the University of Catania,‖ giving the results of a long and very careful series of experiments upon the resistance of a copper wire in air and petroleum. These researches have been conducted with greater refinement and more delicate apparatus than have any previous experiments upon the same subject with which I am acquainted. The results show a degree of concordance quite remarkable when the difficulties of the determinations are taken into account. In every case the resistance of the wire in petroleum was found to be less than in air. This difference in resistance was, however, when reckoned as a percentage of the whole resistance of the wire, only about one-twelfth as great as in the case of the wire with which the phenomenon was first discovered by me; but the total variation in resistance amounted, taking the mean of all the determinations, to 0.00002 ohm, while in the same dielectric with the wire originally used by me it amounted to 0.00006 ohm. The wire used by Signors Grimaldi and Platania was 304 mm. in length and 0.22 mm. in diameter. Its variation in resistance per unit length was accordingly greater than in the wire used by me, while the corresponding surface exposed was less than one-fourth as great.

NEW YORK INDUSTRIAL BUILDING—LIBRARY.

The intelligence and care shown in the published work of Signors Grimaldi and Platania, and the remarkable uniformity of their results, make it improbable that the existence of the phenomenon will again be questioned.

The method and apparatus used in the following experiments were practically the same which I described in my former papers. The wires whose conductivities were to be measured were stretched lengthwise through the tube used in the earlier experiments, and were sometimes soldered and sometimes connected by means of a binding screw to the inner end of one plug, and were carried through the insulating plug at the other end of the tube. The resistance of the wire and tube was at first measured by means of a Hartmann & Braun resistance box and bridge, with bridge arms of 1 : 1000, the comparison coils being divided to tenths of an ohm. Later, a Nalder Brothers resistance box and bridge, with arms of 1 : 10000 was used, the comparison coils being divided to tenths of an ohm. The galvanometer used gave a noticeable deflection for a change in resistance of 0.00002 ohm, and later for 0.00001 ohm.

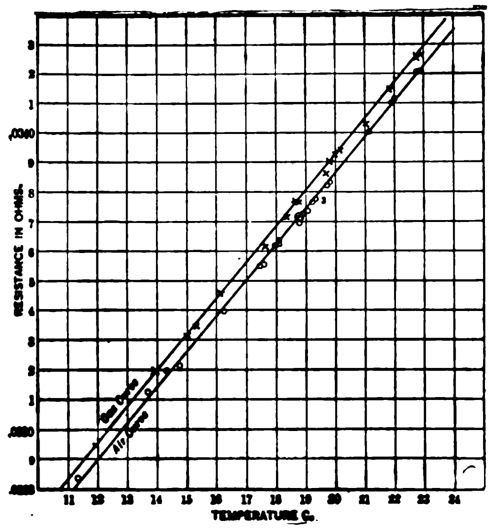


FIG. 1.

The temperature of the interior of the tube was measured by a standard thermometer graduated to 0.1°, inserted into the side tube with its bulb in contact with the wire, and read through a telescope which enabled the observer to estimate to 0.01° with a fair degree of accuracy.

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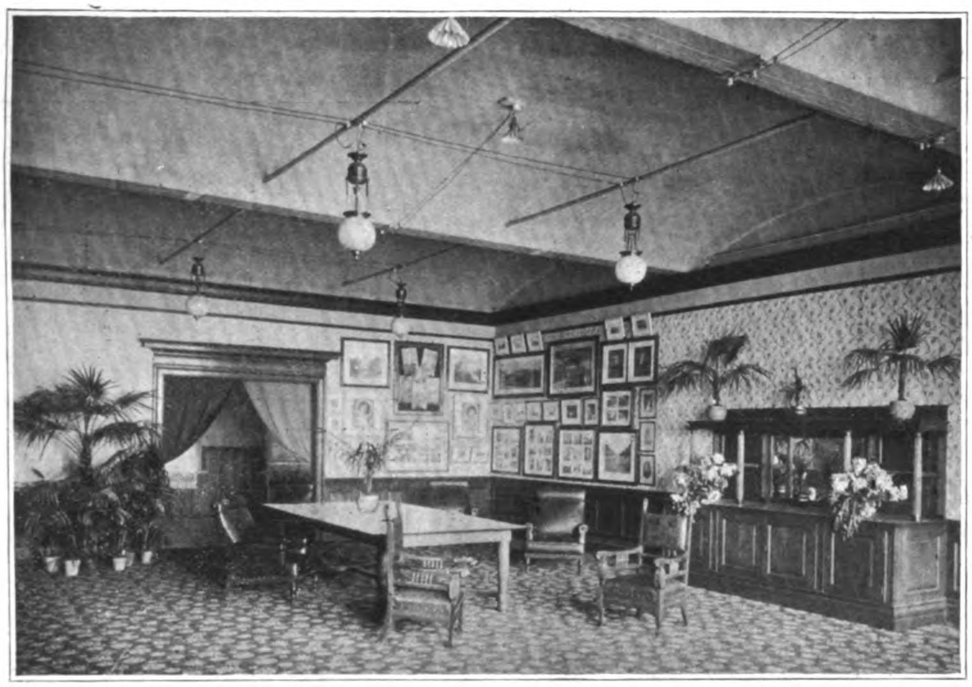
* From the *Physical Review*, Vol. III, No. 8.

† Leland Stanford, Jr. University Publications. Studies in Electricity, No. I.

‡ *Phil. Mag.*, January, 1893, Vol. XXXV, p. 65.

‖ Sulla Resistenza Elettrica dei Metalli nei diversi Dielettrici. Memoria del Dott. Giovan Pietro Grimaldi, Professore de Fisica nella Regia Universita di Catania, e Dott. Giovanni Platania, Assistente al Gabinetto di Fisica della stessa Universita. Parte I. Ricerche sulla variazione di resistenza del rame nel petrolio. See also, Dal Bollettino mensile dell' Accademia Gionenia di Scienze Naturali in Catania. Fascicolo XXXVIII, seduta del mese Dicembre, 1894. Also Nuovo Cimento July, 1895.

The wire first used had with the tube a resistance of 0.0335 ohm at 18° C., and a temperature variation of 0.000014 ohm for one-tenth of a degree centigrade. By reversing the current it was possible, even with the least sensitive galvanometer used, to estimate the resistance accurately to 2 in the fifth decimal place; and with the galvanometer used later an error of 1 in the fifth decimal place would not be made, even without reversing the current. This. while not the highest attainable accuracy in resistance measurement, is sufficiently accurate for the work, since the temperature of the wire could not be known with certainty to a greater accuracy than 0.1°. Had the measurements been made at a temperature differing greatly from the room temperature, or had the wire been perceptibly heated by the current, even this degree of accuracy would be improbable, since what was really observed was the temperature of the thermometer in the tube near the wire, and the small wires used would almost certainly change in temperature more rapidly than the thermometer. To guard against a possible error of this kind, the measurements were all made at the room temperature, which very rarely varied so much as 10° in twenty-four hours. The measurements were also made at all hours of the day, and sometimes late at night, in order that approximately the same number might be made with rising as with falling temperature.

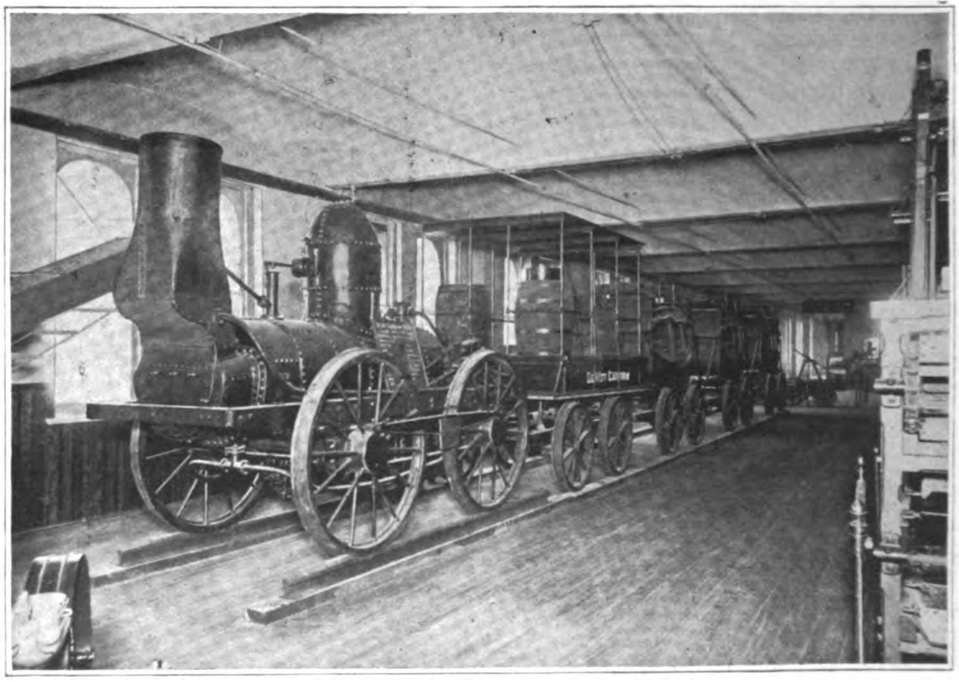


NEW YORK INDUSTRIAL BUILDING—CLUB ROOM.

To guard against the error due to heating of the wire by the current, the resistance of the wire at the same apparent temperature was observed for a wide range of current strength, and the current strength was kept far below the point where the resistance of the wire seemed to increase. The zero method of measurement was used throughout, and the current was passed through the wire only long enough to enable the galvanometer deflection to be read. In the first work, in order to secure a constant current strength, a battery of thirty-two silver chloride cells with high internal resistance was used with 100 ohms additional resistance in the battery circuit. Later, one Edison-Lalande cell was used with a resistance of from 50 to 100 ohms in the battery circuit.

That temperature fluctuations did not cause serious error may be seen from the data published with the first mentioned paper. The curve shown in Fig. 3 of that paper is reproduced here as Fig. 1. It represents the resistance of the wire in air, and in the gasoline burning gas used in the laboratory. There are twenty-six measurements made with the tube filled with air. These were made at irregular intervals for six days, the tube having been in the meantime filled with burning gas, and seventeen measurements made on three successive days with the wire in this dielectric. The tube and wire were neither disconnected nor moved in changing the dielectric. The gas was admitted through one of the end stopcocks, which was attached by a rubber tube to a gas cock in the laboratory, and was removed by blowing air through the tube with a bellows.

Of the twenty-six points platted for the air measurements, nineteen were made before the tube was filled with the gas, and seven were made before the gas had been removed. The greatest distance of any single air point from the curve corresponds to a resistance of 0.00002 ohm, or a temperature variation of 0.14°. In the seventeen measurements made with the tube filled with the burning gas, the greatest distance of any point from the curve corresponds to a difference in resistance of 0.000025 ohm or a temperature variation of 0.15°, while only one point in the seventeen is more than 0.00001 ohm from the curve.



NEW YORK INDUSTRIAL BUILDING—A CORNER IN RAILROAD EXHIBIT.

The average difference in the resistance of the wire and tube with the dielectrics named was 0.000058 ohm, corresponding to a temperature difference of 0.41°, while the nearest approach of any gas point to the air curve represents a difference in resistance of 0.00005 ohm, corresponding to a temperature difference of 0.36°.

That the temperature of the wire can be known with sufficient accuracy when the above precautions are taken is shown by the data published in the article by Professor Carhart, of which mention has already been made. In the investigation reported by Professor Carhart, a tube and wire combination similar to the one above described was heated up to 30° C. by warm water, and a series of resistance measurements was made while the temperature was falling to 20° C. Even with this arrangement, and with a thermometer reading only to half degrees, and a wire whose resistance varied by 0.000018 ohm for one tenth of a degree, the different measurements show a very uniform decrease of resistance for the estimated decrease of temperature.

I lay special stress upon this point, because in the editorial article in *The Electrician*, previously referred to, the writer charges that it is "a great assumption to suppose that the temperature of the wire is the same as that of the dielectric," and says: "The wire is, of course, being heated by the current, and a slight change of temperature would necessarily result from change of emissivity, owing to the different thermal properties of the various dielectrics used." This explanation would hardly have been offered had the author read with any care the article which he was criticising, since it would make it necessary to assume from the data there given that the temperature of the wire in petroleum was 0.43 of a degree *less* than in air, while in petroleum containing a little wood alcohol its temperature with the same current through it as before was 0.5 of a degree *greater* than in air. As a matter of fact, increasing the current strength fourfold did not alter the apparent resistance of the wire at the same temperature. In the very careful provisions made for maintaining the wire at constant temperature by Signors Grimaldi and Platania, this possibility of error was still further eliminated, so that it is certain that, whatever else may be the cause of the phenomenon, it is not due to a temperature variation of the wire.

(*To be continued.*)

ANOTHER PATENT SUIT.

The Elgin, Ill., Electric Illuminating Co., according to a local paper, has been notified by the General Electric Company that it is infringing one of the latter's patents by using the bridge circuit around a single dynamo and transferring switch.

It is understood that a rival manufacturing company will defend the suit.

The Storage Battery.*

A DISCUSSION OF ITS APPLICATIONS BY THE MEMBERS OF THE A. I. E. E.

PAST AND PRESENT OBSTACLES IN THE STORAGE BATTERY DEVELOPMENT.

BY CARL HERING.

The question which the engineer and constructor should discuss at present is not "Is a battery desirable?" but rather "Why is it that storage batteries seem to have been unsatisfactory?" And the question which concerns the capitalist is "Does it pay in dollars and cents to use the storage battery even if it is kept in a satisfactory condition by the makers?" Limiting ourselves to this country and judging in a general way from the number of storage battery installations, it would seem that the price at present (including of course the cost of maintenance) is such that in perhaps the majority of cases the margin of profit to the user is so small or so doubtful that it does not balance the supposed risk. The commendable practice of renting relieves the purchaser of this risk, which then leaves the question a mere matter of cost. A material reduction in the first cost and cost of maintenance would therefore at once turn the tables in many cases so decidedly in favor of the storage battery that there would be little doubt left as to the economy, and it would render the practice of renting unnecessary in most cases.

The chief reason why so few storage battery plants exist in this country seems to have been that the accumulator companies have for years been so busy fighting each other's patents and have spent so much money in this litigation that they have had neither time nor money left to manufacture and install their batteries. But all this litigation has now come to an end, thanks to an enterprising company which has bought up all the little life that is left of these historic "pasted plate" patents. This, together with the fact that it is now conceded by many authorities that for many if not most purposes the unpatented Planté type of cell is the better, removes the chief obstacle in the storage battery development in this country. As the patent question has now been settled and as cells of the Planté type have now been developed into practical forms, the storage battery outlook at present lies largely in the hands of the constructing engineer, and we should therefore look at the question from this standpoint.

To the user the five chief diseases of the accumutors appear to be: buckling, short circuiting, sulphating, disintegration and dropping out of the peroxide. Many inventors have thought that most of these may be made uninjurious by a process of opposing or resisting their disastrous effects, as distinguished from preventing their occurrence, although the term "preventing" has incorrectly been used to describe it. Buckling has been opposed by main strength and sometimes awkwardness; short circuiting by porous insulating sheets between the plates; falling out, by enclosing or locking the peroxide so that it cannot drop out, etc. Whether and how far such heroic methods have been successful can be determined only by tests. To attempt to prevent the almost irresistible force of expansion of the peroxide from exercising itself by confining the material in an inelastic lead frame, is a formidable, and it seems an almost hopeless task; the inevitable result is that one or the other must give way. If it is the peroxide, it will ultimately be crumbled by the pressure; if it is the lead, there will probably be buckling, or at least a separating of the contact surfaces at the subsequent contraction of the peroxide, and this inevitably results in the formation of that very objectionable layer of white sulphate which practically insulates the active material from its conductor, the consequences of which are sure to be fatal. The development of the storage battery has been greatly retarded by the fact that it was in the hands of mechanical engineers instead of chemists.

The careful constructor should attack the problem in a different way; he should go back to the beginning to find out the prime causes, and then prevent, if possible, these causes from arising, rather than to attempt to oppose their effect by sheer force and awkwardness.

What should be done is to try to construct the plates so that they are adapted to high rates without a great loss of efficiency or capacity. It will be found that in the majority of cases in which the storage battery would be of special value, it is a question of *rate* rather than *capacity*, that is, a great horsepower for a short time is more often required than a large quantity of energy delivered at a slow rate; it seems from a number of cases that any capacity above that which is obtained at a one, two or three hour discharge is generally of comparatively little value.

To study the effects of rapid discharges it must be remembered that the acid is as important as the lead oxides. When its density falls too low there will be a lowering of the E. M. F.; acid is withdrawn from the solution during discharge, hence the diluted acid in the fine pores of the active material must get out and denser acid must get in; but the only force which does this is the difference between their specific gravities, and as this is very small the force will be small and therefore the circulation will be slow, which in turn reduces the E. M. F. The chemical action will therefore be confined chiefly to the external surface, which is freely exposed to the acid, and the action then becomes so great per unit of surface, that white sulphating, or better, complete sulphating, takes place. If a rapid discharge is not to injure the plates nor lower the voltage by reason of the acid in the pores becoming too dilute, the circulation must be rapid; great porosity accomplishes this partly, but is attended by frailty and poor conductivity of the peroxide, which again results in a fall of the voltage. The ideal method would, therefore, seem to be a vertical lead plate to act as a good conductor with an extremely large surface and a very thin layer of peroxide on it, freely exposed to a large quantity of acid, which is capable of circulating rapidly. That such a plate may be made to have a greater capacity per pound of plate for rapid discharges and perhaps an equal one for slow discharges, as compared with the best thick, porous plates, has been shown by experiments.

In rapid charging the acid becomes too dense in the pores of a thick mass of active material if the circulation does not keep pace with the demand; this dense acid softens the peroxide and there is a tendency to form gases when the proper chemical action cannot keep pace with the current. Both the softening of the peroxide and the mechanical effects of the gases are injurious. The negative plates being soft and tough, are not so easily injured, but unless the acid can circulate very freely there will still be a lowering of the voltage like with the positive plates, and probably also a lowering of the ampere-hour capacity.

The contact between the peroxide and its conductor must be very good, for, if poor, then a white sulphate forms at the surface, which practically produces an insulating layer and disastrous effects are then inevitable. The peroxide will insist on expanding during the discharge and on contracting during the charge. It would be much better to accept this as an inevitable fact than to try to keep the material from obeying the laws of nature by forcibly confining it within an inelastic frame, as many inventors have attempted to do. To hold a large mass of active material firmly in contact with a lead conductor, when one expands and contracts while the other does not, or expands without afterwards contracting again, is a difficult matter. The best solution seems to be to have the active material in the form of an extremely thin layer over a large surface and formed from the lead itself, as this increases its adhering properties. If such a layer can be made porous, and if the surface is made up of small facets, there will be little tendency to buckling or scaling.

The gradual washing away of the surface of the peroxide, and the slow peroxidation and consequent disintegration of the lead support, seem to be absolutely unavoidable. Until some preventive is found, if it ever will be, it seems wisest to accept the inevitable and acknowledge that the positive plates are perishable. To use any other metals or carbon is out of the question; the addition of antimony to the lead seems to retard but does not prevent peroxidation. The favorite method of trying to avoid the effects of disintegration is to make the frames of the positive plates quite thick, thus prolonging their life. But such a method is certainly not satisfactory for cheap or portable cells, and the gradual washing away of the peroxide remains the same whether the frame is heavy or light, provided that the surface exposed to the liquid is the same.

But there is another way of meeting those unavoidable effects of use, which has recently been applied, and which seems to be a much more rational and effective solution of this vexed problem, at least when lightness and smaller first cost are desired. Instead of making the positive plates heavy and expensive, they may be made very light, cheap and easily replaceable; their life may then be shorter, but the battery will be as good as new whenever these perishable parts have been renewed. Their life is soon known to the user, and he can then readily determine for himself how much he must allow for amortization. But such a method, to be successful, requires that the old plates and sludge can be converted at a small cost into new plates; this it seems can now be done, and the writer believes that this alone will have a very important bearing on the outlook of the storage battery, at least for portable cells that are required for traction and many other purposes, or for both portable and stationary plants, if the first cost is an important factor. Such a method becomes practicable only when the chief factor in the cost of the plate is the material, the cost of labor and forming being small.

For stationary purposes, in which the only objection to the weight is the first cost of the lead, good storage batteries have been used abroad with success for some time, provided the rates of charge and discharge are kept low. Assuming that the same storage batteries may be made in this country as well, the question which affects the outlook here is then only one of the cost. But neither abroad nor here does there seem to be a battery in the market in which the weight has been sufficiently reduced and the rate sufficiently increased for a really successful traction battery, the success of which has been demonstrated beyond dispute. It is here assumed that to the public and to railway companies, traction batteries are not a demonstrative success until a traction company which has no affiliation with the accumulator makers finds it to his own advantage to use them in preference to other systems.

It seems to the writer that the only batteries which have a promising outlook for this very trying work are those which have a very large surface, very small depth of active material formed electrolytically, and a very free circulation of the acid. The lead frames should be made only thick enough for proper conduction, the batteries must be cheap in first cost, and the positive plates should be capable of being replaced comparatively frequently at small cost. They should be proportioned so that a discharge corresponds to one trip of the car—and only one. To claim as an advantage that a battery can run a car, say four trips, is mere deception, and to the intelligent engineer it is simply an admission that it can do no better. No one would think of carrying four relays of horses on a trailer of a horse car, and why should the equivalent be done with the storage battery unless it is that the battery can do no better and that it cannot be discharged rapidly enough so that the capacity and weight may be reduced to that required to run only one trip? The ideal is certainly a single trip discharge. If the rate for a four-trip battery could be increased four times without materially affecting the capacity, its weight and capacity for a single trip discharge would evidently need be only one-fourth as great. The charging rate should also be equal in hours to the discharge rate, or else it will take a plant of more than two sets of batteries to a car.

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*Abstracts of communications read at the 101st Meeting of the American Institute of Electrical Engineers, New York and Chicago, November 20, 1895.

The objection to a plate with a thin layer of active material is that it may not retain its charge as well as one with a thick layer or pellets. but in most cases in which rapid rates are desired or cannot be avoided, the small loss in standing is probably more than balanced by the fact that the plates are not injured by rapid rates. As a rule, long periods between charges go hand in hand with slow discharges and less objection to great weight, while short periods between charges, high rates of discharges and lightness usually go together.

In conclusion the writer desires to make the following recommendations in the interests of engineers who may have to calculate accumulator plants :

The rates of charge and discharge be designated in *hours* and fractions, the current (or for power purposes, the watts,) during that time being considered to be kept constant. There can then be no mistake as to what is meant, as this represents the time in hours during which a cell will continue to give a practically constant current before the voltage falls below its limit.

That efficiencies and capacities be always accompanied by the corresponding rate in hours.

That in giving an efficiency it should always be stated whether it is for ampere-hours or for watt-hours.

That for portable batteries intended for power purposes the capacity be given in watt-hours instead of ampere-hours and that the weight given be that of the complete cell ready for use, as distinguished from the weight of the plates alone.

PERSONAL.

Mr. Henry Sachs, late manager of the Beacon Lamp Company, has accepted a similar position with the Colc & Gerald Manufacturing Company, makers of bicycles. It is one of Mr. Sachs's plans to induce electrical supply dealers to handle bicycles next season. With retail jewellers already in the field as bicycle agents, there seems to be no reason why any merchant should not add them to his stock.

Among our New York visitors this week have been Mr. George Redman and Mr. Charles Burns, of Rochester; C. P. H. Vary, of Newark, N. Y., and Mr. J. H. Rhotehamel, of St. Louis.

Mr. J. M. Hill, Chicago agent of the Columbia Incandescent Lamp Company, spent a few days in New York last week.

The Electrical Potentials.

The members of this prosperous social organization, which is the successor of the Boston Electric Club. dined together at Young's Hotel, Boston, on Monday evening, November 25. The paper of the evening was "The Insulation of Overhead and Underground Wires," read by Capt. Brophy and published in ELECTRICITY last week. The following gentlemen were present :

H. H. Daggett, Jr., Frank Mowbray, Attleboro, Mass.; Wm. L. Woodward, Providence, R. I.; A. A. Ziegler, R. F. Ross, A. T. Clark (American Circular Loom Co.), E. S. Garfield (Fort Wayne Electric Corporation), J. R. Orford (Boston Electric Light Co.), Percival J. Burgess, Eliot L. Caldwell (Edison Elec. Illuminating Co.), W. J. Denver (New England Telephone Co.), C. H. Holtzer and E. C. Newcomb (Holtzer-Cabot Electric Co.), T. H. Farnham (New England Telephone Co.), G. W. Blodgett (Boston & Albany Railroad), C. S. Sergeant (general manager West End Railroad), Henry F. Woods (purchasing agent West End Railroad), Frank Ridlon, Capt. W. Brophy (Assistant Commissioner of Wires), John R. Murphy (Commissioner of Wires), F. E. Barker, Josiah Q. Bennett, C. F. Pattison, C. B. Davis and F. M. Kimball (General Electric Company), W. E. Clark, G. W. "Happy" Adams, C. R. Fisk, R. A. Ripley, F. A. Swan, I. M. Mosher, Sidney Hosmer and Frank Brophy (Boston Electric Light Co.), W. S. Key (ELECTRICITY), W. H. Coughlin, C. S. Haley (General Electric Co.), H. S. Anderson, D. W. Dunn (Fort Wayne Electric Corporation), Boston; F. H. Raymond, Cambridge; H. H. Fairbanks (Electric Light Co.), Worcester.

GENERAL NEWS.

What is Going On in the Electrical World.

Clinton, Ia.—The "Herald" states that Prophetstown is to be lighted with electricity.

Middleburg, N. Y.—There is talk of building an electric road extending from Durham to Middleburg.

Norfolk, Va.—The electric car line to Lambert's Point is completed, and cars are now running daily.

Rockville Center, L. I., N. Y.—The trustees having given consent to erect poles and wires in the village, a company will be organized at once to put in a plant.

Bath, N. Y.—The New England Traction Company is going to apply for a charter for an electric road in Bath and to Hammondsport.

Birmingham, Ala.—The Birmingham Railway & Electric Company intends to convert its whole street railway system into electric lines.

Milwaukee, Wis.—The Milwaukee Street Railway Company is preparing plans for building an electric railway to Whitefish Bay early next spring.

Leonia, N. J.—A meeting has been held in favor of an electric road in this borough and a company is securing right of way. Leon Abbett, of Jersey City, is interested.

Groton, Conn.—A local manufacturer with sufficient steam power to generate all the electricity required by the business places of the village proposes to put in a plant.

Springfield, Vt.—The proposed electric road from Springfield to Charlestown, N. H., is receiving fresh attention, and there now seems a probability that it will be built.

Hillsborough, N. H.—The Hillsborough Electric Light & Power Company has got its plant in working order and is furnishing light for the streets and business places.

San Antonio, Tex.—The Citizens' Electric and Street Railway Company of San Antonio has filed an amendment to its charter changing its name to San Antonio Edison Company.

Atlantic City, N. J.—The councils of Holly Beach, Anglesea and Wildwood, on Five-Mile Beach, have granted a franchise to a trolley railway company to lay tracks along the beach.

Wheeling, W. Va.—A New York syndicate is negotiating for the purchase of the Wheeling trolley railway system, comprising about twenty miles of track, for a sum approximating $1,000,000.

New Orleans, La.—The ordinance granting a franchise to J. J. Cohn, M. Bier and associates for an electric lighting system in the city has been favorably reported by the council committee.

Independence, Mo.—The electric light plant owned and operated by the Western Electric Light Company of this city has passed into the possession of Charles Gudgell, as trustee of the bondholders.

Decatur, Ill.—John H. Culver of Decatur has been granted a franchise by the city council for an electric-light plant, to cost $10,000. The franchise is for twenty years and the contract with the city will be for ten years.

Cincinnati, O.—The Cincinnati Street Railway Company is building cars for its Walnut Hills line which are half closed and half open, that is, summer and winter cars combined. The new vehicles are much larger than the ordinary cars.

Salem, Mass.—A few evenings ago at the regular meeting of the Y. M. C. A. Congress the principal bill up for discussion was that providing for Welsbach gas lighting in place of electric lighting of the streets. The bill was defeated by one vote.

Santa Barbara, Cal.—The Santa Barbara Consolidated Electric Company, which holds franchises for electric roads to Carpenteria, will erect at Summerland a power-house sufficient for the needs of the line and for the local supply of light and power.

Wilkes-Barre, Pa.—The People's Electric Railway of Nanticoke and Newport, which connects Newport Township with Nanticoke, was opened for traffic last week, and the first car was greeted with cheers from crowds gathered along the line.

Johnstown, Pa.—A motor manufacturing company has made arrangements to remove to Johnstown as soon as the Pennsylvania Railroad Company builds a spur to the works. It is stated that the new works will employ 400 skilled mechanics.

Suffolk, Va.—The Suffolk street railway is likely to be purchased by Pennsylvania capitalists who propose to convert it into an electric line and extend the road to Lake Kilby and the Suffolk Fair grounds, thence to Smithfield, and in time to Portsmouth.

Detroit, Mich.—At the annual meeting of the stockholders of the Citizens' Electric Railway Company, held recently, the old officers were re-elected, as follows : Tom Johnson, president ; J. C. Hutchins, vice-president and treasurer, and J. C. Peters, secretary.

New Haven, Conn.—The reports of the four electric street roads of New Haven show that they are all doing a prosperous and paying business and that since the adoption of electricity as a motor they have increased their patronage as well as their usefulness to the city.

Lebanon, Mo.—The property of the Light & Water Company has been purchased at foreclosure sale by Edmon E. Crebs, of Fairfield, Ill., who represents the present holders of the bonds, amounting to $100,000. The property was knocked down to Mr. Crebs at his bid of $20,000.

Akron, O.—It is stated that Gen. Samuel Thomas and Calvin S. Brice, acting for a syndicate, have bought the Akron Street Railway and the Akron General Electric Company. The price quoted is $1,200,000. The road operates by trolley twenty miles of track in Akron and its suburbs.

Canastota, N. Y.—The Marvin Drill Company has just completed its first electric rock drill at its works here. The company has received inquiries from England, France, Germany, Norway, Sweden, Russia, Italy, Japan, Chili, Brazil, Cuba, South Africa, Mexico and Canada.

Amherst, Mass.—The board of trade has appointed committees to gather facts from neighboring towns relative to the cost, construction and management of their electric roads as a preliminary move toward establishing an electric line from Amherst to Sunderland, through North Amherst.

Chicago, Ill.—The Mutual Electric Light & Power Company, whose offices are in the Dearborn National Bank building, has made an assignment to Randall W. Burns. The franchise of the company and its plant are at Brainard, Ill., where it began business about three years ago.

Xenia, O.—The Rapid Transit Company of Xenia has contracted with the George H. Mellen Company of New York to build an electric road between Xenia and Springfield, twenty-two miles, work to be begun on February 1, the company to furnish everything and turn over the road ready for operation by the middle of next summer.

Baltimore, Md.—The Baltimore & Gunpowder Electric Railway Company has been granted a franchise for an electric railway beginning at the intersection of Monument street with the eastern limits of Baltimore and running thence east to Eleventh street, thence south to the Philadelphia Road, and thence along the Pennsylvania Road to the Gunpowder Falls.

Rochester, N. Y.—Proposals will be received at the office of J. Foster Warner, architect, 1036 Granite Building, Rochester, until December 17 next, for gas and electric light fixtures for the new Monroe County Court House. Designs must accompany all proposals, together with a certified check for $1,000. Proposals should be addressed to Lyman M. Otis, chairman building committee.

Kingston, N. Y.—Prominent business men in Port Jervis, Monticello and Ellenville have lately gone over the route of the proposed electric railroad connecting those places with Kingston, and are said to be convinced that it would be a profitable enterprise. The plan proposed is to build a freight, passenger and express line between Port Jervis and Kingston taking in the villages on the route.

Sauk Rapids, Minn.—At a special election held here recently for the purpose of voting $25,000 bonds to build a new dam across the Mississippi river to supply water power for an electric generating plant, etc., the issue was unanimously carried, there being not a single vote against it. A large paper mill will be built as soon as the dam is completed, and other manufacturing industries are talked of.

Buffalo, N. Y.—The board of aldermen have at last finished their work on the franchise for the Niagara Falls Power Company by modifying the conditions of the rejected instrument to suit the company in all but one particular, that retaining the power to annul the entire contract in case the company shall violate or fail to comply with any provisions of the grant for thirty days after notice from the board of works.

Portland, Ore.—A decree of foreclosure has been taken in the United States Circuit Court in the suit of the Mercantile Trust Company of New York against the Portland Consolidated Street Railway Company. The road has been operated by a receiver for the past year. The amount of the decree is $452,775, which comprises the consolidated bonds of the company, with interest. The railway system comprises thirty-one miles of electric road.

Niagara Falls.—The Niagara Falls Power Company, to meet the present and prospective demands for power, intends to immediately extend its wheelpit and put in three more turbines and as many dynamos. The wheelpit when completed will have room for seven more turbines and the extension of the power house to a corresponding size will afford room for seven more dynamos, making ten in all, or a total power from these ten turbines of 50,000 horse-power.

Shelton, Conn.—The Shelton Street Railway Company has been organized and will begin construction of its tracks through Howe avenue in Shelton and across the river to connect with the Derby street railway immediately. The capital of the company is $22,000 and the directors are Thomas L. Watson and Allen W. Paige of Bridgeport, W. J. Miller and D. S. Brinsmade of Shelton and W. S. Downs of Derby. General Watson has been chosen president and Mr. Paige secretary and treasurer.

Meriden, Conn.—At the annual meeting of the Meriden Street Railway Company, on the 25th ult., the formal transfer of the road to the New York, New Haven & Hartford Company was ratified. The price paid was $750,000.—Rumors are current here to the effect that the

Meriden, Waterbury & Connecticut River Railroad is to be equipped with electricity and that the Consolidated Company is seriously considering a plan to build electric roads to outlying towns and use them as feeders for their main line.

Reading, Pa.—All lines operated by the Reading Traction Company at present, including the Black Bear line and the Reading and Womelsdorf Railway, will be merged into the United Traction Company, and application for a charter for the new organization will be made on December 17. The names of the corporators are Wm. R. McIllvain, Henry C. England, James A. O'Reilly, Samuel E. Rigg and Oliver S. Geiger. The company will be capitalized at $400,000.

Stockton, Cal.—James Cross, manager of the Hobart estate, and others are interested in a scheme to supply Stockton with electric power, to be generated at South Spring Valley reservoir, twenty-four miles from here. The force from the water can be utilized without detriment to the mines. It will generate 7,000 horse power, which can be conveyed to Stockton and used for manufacturing and lighting purposes. The scheme is considered feasible by experts.

Ansonia, Conn.—Charles S. Mersick, as receiver for the Ansonia Electric Company, has been authorized to sell, assign, compromise, or in any way dispose of the uncollected accounts of that concern. The total of the uncollected accounts amount to $51,439.90 and more than half of them are considered to be practically worthless. There are claims amounting to $2,669 which are considered to be of some value, there is $4,507.19 involved in offsets, disputes and commissions and also $5,567.41 in litigation in Detroit.

Meadville, Pa.—The Meadville city council has granted to George D. Twain, who represents the Meadville Street Railway Company, a franchise of thirty-five years, for the operation of an electric street railway. The conditions are: The company is to complete six and a half miles of track within one year; to pay to the city. on its gross earnings, after five years, 1 per cent., after ten years, 3 per cent., and on the execution of the contract, to pay the city a cash bonus of $4,000.

Peoria, Ill.—The stockholders of the Consolidated Electric lines of this city have ratified the action of the directors at the recent meeting in arranging for consolidation of the two lines. Hereafter the two systems will be operated under the name of the Central Railway Company. The stockholders authorized the issuing of $750,000 bonds for the purpose of taking up the outstanding bonds and improving the road. The stock of the new company is owned principally by Columbus R. Cummings of Chicago, Walter Barker, J. B. Greenhut, Samuel Woolner, Jr., George H. Littlewood and other Peorians.

Montreal, Can.—It is stated that the Lachine Rapids Hydraulic & Land Company has secured the stock of the Citizens' Light & Power Company, and the Standard Light & Power Company, two companies which have very valuable franchises for the use of electricity in all its forms in Ste. Cunegonde and St. Henri, for street lighting in Westmount and St. Louis de Mile End, the lighting of the Montreal harbor, and the right to erect poles in the streets of Montreal. The Lachine Rapids Company is constructing extensive works on the shore at Lachine Rapids for the development of power for electrical transmission.

Utica, N. Y.—It is announced from Philadelphia that the entire issue of Empire State Light, Heat and Power Company fifty-year 5 per cent. consolidated mortgage gold bonds have been taken. The issue amounts to $3,000,000, of which $1,000,000 is to be held in escrow to retire underlying liens. Of the $2,000,000 to be sold, $1,000,000 goes to New York, $500,000 to Boston, and $500,000 to Philadelphia. The company will control by purchase the street railway and electric light companies in Utica, Whitestown (N. Y.) mills and New Hartford, N. Y., and will have an electric storage plant of 20,000 horse power capacity, the power to be received from Trenton Falls, N. Y.

Pittsburg, Pa.—On December 23 the proposed consolidation of the traction roads of Pittsburg will probably be consummated. On that day the Pittsburg, Duquesne, Central and Pittsburg, Allegheny and Manchester companies will hold special meetings at which the shareholders will be given an opportunity of voting on a proposition to lease the several lines and their franchises to the so-called Consolidated Traction Company for a period of 950 years. There is no doubt that the project will go through, and this will leave the Pleasant Valley, the Second avenue, West End and the Pittsburg and Birmingham traction companies in the field as independent corporations, the directors of these latter companies having declined to enter into a lease with the combine.

New York.—The Assembly committee appointed by the Legislature to inquire into the fiscal condition and the management and operation of street railways in the State were in session in this city during the week past and took the testimony of officials of several of the street railways, among them those of the "Huckleberry," the committee's report of which will be looked for with interest. Mr. Eli T. Langdon, of the Dry Dock, East Broadway & Battery Surface Railroad, told the committee that his company was only waiting for a fairly perfect system of electric motors to introduce the method on their road.—The Fourth Avenue Company (Vanderbilt) has two cars equipped with storage batteries running constantly on the Astoria Ferry cross-town line as an experiment; these cars have worked satisfactorily from the first trip, and the officials believe they have found a system that will continue to operate successfully.

TELEPHONE AND TELEGRAPH.

The Telephone in Maine.

The "Bulletin" of Madison, Me., thus tells of the "wonderful accommodations" which are furnished by telephones in the Pine Tree State: "Prof. Baker, of Brunswick, the whistler, singer and quick-witted coon, went to Bingham to give one of his street concerts when he was informed that a company at the Forks, which is twenty miles above Bingham, would like to hear him whistle. He secured the use of the telephone and after getting an order from the agent at Bingham to pay a specified sum he proceeded to send his shrill notes for a distance of twenty miles over the wire. The result was so satisfactory that he continued to entertain his unseen audience for some time, for which he realized a good sum."

A Verdict for Non-Delivery of Messages.

L. C. Hendershoot, of Ottumwa, Ia., has secured a verdict for $1,234 in a suit against the Western Union Telegraph Company. The suit was brought to recover the value of his race horse, which, he alleges, died for the lack of veterinary treatment which could have been given him had the telegraph company delivered promptly a message sent by the horse's trainer.

The independent telephone movement in central Pennsylvania seems to be in a healthy condition. The Home Telephone Company of Lewisburg is now building a line from Lewisburg to Mifflinburg. When it is finished a line will be built from Lewisburg to Milton and from Lewisburg to Northumberland and Sunbury. The Lykens Valley Telephone Company is now building a line from Uniontown in Snyder County, to Selinsgrove, crossing the river at Herndon. The Lykens Valley line connects Tower City, Williamstown, Lykens, Millersburg, Georgetown, Herndon and other towns. The two lines will be united at Selinsgrove. The officials of the two companies intend to extend the line to Williamsport, Harrisburg and Pottsville.

The Northwest Telephone Company is completing arrangements for the extension of its line from Fargo to Lisbon, S. D., in the spring. It is reported that the long-distance line is to be extended from Grand Forks to Grafton and Park River, and from Grand Forks to Larimore, and from Fargo to Tower City and Valley City. The proposed lines will give telephone communication from Fargo to all parts of the State.

George W. Cay and Martin Garrison are promoting the organization of the People's Telephone Company of New Haven, Conn., to compete with the service of the Southern New England Telephone Company in that city. Subscribers are being secured on the basis of $3 and $4 rates. The promoters contemplate similar organizations to Hartford, Meriden, New London, Norwich and the other cities of Connecticut.

Local capitalists of Grove City, Pa., have organized a company to construct a line from their town to the many surrounding coal mines and small hamlets, and finally centering in Mercer. Prominent men in Sharon and Greenville contemplate the construction of a line from their respective towns to Clarksville, taking in the small towns on the way, and from Clarksville to run it to Mercer.

Oakland, Cal., is trying to collect from telegraph and telephone companies an annual ground rent of $2 for each pole within the city limits. To fix the basis for the rent, the council passed an ordinance directing the companies to number their poles. This the companies neglected to do, and the police then counted the poles preparatory to a demand upon the companies for the rent. The companies will resist collection.

By the extension of the Rapid Telegraph & Telephone Company's line, now completed to Bethel, Vt., South Strafford, Strafford, Tunbridge, North Tunbridge, Chelsea, Royalton, Stoughton's Mills, East Bethel, Bethel and South Royalton are brought in direct communication, with reduced rates.

The Postal Telegraph and Cable Company is considering the extension of its telegraph line into Texas. President Chandler has recently made a tour of that State with this idea in view. The extension, if made, will be over 1,000 miles in length and include the principal Texas cities.

The Fulton Valley Telephone Company will extend its lines from Middleburg, through Fultonham, Breakabeen, Mackey and Broome Center, to Gilboa and Conesville, and from Breakabeen to Blenheim and West Fulton, and from Middleburg to Central Bridge, Conesville, West Fulton and Blenheim, N. Y.

The Bell Telephone Company makes a good instrument showing for the month ended November 20, coming within 36 instruments of September, which was the largest on record. Compared with a year ago, the gross gain was 8,624, and the net 8,984.

The county board of Menominee, Wis., has rejected the proposition of the Wisconsin Telephone Company to accept free of charge for one year telephones in the court house, jail and asylums. The Menominee Telephone Company, a local institution lately organized, has installed a new telephone system and secured the greater part of the old company's subscribers at a reduced rate.

The Logansport Mutual Telephone Company, Logansport, Ind., is preparing to make extensions to a number of surrounding towns. Royal Center and Deer Creek are to be first accommodated, and extensions will then be made to Winamac, Kewanna, Rochester and a number of other points.

Dr. Sawbridge, of Stephenson, Mich., is interested in the organization of a company for the establishment of a telephone line connecting Menominee with the villages of Wallace, Ingalls, Stephenson, Daggett, Talbot, Bagley, Caney and Nadeau.

Henry C. Wisner, a well-known attorney of Detroit, Mich., has filed a petition for a mandamus to compel the Michigan Telephone Company, the local Bell company to furnish telephone service at a more reasonable rate than is now exacted.

The director of public works of Philadelphia has been authorized to advertise for proposals for telephones and all wires where the city has its own circuit and no exchange service is needed. Over 600 'phones will be required.

C. W. Rickerd, general manager of the Willow River Lumber Company, New Richmond, Wis., has asked for telephone franchises in New Richmond and Hudson. The system when completed will connect New Richmond, Hudson, Stillwater, St. Paul and Minneapolis.

The township committee of Kearny township, N. J., refuses to grant overhead street rights to the New York and New Jersey Telephone and Telegraph Company, demanding that wires be placed underground.

The telephone war at Durham, N. C., between the Bell and Inter-State companies has reached that stage where Bell service is offered free of charge.

John M. Lennan has been granted a telephone franchise at Orlando, Fla. It is his intention to construct a long-distance service in that part of the State, making Orlando the central office.

The application of Hermann de Laguna for a telephone franchise at Pasadena, Cal., has been referred to the city attorney and the judiciary committee of councils for action.

W. E. Zeigler and C. A. Limmins are canvassing Gettysburg, Pa., with a view to establishing a telephone exchange. It is proposed to connect with Baltimore via Hanover and Westminster.

W. Z. Haight, of the Blue Earth Valley Telephone Company, of Winnebago City, is canvassing Mapleton, Minn., with a view to putting in a telephone exchange.

The Wisconsin Telephone Company has acceded to the demands of its subscribers in Milwaukee and will adopt a revised schedule of rates.

J. W. Walker will be manager of the new telephone exchange to be constructed at Florence, Ala.

The telephone system of Gainesville, Ga., has been purchased by J. M. Oliver, of Montgomery.

The council of Paris, Ill., has granted a telephone franchise to P. G. Furrow, of Cairo, Ill.

The Oak Telephone Company of Bloomingdale, Mich., will construct a line to Paw Paw, Mich.

Oxford and Henderson, N. C., are to be connected by a telephone line.

New Companies Incorporated.

The Pacific Coast Telephone and Electric Motor Company, Los Angeles, Cal.—to manufacture telephones, motors, etc., and construct and dispose of telephone and telegraph lines, etc. Capital stock, $100,000. Promoters: L. M. Gibson, W. C. Harrison, Jno. C. MacCabe, S. Weathercott, H. I. Lloyd, Los Angeles.

The Western Telephone Construction Company, Janesville, Wis. Capital stock, $5,000. Incorporators: W. F. Palmer, George S. Parker and T. A. Pipelow. The company will manufacture telephones and build and equip lines. The factory will be located in Janesville. T. A. Pipelow, of Milwaukee, will have charge of the work.

The Iowa and Dakota Telephone Company, Centerville, S. D. Capital stock, $25,000. Incorporators: J. E. Tomilson, W. A. Houts, and W. A. Cottrell.

The Pierce County Telephone Company, Wisconsin. Capital stock, $3,000. Incorporators: E. R. Condit, J. M. Johnson, T. E. Nelson and A. E. Michael.

The Crowley Telephone Company has been organized at Maple Rapids, Mich., with a capital stock of $2,200.

COMMERCIAL PARAGRAPHS.

George Cutter's street lamp fixtures are known wherever electric light is used. The latest candidate for favor in this line is the "Always Level" suspension streethood which is illustrated and described in a circular now being issued to the trade.

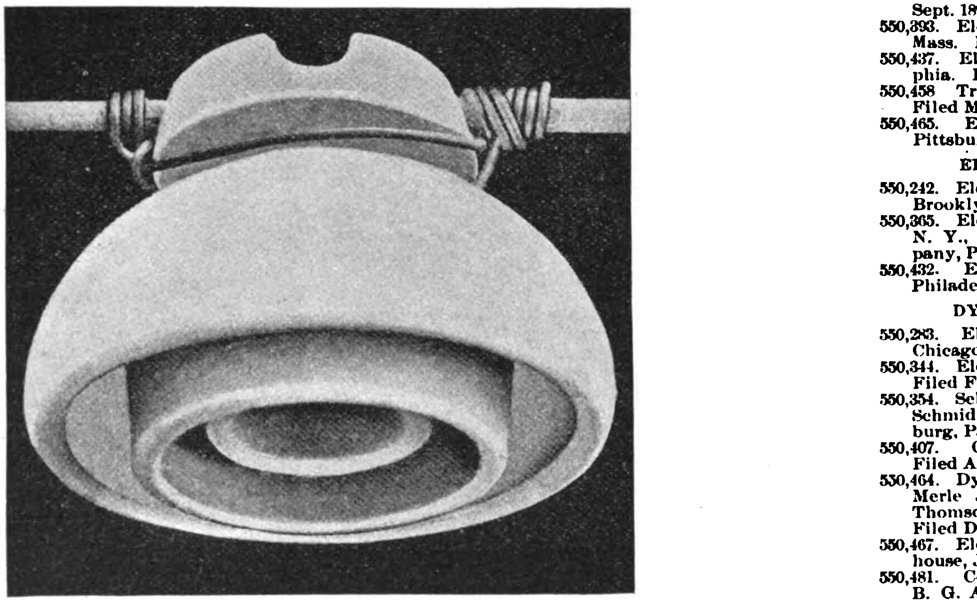
The *Columbus Lantern* of November 6 says: "The disposition of manufacturers of electrical apparatus to be well represented at the Ohio State University is typified in the recent action of the Standard Electric Company of Chicago. A year ago last May a 20 light arc dynamo was made especially for us from the latest designs. Since that time the company has improved the regulating apparatus used on the machine and has sent, without expense to us, the entire set of new parts necessary to adapt this new method of regulating to the old machine."

Southern Planters Interested in the Tesla Motor.

The Atlanta *Constitution* says: "The Westinghouse Electric and Manufacturing Company is giving some valuable suggestions to the planters of the South who feel more and more the necessity of some convenient and cheaper motive power to take the place of steam or, what is still worse, the horse. The Tesla motor at the exhibit of the Westinghouse Company is solving this problem for the farmers. Suppose a number of planters in the same community and residing near a water course should get together and utilize the water power to generate electricity. This would make the cost to each but nominal; not more than about $200. Now, with connecting wires, each planter could operate a motor on any portion of his farm to gin his cotton, shell his corn, saw his wood, or run any sort of machinery about the place. One Tesla motor could do all the work, and the cost, once the power station or plant was established, would be far less than the cost of steam and a thousand times more convenient. This matter is attracting the attention of the farmers who visit the Exposition and the Westinghouse Company will have done a great good for the South when it has introduced this motor on the plantations."

Insulators for High Potential Circuits.

It is admitted that high potential circuits are dangerous if not properly insulated. It is the opinion of Capt. Wm. Brophy, chief of the Boston Wire Department, that "the so-called insulating covering in use at the present time for high potential circuits is worse than a delusion and snare. Knowing the worthlessness of the material, it becomes necessary to use the best form of insulating supports. The present style of glass insulators is not what is required. Many of these insulators are only so in name. The very best grade of glass or porcelain should be used, and the double or single petticoat pattern, the form best suited to the purpose being that which will offer the greatest amount of dry surface between the wire and the supporting pin.



Locke's Triple Petticoat Insulator.

The qualities of an insulator deemed by Capt. Brophy to be essential for the purposes of high insulation are supplied in the Triple Petticoat China Insulator manufactured by Fred M. Locke, Victor, N. Y.

This Insulator is made from the highest grade chinaware in the world. It measures 5¼ inches in diameter and 4 inches in height, and has over 12 inches of surface between the wire contact and the supporting pin. About 10 inches of this surface is on the under side of the insulator, out of reach of direct rainfall, where it keeps comparatively dry. The surfaces of the bottom of the insulator are perpendicular, and therefore catch no foreign matter.

By repeated practical tests it has been found that a potential of 85,000 volts is required to puncture the insulator; hence it will carry with safety and economy any voltage that is practicable for use in commercial applications of electric power. The body and glaze of these insulators are of simple earths only, fused together into a vitreous, homogeneous mass at the greatest heat. No lead or other metallic oxide being used in making, the glaze is not a conductor.

These Insulators will not craze or crackle on the surface, or "leak," as insulators made of inferior material will do when subjected to variations of temperature. The ware used in the construction of these Insulators will stand severe tensile strains or heavy blows without injury, and will not crack or chip from the effects of high potential currents.

Heat, cold, dampness, acids, alkalies cannot act to disintegrate or otherwise injuriously affect the properties of the Insulator. The structure resists the action of gaseous and fluid substances as well as of other forces. No other insulator possesses, or maintains to such a high degree, all the essential qualities of high insulation resistance.

Many of these insulators are already in use on high potential long distance transmission lines and have uniformly given efficient, safe and satisfactory service.

INCORPORATIONS.

The Pittsburg and Monongahela Traction Company, Pittsburg, Pa. Capital stock, $12,000. Promoters: M. C. Bulger, Brownsville, Pa.; H. C. Johnson, Pittsburg; M. J. Eakin, Allegheny, Pa.

The Belleville Traction Company (Limited), Belleville, Can.—to establish an electric street railway in and about Belleville. Capital stock, $100,000. Incorporators: S. A. Lazier, T. C. Lazier, R. C. Lazier, S. S. Lazier and S. D. Lazier.

The Pottstown and West Chester Electric Railway Company, Pottstown, Pa.—to build and operate an electric railway about 22 miles long from South Pottstown to Buckton, Pughtown, to West Vincent, to the Eagle, to Lionville and to West Chester. Capital stock, $500,000. President, John P. Robinson, of Philadelphia. Directors: Arthur C. Ash, of Trappe; H. P. Clay, of Pottstown; Henry H. Robinson, Collegeville; Forrest D. Ash, of Spring City, and Joseph F. Ash, Trappe.

The National Electrical Exposition Company, New York City—to hold exhibitions of all productions of electrical and kindred industries. Capital stock, $10,000. Directors: Harrison J. Smith, Marcus Nathan, Robert B. Corey, Stephen A. Douglas, William F. Weise, William A. Stadelman, C. O. Baker, Jr., John A. Seeley and George F. Porter, of New York City.

The New York Gas Improvement Company, New York City—to purchase and develop real and personal property, including machinery, inventions and patent rights relating to the manufacture and production of gas or electricity, and to construct and equip buildings and machinery, and to lay pipes or wires. Capital stock, $23,000. Directors: Charles D. Lithgow, Emil Carlebach, John A. Snyder, Edward J. Kavanagh, Edward D. Phillips and P. F. Vaughan, of New York City.

The Bergmann Electric Company of New York City—to manufacture appliances to produce electricity, gas, steam, or heat, and to distribute the same. Capital stock, $500,000. Directors: Sigmund Bergmann, Harry E. Bailey, Edwin Lavens, Philip H. Klein, Jr., and Frederick La Roche, of New York City.

The Orange Mountain Traction Company has filed articles of incorporation at Newark, N. J. The company is to take the property of the Mountain Cable Company, which was recently sold by the receiver. The capital stock of the new company is $150,000. The corporators are Walter G. MacFarland and Leonard G. Dodge, of Philadelphia, and William S. Hood, of Camden, N. J.

The Woodbury (N. J.) Hygiene Ice and Manufacturing Company has filed articles of incorporation, and intends to offer to light the city with electric light in competition with the Woodbury Gas and Electric Light Company.

The Woodhaven Electric Light Company, Jamaica, N. Y.—to manufacture and use electricity for producing light, heat and power. Capital stock, $225,000. Promoters: Florian Grosjean, Brooklyn, N. Y.; E. M. Martin, Elizabeth, N. J.; A. J. Cordier, Woodhaven, N. Y.

The Allegheny and Evergreen Street Railway Company, Allegheny, Pa.—to build an electric street railway in Allegheny County. Capital stock, $30,000. Promoters: H. C. Bolster, Wm.L. Hartmeyer, J. C. Eckerman, Allegheny, Pa.

The Salida Electric Company, Denver, Col.—to furnish electricity for light, heat and power in Salida. Capital stock, $50,000. Promoters: Geo. A. Goddard, James E. Johnson, John Brennan, Denver, Col.

The Orchard Water Company, Kalama Wash.—to maintain and operate water works and electric lights in any town in Washington. Capital stock, $7,000. Promoters: H. Orchard, J. P. Atkin, A. H. Innis.

The Tacoma Auxiliary Fire Alarm Company, Tacoma, Wash.—to install electric auxiliary fire alarm systems in Pierce County, Wash. Capital stock, $30,000. Promoters: J. M. Bell, B. K. Worley, D. B. Worley, W. E. Theodore.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

DECEMBER, 1895.

Date.	Light.	Date.	Exting.
1	4.10 A. M.	1	6.00 A. M.
2	No light.	2	No light.
3	"	3	"
4	5.00 P. M.	4	8.00 P. M.
5	5.00 "	5	9.00 "
6	5.00 "	6	10.10 "
7	5.00 "	7	11.30 "
8	5 00 "	9	12.40 A. M.
9	5.00 "	10	1.00 "
10	5.00 "	11	1.50 "
11	5.00 "	12	3.00 "
12	5.00 "	13	4.20 "
13	5.00 "	14	5.30 "
14	5.00 "	15	6.20 "
15	5. 0 "	16	6.20 "
16	5.00 "	17	6.20 "
17	5.00 "	18	6.20 "
18	5.00 "	19	6.20 "
19	5.00 "	20	6.20 "
20	8.00 "	21	6.20 "
21	9.10 "	22	6.20 "
22	10.10 "	23	6.20 "
23	11.00 "	24	6.20 "
24	11.00 "	25	6.20 "
25	...... "	..	....
26	12.10 A.M.	26	6.20 "
27	1.10 "	27	6.20 "
28	2.10 "	28	6.20 "
29	3.20 "	29	6.20 "
30	4.20 "	30	6.20 "
31	No light.	31	No light.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED NOVEMBER 26, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

550,319. Electric Tramway With Underground Distribution of Current. Alfredo Diatto, Turin, Italy. Filed Sept. 1894.

550,393. Electric-Car Truck. Louis J. Hirt, Somerville, Mass. Filed March 5, 1894.

550,437. Electric Railway. David Brooks, Jr., Philadelphia. Filed Feb. 28, 1894.

550,458 Trolley. Eugene L. Richter, Philadelphia, Pa. Filed March 27, 1895.

550,465. Electric Railway. George Westinghouse, Jr., Pittsburg, Pa. Filed June 13, 1890.

ELECTRIC LIGHTS AND APPLIANCES.

550,242. Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed March 7, 1895.

550,365. Electric-Arc Lamp. Frank Emery, New York, N. Y., assignor to the Standard Thermometer Company, Peabody, Mass. Filed April 22, 1895.

550,432. Electric-Lighting Gas-Burner. John M. Anck, Philadelphia, Pa. Filed March 29, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

550,283. Electric Mining-Machine. Edmund C. Morgan, Chicago, Ill. Filed Dec. 12, 1894.

550,344. Electromotive. Jean J. Heilman, Paris, France. Filed Feb. 13, 1895

550,354. Self-Exciting Constant-Current Alternator. Albert Schmid, Allegheny, and Benjamin G. Lamme, Pittsburg, Pa. Filed Aug. 24, 1891.

550,407. Commutator. John Dice, Wilkinsburg, Pa Filed Aug. 21, 1895.

550,464. Dynamo-Electric Machine. Elihu Thomson and Merle J. Wightman, Lynn, Mass., assignors to the Thomson-Houston Electric Company of Connecticut. Filed Dec. 2. 1889.

550,467. Electric and Fluid Locomotor. George Westinghouse, Jr., Pittsburg, Pa. Filed Feb. 5, 1892.

550,481. Controlling Apparatus for Electromotors. Jean B. G. A. Canet and Andre Hillairet, Paris, France. Filed Aug. 28, 1894.

TELEPHONE AND TELEGRAPH APPARATUS.

550,255. Apparatus for Hanging and Cleaning Telegraph or Telephone Wires. Alphons Custodis, Dusseldorf, Germany. Filed May 15, 1895.

550,260. Telephone-Circuit Signal. Mark A. Edson, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed May 20, 1895.

550,510. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Filed May 25, 1895.

550,511. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Filed Sept. 7, 1895.

BATTERIES.

550,480. Plate for Secondary Voltaic Batteries. William A. B. Buckland, London, England. Filed July 1[illegible], 1895.

550,534. Battery-Well. Jens D. Schreuder, Edgewood, and Simon H. Stupakoff, Pittsburg, assignors to the Union Switch and Signal Company, Swissvale, Pa. Filed Oct 25, 1894.

MISCELLANEOUS.

550,252. Commutator-Brush. Nellis M. Cross, North East. Pa., assignor of one-half to Charles A. Ensign, same place. Filed Oct. 29, 1894.

550,281. Tube, Pipe or Conduit. Robert H. Martin, Brooklyn, N. Y. Filed Feb. 28, 1894.

550,298. Electrically-Controlled Clutch Mechanism. John E. Stannard, Springfield, Mass. Filed April 5, 1895.

550,329. Electrical Pumping Apparatus. Gustaf Rennerfelt, Arvika, Sweden. Filed July 16, 1894.

550,330. Electric Pumping Apparatus. Thurs G. Rennerfelt, New York, N. Y. Filed July 3, 1895.

550,355. System of Electrical Distribution. Oliver B. Shallenberger, Rochester, assignor, by mesne assignments, to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed Oct. 12, 1886.

550,403. Electrodepositing Apparatus. Henry L. Bridgman, Blue Island, Ill. Filed Dec. 22, 1894.

550,411. Electric Switch. Thomas Harper, New Brunswick. N. J. Filed Aug. 29. 1894.

550,462. Register for Fire-Alarm Systems. Nathan H Suren, New York, N. Y. Filed Jan. 29, 1895.

550,468. Ventilating Means for Electrical Apparatus George Westinghouse, Jr., Pittsburg, Pa. Filed May [illegible] 1895.

ELECTRICITY.

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EDITORIAL NOTES.

An Urgent Necessity. That the condition of the electrical trade has undergone a marked improvement during the past year is beyond question. It is equally true that the measure of this improvement has been much less than it would have been if all the leading companies had been managed in the interests of stockholders and with sound common sense. If there is one company which has failed to secure any benefit from better general conditions, it is the General Electric Company. And this company, being the largest one in the country, with its slovenly or corrupt management is the only apparent stumbling-block which prevents this trade taking its place near the head of the procession of prosperous American industries. If the interests of the G. E. Company were the only ones to be injured by the policy pursued, the subject would not be worthy of comment. But this is not the fact. They are the pacemakers. They do a larger business than any other company. They make and sell in greater or smaller quantities about everything needed in the railway or lighting business. They virtually make prices. Though other companies may get perhaps 10 per cent more in competition it is almost entirely the fault of the G. E. management that prices are not at least 25 per cent. higher. It is only a few months indeed since in official circulars they announced an average reduction of 25 per cent. on small supplies, in face of the fact that with the general recovery of business prices of iron, copper and other raw material had been advanced.

If it is argued that the G. E. Company is doing a big business, it is admitted. But to whose benefit? Certainly not to that of the stockholders. The only apparent benefit in the present conduct of that business accrues to the small coterie of salaried schemers who direct its affairs but who pay no share of the losses.

The troubles in that company are deep-seated, and will require the concerted action of the stockholders before they are cured. Nothing less than a revolution in management must occur, with the dismissal of every man holding high position there to-day. A house divided against itself cannot stand, and no business concern can endure whose control is intrusted to various cliques of malcontents, each working for his own ends, without harmony, without an able or authoritative central head. In the G. E. Company there is nothing but petty intrigue, jealousy and contention for place. As the formation of the company itself was a grand conspiracy against the electrical trade of America, so its management has descended into a series of petty conspiracies, one against the other, each with the same object in view. In this we do not refer to the Board of Directors, but to the officers, from the president down to the heads of departments. Each one is after the scalp of the man above him, and no trick is too mean when there is any hope of success. Several of the pigmies have agreed that the president ought to be displaced. There the argument ends. Each thinks that he is the man for the place. Conspicuous aspirants for this position are Messrs. Ord and Darling. This internal warfare has gone so far that one man hires detectives to watch his rival, and the private detective agencies of the city have reaped quite a harvest.

It should be obvious to the stockholders that the condition of their property cannot improve materially as long as the present state of affairs exists. It is for them to determine what shall be done. There can, however, be no half-way measures. The remedy must go to the bottom of the difficulties. It must begin at the top, but not end there.

Charles A. Coffin must go. He has showed his utter unfitness to manage a large manufacturing enterprise. Whatever power he ever had for good has been destroyed, and his capacity for evil on the outside of the company has been greatly overestimated. He could never again gain a foothold in this trade. Any company taking him up would be marked for certain destruction. The man and his methods are too well known. He would have to devote his talents to some other line of business.

The company needs a strong central head. The man cannot easily be found, but he must exist. The requirements are peculiar, but not impossible.

The diverse and sundry committees must be abolished. Every one of the officers and employés who has been engaged in the petty intrigues of the past two years must go with Mr. Coffin, or follow him quickly; new blood is needed.

The intrinsic value of the stock becomes less and less the longer the maladministration of affairs continues. Interest can never be earned on the present capitalization but with a proper reduction, and with a strong management the property would soon be turned into a paying one. Every company in the field would thereby be benefited, but the greatest benefit would be to the G. E. Company itself.

The revolution is inevitable. The sooner it comes the sooner will the ill-repute of the company in the trade be removed, the confidence of the press be restored, the securities of the concern again command some measure of respect, and the stockholder obtain some return on his investment.

* * *

If the Standard Telephone Company has any more patents it desires illustrated, it can send in its lists. Electricity is the best read trade paper in the world, and reading notices of this nature cost nothing.

More Lamp Litigation. Most of our readers will be surprised to learn, on reading this week's issue of ELECTRICITY, that further injunctions have been granted in favor of the General Electric Company against an independent lamp manufacturer. While the General Electric Company had made many boasts after the expiration of the fundamental Edison filament patent that there were many detail patents in reserve which could still be used to suppress competition, no one posted in incandescent lamp manufacture had taken much interest in the subject, knowing that there was nothing left of any value in the way of patents on the incandescent lamp, and that whatever suits might be brought by the General Electric Company would be brought simply for the sake of annoyance and with no expectation that competition could be killed.

We reproduce this week the full text of the patent upon which an injunction has been granted, with illustrations. This is done, not because the subject merits particular prominence, but to allay the fears of such of our constituency as have not ready access to the facts. The patents cover nothing of importance. and it is doubtful if any independent lamp factory in the United States is infringing them. They cover details of manufacture which have long since been superseded by the makers of the best lamps by other and better processes. The methods covered are still used in the Harrison lamp works, but it is well known to every user of incandescent lamps that the Edison lamp of to-day is not the best lamp on the market, and it is admitted by everyone except the General Electric people themselves that it stands fifth or sixth in the field. It is extremely doubtful that the patents could have been sustained if a thorough defence had been set up, but the facts are that the patents were not worthy of any defence, and we do not see why the Bryan-Marsh Company should be particularly criticised for allowing a judgment to be taken by default. We do think, however, that this company would have used good judgment to have advised the trade through the press when this suit was brought as to just what the action comprehended.

That the Bryan-Marsh Company do not attach special importance to the decision recorded against them is shown by the following statement of Mr. Converse D. Marsh, president:

"Three days before we received notice of the suit we had discontinued the use of the methods described in these patents, because we found them to make unsatisfactory lamps. But until we received formal notice of infringement from the Edison Company, we did not know that the method of securing a filament from the inside of a lamp was patented. However, the whole matter was of no importance, as the Edison Company readily agreed to take judgment and waive damages, they paying all the costs of the action.

"The judgment in no wise affects us or our customers, as the $1 damages awarded the Edison Company covers the entire matter."

* * *

No Trolley Monopoly Yet. The decision of Judge Townsend in the suit of the Thomson-Houston Electric Company against the Winchester Avenue Railroad Company, sustaining the validity of patent No. 495,443 and invalidating patent No. 495,383, will doubtless prompt the General Electric Company to claim a monopoly of the under-running trolley system in this country. Indeed it would seem, at first thought, that the decision in this suit affords ample ground upon which to base such a claim. But such an assumption can be properly made only after certain other conditions are fulfilled.

Should the New Haven decision be sustained by the higher courts, it will certainly mean that those roads now operating without licenses from the General Electric Company will be compelled to either abandon the present form of trolley or to pay a royalty for its continued use. An appeal is to be taken, however, and it is the opinion of able legal talent that Judge Townsend may be adjudged to have been in error when he so broadly sustained the claims of patent No. 495,443. In the event of the decision being affirmed, those roads not licensed by the General Electric Company need not render their tribute to Cæsar, having, as they will, recourse to the use of other forms of trolley not covered by the patent in suit.

If the somewhat remote, if not impossible, contingency implied by a failure to invent a non-infringing trolley should arise, there yet remain other efficient methods by which current can be supplied to the motors of a moving car, none of which come within even the broad scope of any of the claims of the Van Depoele patents. Of one of such devices ELECTRICITY said in its issue of May 29:

> Reference is here made to the flexible sliding contacts usually mounted in the form of a parallelogram on the top of the car. One great advantage that this form of contact has is that it does not lose contact with the wire and that upon reversing the direction of the car it is not necessary to pull down the trolley, reverse its position and then adjust it to the conductor. In fact, we have often wondered that this device, so well and favorably known abroad, has not been adopted here to the exclusion of the devices with which we are familiar.

It has not frequently occurred that we are compelled to go to Europe for mechanical or electrical ideas of any kind, but when forced, either by restrictions of patents or other circumstances of trade, to borrow from our neighbors on the other side, Yankee ingenuity has always found abundant opportunities for improvement. The European form of trolley, improved to suit the local conditions of traffic in this country, would certainly prove quite as efficient and satisfactory in American service as it has abroad.

In any event, a trolley monopoly, even if established through protracted litigation, cannot be made effective, nor can it be long continued.

* * *

Electricity Direct From Heat. A careful perusal of Mr. Leon Le Pontois's interesting paper on "The Inefficiency of the Direct Methods of Converting Heat into Electricity," concluded in this issue, leads rather than forces one to accept as correct the author's conclusions "that it is not very likely electricity will ever be obtained, efficiently. from heat," and "that after all the most economical solution to the problem lies in the construction of a more perfect heat engine, driving the already highly efficient dynamo."

Able and distinguished scientists and experimenters have given much careful thought to the problem; but so long as it remains seemingly impossible to devise any apparatus, or to employ any process by means of which no more than 2 per cent. of the heat energy of any combustible can be converted into electricity without the aid of intermediary devices, this method of conversion will certainly not extend its usefulness beyond the realm of laboratory experiment. As interesting as it may be to follow the researches of the investigators in this field, the results attained by them must at last be judged from a commercial rather than a scientific standpoint. By this standard any energy-converting device having an efficiency of 2 per cent. or less becomes useless for any of the purposes of this eminently practical age.

In view of the unsuccessful attempts already made, it would seem that the science of thermo-electricity has reached a stage of development beyond which it is not possible to go until some more efficient process of conversion has been discovered. When it is found what electricity actually is, or when the true relation existing between electricity and heat becomes known, a commercial solution of the problem of converting the latter into the former by direct methods will doubtless be accomplished.

"The Evolution of a Technical Journal."

(From W. J. Johnston's latest brochure.)

ELECTRICITY has become a necessary part of daily life. Every branch of human industry has come more or less within the range of its columns.

Under the Searchlight.

Views and Opinions on Timely Topics.

STRANGER *things have happened than that Henry Villard should succeed Charles A. Coffin in the presidency of the General Electric Company. Mr. Coffin has already announced to Mr. Villard personally that he would cheerfully retire in the latter's favor. Mr. Villard has time, ambition, power to raise money. Why should he not take it into consideration?*

* * *

Asks Advice of Congress in the Berliner Case.

In his report of the operations of the Department of Justice for the last fiscal year Judson Harmon as Attorney General asks Congress to direct him what to do in the Bell telephone litigation. The expense of this case, he says, is very heavy. It will take six months to prepare rebuttal testimony. He favors continuing the case to a final decision, providing the expenses can be met, and says:

"If the people have been deprived of their natural rights by the improper issue of a patent, as the Government avers, it would not be a proper course on its part to discontinue litigation which has probably been purposely protracted until the patents have expired, but such litigation should be persisted in to establish, for the sake of future action on its part, its right to sue to annul patents."

* * *

ELECTRICITY offers as a suggestion to some one of the lamp companies that at the Grand Electrical Exhibit of 1896 a drawing-room be fitted up to show the possibilities in effects with concealed lamps. Any good concern in the business would cheerfully do the glass work without charge, and any one of a dozen furniture establishments would supply the furnishings and draperies on the same basis. Would not such an exhibit attract the attention of many a householder in the larger cities, and show that the highest triumphs in artistic lighting are reserved for the electric incandescent lamp?

* * *

Some Reasons Why Supply Dealers Complain of Low Prices.

(From New York Department Store Advt.)

Electric Call Bell Outfit.—We offer this entire outfit with full directions so simple that a child can put it up, all complete for 98 cents.

Dr. ——'s Medical Battery, one of the finest batteries manufactured, in a handsome polished oak case, convenient and most reliable, metal parts handsomely nickel-plated, with complete set of fittings; regularly sold at $6.00; special, $3.98.

If you want to catch the worm buy one of our "Early Bird" Electrical Alarm Clocks, mounted on handsome polished oak cabinet, complete with battery; formerly sold at $5.50; special $2.98.

* * *

FROM the Richmond (Va.) papers we learn that during the progress of the fight for a franchise in that city between the Home Telephone Company and the Standard Company agents of the latter telegraphed to the editors of the *Electrical World* and the *Electrical Review*, asking their opinion of the standing of ELECTRICITY. Both these gentlemen replied that they had no opinion to express. This is characteristic. Neither one of these esteemed contemporaries has ever been known to have an opinion on any subject. At the same meeting of council letters were read from the following gentlemen expressing the opinion that ELECTRICITY is a paper of very poor standing: Morris Hunter, Richmond, Va., Secretary Old Dominion Construction Company; C. W. Winston, Richmond, Va., Secretary and Treasurer Electric Construction Company and Home Electric Company; A. Pizzini, Jr., Richmond, Va., President Electric Construction Company and Vice-President Home Electric Company; M. W. Thomas, Richmond, Va.

General Manager Old Dominion Construction Company.

We cannot claim the pleasure of the acquaintance of any of these gentlemen, and as Mr. Toots said to Capt. Sol. Gills, we do not see how they ever can know us *without* giving us the pleasure of their acquaintance.

* * *

Has Not Sold to the Bell Company.

A statement was recently made in the columns of the *Commercial Appeal* of Memphis, Tenn., to the effect that the Memphis Telephone Company, which in August contracted with the American Electric Telephone Company of Kokomo, Ind., for a $100,000 plant, had sold its rights to the Bell Company. The matter being brought to the attention of the American Company, the following denial was made by Paul W. Bossart, Assistant General Manager:

"There is no truth whatever in the statement that 'the Bell Company has bought the Kokomo claim in Memphis?' Preparations are being made to prosecute the work under contract."

* * *

LORD DUNRAVEN, the ex-yatchsman, widely known in literary circles as the author of "Explanations which do not Explain," has, it is rumored, instructed a New York attorney to institute proceedings under the copyright laws against Thurlow Weed Barnes. It is alleged that the title of the distinguished English author's most recent production has been appropriated without consent or credit by his American contemporary, whose facile pen has already produced two installments of his highly interesting work of creative and imaginative writing.

* * *

"Electricity" finds Mr. Angell.

To the Editor of ELECTRICITY.

SIR: In this week's issue of your paper I notice a request for my address.

You may say to your correspondent that I am on the road most of the time and will be at this hotel address until Thursday next, where the party can communicate with me if desirable.

At Hotel Burns, Syracuse, from 12th to 15th.

The value of your paper is demonstrated in this instance. Yours truly,

F. H. ANGELL.

The Avery, Auburn, N. Y., Dec. 9, 1895.

* * *

The Standard in Congress.

Senator Gorman has introduced in the Senate a bill to authorize the Standard Telephone and Telegraph Company of Baltimore and Washington to operate and maintain a plant and exchange in Washington.

* * *

ONE of the funniest things which Mr. Thurlow Weed Barnes has said is that the criticisms of his company have emanated from the Bell Company. We suppose the Bell Company would gladly swap off its best patents for the assurance that there would be a company just like the Standard started every month. Nothing would be surer to prolong the life of the Bell monopoly.

* * *

Free Telephone Service.

(From the Providence Journal.)

That it is neither impossible nor necessarily dangerous beyond the actual risk to capital invested, to bring the Bell Telephone combination to terms is seen by the report from Durham, N. C., where the Inter-State Telephone Company has pressed its competition to such a critical point that the Bell Company has offered instruments to the public free of charge.

* * *

The Oft-Recurring Rumor.

(From Town Topics.)

For the twentieth time a pool has been formed in General Electric, with a view of putting that stock well in the 80s. I hope that on this occasion success will perch upon the banner of those who are expending such force in trying to *shock* the bears on General Electric.

Westinghouse Wins and Loses.

THE UNDER-RUNNING TROLLEY.

One of the Van Depoele Patents Declared Invalid; Another Sustained.

Judge Townsend, of the United States Circuit Court at New Haven, Conn., on the 7th inst., rendered a decision in the suit of the Thomson-Houston Electric Company vs. the Winchester Avenue Railroad Company, declaring one of the Van Depoele under-running trolley patents in suit to be invalid and sustaining the other.

At the time this suit came up for final hearing, in May last, ELECTRICITY devoted considerable space to a review of the case, thereby acquiring all the distinction which comes to the only electrical journal having enterprise enough to go after and to get important and interesting news. As will be remembered, the suit in question is based upon two patents issued to Charles J. Van Depoele, which it was broadly claimed covered the under-running trolley as now used in electric traction work. These patents became the property of the Thomson-Houston Company, and later of the General Electric Company. The defendant in the suit is a licensee of the Westinghouse Electric and Manufacturing Company, hence the contest was in reality between the General Electric and Westinghouse companies. As the case now stands, the honors are about evenly divided.

The patents upon which suit was brought are Nos 495,383 and 495,443, both bearing date of April 11, 1893, although the former was filed June 18, 1888, and the latter March 12, 1887, the delay in issue being caused by interference with the applications of R. M. Hunter, Frank J. Sprague and others. Of these patents, No. 495,443 was deemed to be the stronger, as it was certainly broader in its claims. Of the sixteen claims under this patent only the 6th, 7th, 8th, 12th and 16th were at issue. The broad character of the patent is illustrated by the 6th claim, which is as follows:

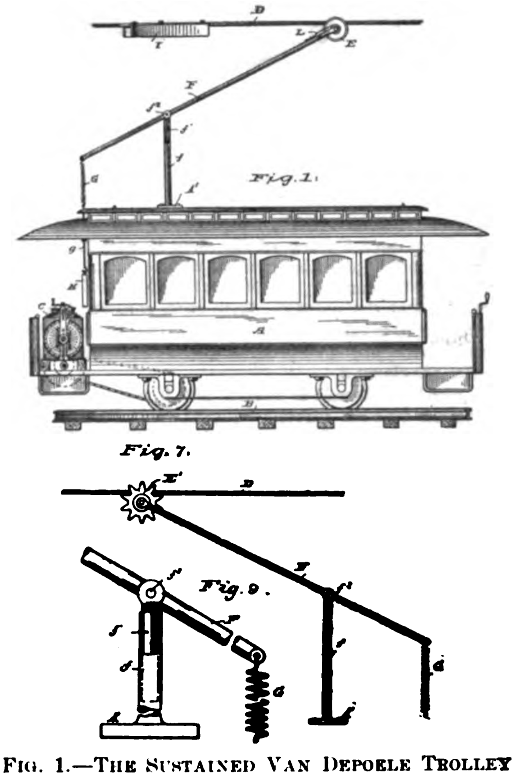


FIG. 1.—THE SUSTAINED VAN DEPOELE TROLLEY PATENT.

6. In an electric railway, the combination with a suitable track and a supply conductor suspended above the track, of a car provided with a swinging arm carrying a contact device in its outer extremity and means for imparting upward pressure to the outer portion of the arm and contact, to hold the latter in continuous working relation with the under side of the supply conductor, substantially as described.

The accompanying illustration, Fig. 1, is a reproduction of the drawings forming a part of the specification of patent No. 495,443.

Patent No. 495,383 was, specifically, for an improvement upon the system broadly claimed by patent No. 495,443. In the suit but three claims of the former patent, to wit, the 11th, 12th and 13th, were involved. These claims are as follows:

11. In an electric railway, the combination of a car, an overhead conductor, a standard on the car, a rotating support thereon, an inclined contact carrying an arm hinged upon said support and a tension spring secured so as to rotate with the support and acting upon the said arm for holding the contact device in position.

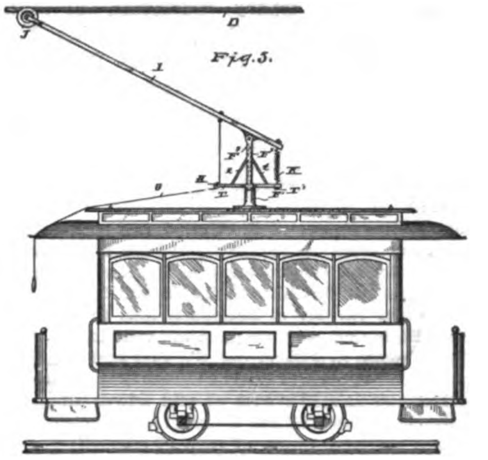


FIG. 2.—THE INVALIDATED VAN DEPOELE TROLLEY PATENT.

12. In an electric railway the combination with a car of a standard on a car, a rotating support thereon, an arm hinged upon said support and provided with a grooved or flanged contact device for engaging with a suspended conductor, and a tension spring secured so as to rotate with the support and acting upon the said arm to hold the contact device in position.

13. A reversible contact device for an electric railway vehicle, consisting of a standard, a rotating support thereon, a contact carrying arm hinged upon said support, and a tension spring secured so as to rotate with the support and acting upon the contact-carrying arm for holding the contact device in position.

The construction and arrangement of a trolley constructed under the specifications of patent No. 495,383 is shown in Fig. 2.

In defence it was claimed that both patents had been anticipated by several prior American and British inventors, among whom were Daft, Sprague, Wesson, Fitzgerald, Parish & Munn, Heald, Smith, and others.

Patent No. 495,443 was asserted to be void because the same invention was disclosed in previous patents to Van Depoele. The answer to the defence denied that any of the patents issued prior to No. 495,383 covered the essential features of the patents in suit. It was claimed that there was nothing in the state of the art at the time patents Nos. 495,383 and 495,443 were issued that would suggest the invention embodied in these patents.

Judge Townsend's decision is a voluminous one, covering twenty-five closely typewritten pages. Patent No. 495,443 is broadly sustained, the judicial conclusion being thus tersely expressed: "Utility is conceded. Infringement is proved." In substance the decision declares that patent No. 495,383 is invalid for want of practicability. It is therefore ordered that "a decree be entered for an injunction and accounting as to the claims in patent No. 495.443, and dismissing the bill as to patent No. 495.383."

An appeal from Judge Townsend's decision will be taken.

A suit involving practically the same patents is now awaiting decision in the United States Circuit Court for the Southern District of New York, the evidence having been presented and arguments made some weeks ago. The litigants in this case are the same as in the New Haven case, although the title of the suit is Thomson-Houston Electric Company vs. the Elmira & Horseheads Electric Railway Company.

The "New Books" department of the December *Review of Reviews* is crowded by the holiday publications, but contains brief reviews of the best literature of the season. The department is fully illustrated.

Lamp Litigation.

ANOTHER INJUNCTION GRANTED.

Patents Out of Date and a Decision of No Value.

There was filed in the Circuit Court of the United States for the Southern District of New York, in the Second Circuit, on the 3d inst., a decree by Justice E. Henry Lacombe granting a perpetual injunction to the Edison Electric Light Company and the Edison General Electric Company, restraining the Bryan-Marsh Company, 136 Liberty street, New York, from infringing Letters Patents Nos. 242,896 and 353,883, for improvements in incandescent lamps. The following is a full text of the decree :

It is, on motion of Dyer & Driscoll, complainants' solicitors herein, Cochran & Tomlinson, defendant's solicitors herein, consenting, ordered, adjudged and decreed as follows :

That Letters Patent of the United States, No. 249,896, granted and issued on the 14th day of June, 1881, to Thomas A. Edison for an Improvement in Electric Lamps ; and Letters Patent of the United States No. 353,783, granted and issued on the 7th day of December, 1886, to the Edison Electric Light Company, are good and valid in law.

That Thomas A. Edison was the first and original inventor and discoverer of each of the said improvements as described and claimed in each of said letters patents and that the complainant Edison Electric Light Company is the sole and exclusive owner of each of said letters patents aforesaid, and that the complainant Edison General Electric Company is the sole and exclusive licensee manufacturer under said letters patents.

That the said Bryan-Marsh Company, defendant herein, has infringed upon each of said letters patents, and upon the exclusive rights of the complainants under the same, by manufacturing, using and selling incandescent electric lamps embodying and containing the inventions and improvements set forth in each of said letters patents and recited in the claims thereof.

And it being agreed by the parties that reference to a Master be waived, and that the profits and damages to be recovered by the complainants of the defendant herein be assessed at the sum of one dollar, it is further ordered, adjudged and decreed that the complainants recover of the defendant the sum of one dollar as damages and profits for said infringement and that execution issue therefor.

And it is also further ordered, adjudged and decreed that a perpetual injunction be issued in this suit against the said defendant, restraining it and its attorneys, solicitors, servants, agents and workmen, and each of them, from directly or indirectly making or causing to be made, or using or causing to be used, or vending to others to be used, any incandescent electric lamps made in accordance with or embodying or containing any of the inventions or improvements described and claimed in said letters patents or either of them, or from in any way infringing said letters patents or either of them of the rights of the complainants under the same.

E. H. LACOMBE,
U. S. Circuit Judge.

New York, November 29, 1895.

It is hereby agreed that the above decree shall be entered in the above entitled cause.

DYER & DRISCOLL,
Complainants' Solicitors.
COCHRAN & TOMLINSON,
Defendant's Solicitors.

The specifications and drawings of the patents in suit are here presented :

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY

INCANDESCENT ELECTRIC LAMP.

Specification forming part of Letters Patent No. 242,896, dated June 14, 1881.

Application filed December 15, 1880. (No model.)

To all whom it may concern :

Be it known that I, Thomas A. Edison, of Menlo Park, in the County of Middlesex and State of New Jersey, have invented a new and useful Improvement in Incandescent Electric Lamps (Case No. 269) ; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

In the use of that class of incandescent electric lamps in which the carbon consists of a filament bent into a horseshoe shape and having its ends secured in clamps, difficulty is sometimes experienced from the carbon bending and falling over.

The object of my invention is to obviate this difficulty by constructing a device which will hold the carbon in an upright position ; and to this end my invention consists in employing a supporter made of glass or other insulating material, having a support at its upper end, by which the carbon loop is held erect.

In the accompanying drawings, Figures 1, 2, and 3 are front views of different forms of my device ; Fig. 4, an edge view of one form, and Fig. 5 a view of a carbon which may be used.

1 2 are the wires passing through the glass N and terminating in the clamps *b*. In each of these clamps is inserted one end of the carbon A A, which is bent into a loop. The glass N is continued upward in the form of a long stem, B, as in Figs. 2 and 3, which has attached to its end a suitable device for holding the carbon erect.

Fig. 1.

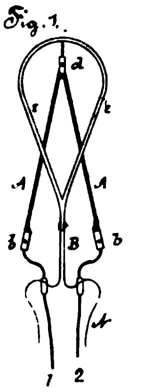


Fig. 2.

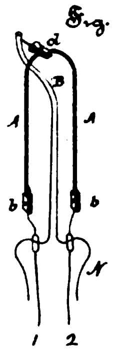


Fig. 5.

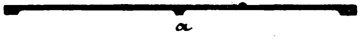


Fig. 4.

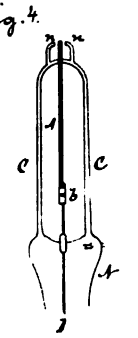
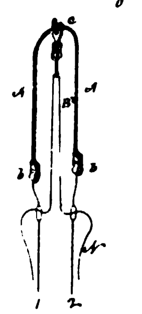


Fig. 3.



In the form shown in Fig. 2 a projection extends out laterally from near the top of the stem B, and carries the clamp *d*, made of platinum or other suitable metal not easily affected by the current, in which is inserted the loop of the carbon A A at the point *a*. With such construction it is preferable to construct the carbon with an enlarged part, as shown at *a*, Fig. 5, in order to give a larger bearing-surface for the clamp *d*.

In Fig. 3 the stem B is shorter and is not bent, and the projection extends directly upward from its top. The clamp at the end of this projection holds the Y-shaped piece *c*, preferably of platinum, between the prongs o which the carbon loop passes, and is thus kept from falling over sidewise.

In the form shown in Fig. 4 a loop of glass, C C, extends upward, being placed at right angles with the carbon loop. The projections *n n*, extending upward from the glass loop, are arranged one on each side of the carbon, and so keep it from bending or falling. In Fig. 1 the carbon is differently formed, extending up from the clamps in straight lines meeting at *d*. The stem of glass B extends up between the carbons a short distance, and then branches off into a loop, *e e*, which passes around above the point of junction of the carbons, and directly above this point a glass stem projects downward, having on its end the clamp *a*, which holds the ends of the carbons.

What I claim is—

1. The combination, with the incandescing loop of an electric lamp, of a support arranged to maintain the carbon loop in its normal position.

2. The supporting-neck in which the wires leading to the loop are sealed, provided with an arm for maintaining the loop in its normal position, substantially as set forth.

This specification signed and witnessed this 3d day of December, 1880.

THOS. A. EDISON.

Witnesses :
H. W. SEELY,
S. D. MOTT.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY, ASSIGNOR TO THE EDISON ELECTRIC LIGHT COMPANY, OF NEW YORK, N. Y.

INCANDESCENT ELECTRIC LAMP.

Specification forming part of Letters Patent No. 353,783, dated December 7, 1886.

Application filed November 9, 1882. Serial No. 76,381. (No model.)

To all whom it may concern :

Be it known that I, Thomas A. Edison, of Menlo Park, in the County of Middlesex and State of New Jersey, have invented a new and useful Improvement in Incandescing Electric Lamps (Case No. 512) of which the following is a specification.

In the manufacture of incandescing electric lamps it may be sometimes desired to construct a lamp of exceedingly high resistance. A convenient way of doing this is to take a considerable length of very fine fiber—such as flax, ramie, or similar vegetable material—and coil or loop it into a compact shape and then carbonize it, the material forming upon carbonization an exceedingly fine flexible filament of carbon. The coils or loops are of course at some distance apart. In a lamp of this kind it is desirable that intermediate supports should be provided for the coils or loops between the leading-in wires, as otherwise such coils or loops would bend and get out of shape and perhaps touch each other.

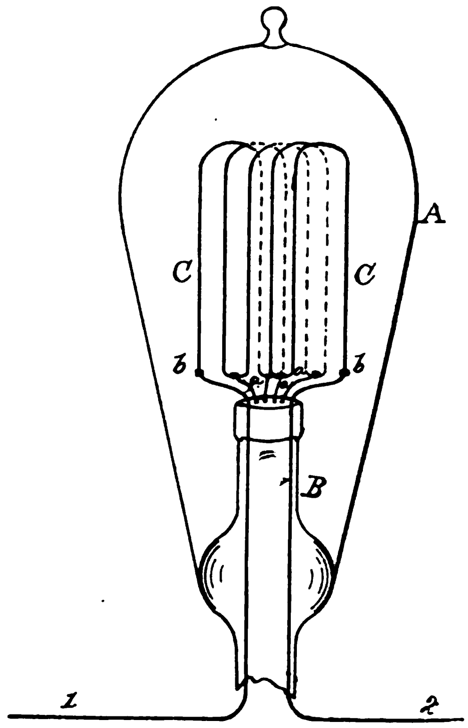
My invention therefore consists in providing intermediate supports for the coils or loops of the fine flexible carbon filament made as described.

My invention is preferably carried out by attaching to the lower portion of each coil or loop, preferably by the electro-deposition of copper, a wire the other end of which is sealed in the glass of the inner stem or wire support of the lamp.

My invention is illustrated in the accompanying drawing, wherein A is the inclosing globe of an incandescing electric lamp, and B the inner stem or wire support.

C C is the incandescing conductor, consisting of a fine filament of flexible carbon bent into a number of loops, as shown ; or the filament might be coiled into compact shape, if desired. The radiating surface and resistance of the filament are so proportioned that the entire filament will give the candle-power desired. Each loop has electroplated to it a wire, *a*, the other end of which is sealed in the glass of stem B, whereby all the loops are supported. The ends *b* and *b* of the filament are electroplated or otherwise attached to the leading-in wires 1 2.

Instead of the arrangement shown, a number of loops or coils of flexible carbon may be electroplated or otherwise attached together in series, intermediate supports being provided, as before.



What I claim is—

1. The coiled or looped carbon filament of an incandescent electric lamp provided with intermediate supports for the coils or loops, substantially as set forth.

2. In an incandescent electric lamp, the combination, with the coiled or looped carbon filament, of a number of wires attached to the coils or loops and all sealed in the glass stem of the lamp, substantially as set forth.

3. In an incandescing electric lamp, the long and fine flexible carbon filament made in one piece, in combination with leading-in wires connected to the ends of the same, and intermediate supports, substantially as set forth.

This specification signed and witnessed this 3d day of November, 1882.

THOMAS A. EDISON.

Witnesses :
H. W. SEELY,
EDWARD H. PYATT.

Telephone Litigation.

Stanley S. Stout, attorney for the Western Telephone Construction Company, Chicago, has brought suit against the Strowger Automatic Telephone Exchange of Illinois for $25,000 damages growing out of the failure of the switches installed at Chariton, Ia., La Grange, Ill., and other places.

THE INEFFICIENCY OF THE DIRECT METHODS OF CONVERTING HEAT INTO ELECTRICAL ENERGY.[*]—II.

BY LEON LE PONTOIS.

THE PYRO-MAGNETIC GENERATOR MOTOR.

It has long been known that iron remains magnetic at red heat, above which point it somewhat suddenly ceases to be magnetic and remains at a higher temperature non-magnetic. This important fact was discovered by that pioneer in electricity and magnetism, Dr. Gilbert. He first showed that a loadstone and a piece of iron equally lost their power of affecting the magnetic needle when heated very hot, and noticed that the magnetic property returned to the iron after it had cooled a little, but that the natural magnetism of the permanent magnet is altogether destroyed. Faraday was the first to discover that there was a critical temperature at which steel magnets lose their magnetism, this temperature varying according to the hardness and structure of steel. This phenomenon has been investigated by quite a number of distinguished electricians, such as Prof. Elihu Thomson, Dr. Hopkinson, and experiments made on different samples of iron, steel and nickel have established the most remarkable fact that at a temperature of 770° C. the magnetization of iron is 11,000 times as great as that of substances which we are accustomed to consider as non-magnetic. A; a temperature of 785° iron is practically non-magnetic, that is, presents an extremely high magnetic reluctance. It seems that the effect of rise of temperature is to diminish the maximum magnetization of which the body is capable—slowly at first, rapidly at the end. It also very greatly diminishes the coercive force and increases the facility with which the body is magnetized. The critical temperature at which magnetism disappears changes rapidly with the composition of steel. For very soft charcoal iron wire the critical temperature is as high as 880° C.; for hard Whitworth steel it is 690° C. This curious property of iron has been utilized in the construction of apparatus for converting, directly, heat into electricity or motive power.

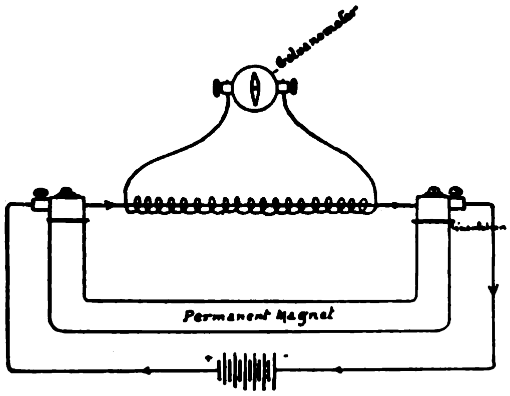


FIG. 3.—GORE'S THERMO-MAGNETIC INDUCTOR.

As far back as 1868 Dr. Gore brought before the Royal Society of London an apparatus in which the principle of the thermo-magnetic generator is fully exemplified. A straight wire of soft iron was placed in the field of a permanent magnet so as to better the magnetic circuit. The wire was fastened by its extremities to two binding posts connected to a circuit including a contact breaker and a battery. A coil of fine wire connected to a galvanometer was wound on a thin glass tube surrounding the iron wire. On sending the current of the battery through the iron wire the latter was heated, its magnetic reluctance increased thereby, and the number of lines of force threading through the coil being altered, current was induced in the coil as shown by the deflection of the galvanometer needle.

On disconnecting the battery, thereby cooling the iron wire, a reversed direction of induced current was produced. No induced current occurred by heating the iron wire if the magnet was absent, nor was any induced current obtained if the magnet was present and wire of copper or german-silver were heated to redness instead of iron wire. It is evident, therefore, that the variation in the magnetic reluctance of the iron wire was the cause of the phenomenon.

In 1879 Prof. E. J. Houston and Elihu Thomson devised a very curious thermo-magnetic motor. This motor, though devoid of practical value, is of sufficient scientific interest to warrant a description. A ring of thin steel was mounted on an axis, so as to be quite free to move, the edge of the wheel being placed opposite the poles of a magnet. The ring being placed at an equal distance from both poles, the lines of force distribute themselves symmetrically on each side of the ring, and the magnetic reluctance of the circuit is minimum under the existing conditions.

If, when the disk is heated at one of the extremities of the diameter, A A^1—B B^1, at the exttemity A, for instance, the reluctance of the heated part of the ring increases, a lateral pull is exerted on the axis, but no rotation takes place, because the resultant of the force exerted by the magnet on the disk passes by the center of the latter.

If, now, the heat is applied at some points 45 degrees apart from A or A^1 the field tends to rotate the ring about its axis in order to allow of an even distribution of the lines of force through the iron, corresponding to a minimum magnetic reluctance. If the source of heat be kept at the same place, and if the disk is thin enough to cool up rapidly, it can be readily seen that the distribution of the lines of force will be constantly modified and that permanent rotation will result of the constant tendency of the field to keep down its reluctance. By means of this little motor mechanical energy is directly obtained from heat, but its efficiency is vanishingly small, for reasons that we will show later on.

In a paper in 1887 before the American Society for the Advancement of Science, Thomas A. Edison described the principle and mode of action of his new machine for converting heat into electricity. The pyro-magnetic generator (such was the name given by Edison to his invention) excited great expectation at first, but in despite of the great inventive ability of the greatest of modern inventors, the efficiency of this machine has never, as far as I know, exceeded 2 per cent.

The pyro-magnetic generator is based on a principle quite similar to the thermo-magnetic motor of Prof. Thomson, but while the latter is a mere toy, the former is a very ingeniously designed machine from a scientific as well as from an engineering point of view. Indeed the pyro-magnetic generator could not be much improved upon—and the reasons for its efficiency do not lie in an imperfect application of the principle discovered by Gilbert, but in the fact that all apparatus based on similar principles are bound to be inefficient ipso facto.

The pyro-magnetic generator motor has many points of resemblance with the ordinary dynamo—in fact it is a dynamotor, provided with an armature looking somewhat like a squirrel cage, rotating in a magnetic field. The armature consists of eight hollow iron cores, constructed of corrugated sheet-iron covered with asbestos and wound with wire. These are held in place by two circular plates, through the center of which runs a shaft carrying at its lower extremity a semi-circular shield of fire-clay, called a guard-plate, which covers the ends of four of the armatures. The field is made of wrought-iron pole pieces, bent in a U, between the lips of which the iron cores are rotated. The shaft carries a cylinder of insulating material, having metallic contact pieces let into it on opposite sides, the line joining them being parallel to the straight edge of the guard-plate. Upon this cylinder eight springs press, each spring being connected to the end of one of the armature coils. The springs are so adjusted that each of them comes into contact with its metallic segment just as the preceding coil of the pair to which it is connected is uncovered by the rotation of the guard-plate. Upon the same shaft and above the cylinder just mentioned a pair of metallic rings are placed, insulated from the shaft, to each of which one of the metallic segments is connected. Brushes pressing upon these rings take off the current produced by the generator. The entire machine is placed upon the top of a furnace, fed by a blast, so that the products of the combustion are forced up through the interstitial cores which are not covered by the guard-plate, and raise them to a high temperature. On rotating this plate the cores are successively uncovered on the one side and covered on the other, so that continually during the motion the magnetic reluctance of four of the coils increases, while the magnetic reluctance of the other four decreases—hence the armature is constantly rotated; and the variations in the number of lines of force threading through the coils varying according to the reluctance of the cores on which they are wound, alternating currents are set up in the moving coils, and they are rectified by the commutator.

In a paper read before the Franklin Institute some years ago Dr. Carl Hering pointed out, with his well-known ability, some of the causes on account of which the efficiency of the pyro-magnetic generator is so low.

A study of the principles involved in this machine shows us that there is a practical limit to the E. M. F that can be induced with a given field magnet. The E. M. F. is, as you know, proportional to two factors—the magnetic induction, or the number of lines of force which is theoretically unlimited, since the field magnets can be made of any size, and the speed at which the armature cuts the lines of force.

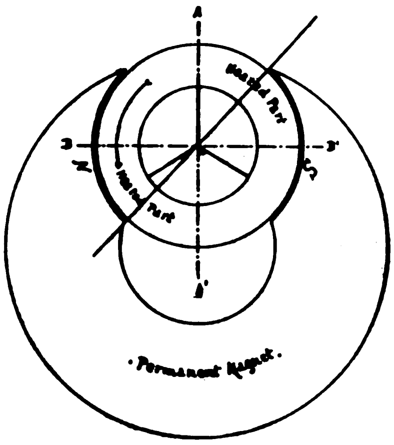


FIG. 4.—HOUSTON'S THERMO-MAGNETIC MOTOR.

In the case of an ordinary dynamo, this speed can be as high as wanted, but in the case of the pyro-magnetic generator this factor depends essentially on the speed at which the magnetic reluctance of the iron can be modified by heat. Edison has found by experiment that 120 heatings per minute are about the fastest rate at which these changes can take place. This means that the lines of force of the field can be cut 240 times per minute, while in a dynamo running at the moderate speed of 1,200 revolutions they are cut 2,400 times per minute. This means that for a given weight of wire on the armature the field magnet should be ten times as powerful as in an ordinary dynamo. Hence the pyro-magnetic generator must be quite large in comparison with the ordinary dynamo.

Another bad feature of this machine is that the iron cores which are to be heated and cooled so rapidly must be made of very thin metal, and as they have to be brought to a high temperature in order to modify their reluctance, it is evident that a rapid oxidation and disintegration of the metal takes place which would seriously affect the life of these parts of the machine. Both of these features are not, however, an insurmountable obstacle, and affect but very little the efficiency of the machine.

As in all heat engines, the efficiency of this motor depends upon the temperature difference in working

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[*] Paper read before the Engineers' Society of Western Pennsylvania.

—the rate of temperature variation—and upon the proximity to the points of maximum effect.

No advantage will be gained by raising the temperature of the heated portion above the point at which its magnetic reluctance is maximum, or practically zero, nor on the other hand would it be advantageous to cool the part between the screens below the point where its magnetic reluctance is practically a minimum. In order to get the best results the difference of temperature working should not be greater than 15 degrees Centigrade.

The efficiency of the pyro-magnetic generator motor should not be lower than the efficiency of an ordinary dynamo motor, if we consider it as an electric generator—but the reason for its inefficiency as a whole must be attributed to the fact that it is nothing else than an ordinary dynamo directly driven by a very inefficient heat engine. If we consider that the specific heat of magnetized iron is greater than that of unmagnetized. it follows that the difference is evidently that which may be converted into motive power.

We have seen that the best range of working is between the temperatures of 785 degrees Centigrade and 770 degrees—if we apply to the case the formula of Carnot $\frac{To-T_1}{To}$ equals efficiency, we obtain 1.9 per cent. as *theoretical efficiency*. If it were possible to limit the heating and cooling in such a way that the greater part of the heat actually consumed could be the difference in *specific heats*, then the efficiency of the machine might be increased, but this is obviously impossible.

As early as 1885 Berliner obtained alternating currents from a stationary coil wound upon a hollow iron core, which was part of a magnetic circuit, the heat of a furnace or a cold blast of air that was successively sent through the core causing variations in its reluctance, and thereby currents were induced in the coil. Tesla has made numerous experiments in the same field, causing small iron armatures to oscillate in front of magnets. In some cases he obtained direct rotation, but these experiments are of secondary interest, because they had already been made long before him by Gore, Thomson, Cooper, Berliner.

Tesla's thermo-magnetic generator is practically based on the same principle as Berliner's, but differs from the latter by details of construction which improve greatly the plant efficiency of the machine. Besides, the products of the combustion, after having heated the iron, are directed under a small boiler placed on the top of the apparatus, and the steam generated is sent through the tubes instead of an air blast. The use of steam as a cooling device is original, and in a certain measure effective, for it diminishes considerably the oxidation of the iron tubes, and thereby increases the life of the machine. However, the efficiency of this thermo-magnetic generator is not superior to the efficiency of the pyro-magnetic generator, because both apparatus, being based on the same principle, work between the same limits of temperature, and are ipso facto inefficient.

From the unsuccessful experiments made in this fascinating field by distinguished inventors and scientists, we may conclude that it is not very likely that electricity will ever be obtained, efficiently, from heat. By the word "electricity" I have reference to those long ether waves by means of which we manufacture light and transmit energy to great distances over wires. A time may come when the beautiful system of lighting and power transmission by means of currents of high potential and frequency devised by Nikola Tesla, will be as practical as it is efficient; then we might succeed in obtaining the considerably shorter electric waves used in that system direct from heat. This is, however, a dream of the future that may never be realized—and while we are confronted with the necessity of obtaining electricity as economically and simply as possible, it seems to me that the commercial solution most promising of success is to improve the gas engine, and harness it to the highly efficient alternating current dynamo.

WATER POWER—ITS GENERATION AND TRANSMISSION.*

BY SAMUEL WEBBER.

The engineers who have been for many years engaged in the question of water-supply for large cities have laid it down as an established fact that, by means of proper and complete storage basins, one-half the annual rainfall may be thus saved, the other half being either absorbed by vegetation or dissipated by evaporation.

This amount has been usually estimated for our Northern cities at 1,000,000 gallons per day from each square mile of drainage area, or one-half an annual rainfall of 42 inches, which is a fair average for the larger part of the United States, east of Kansas and Nebraska, rising, according to Blodgett, as high as 50 and 55 inches, in parts of the southwestern States, but a safe estimate for the area of drainages from the great Appalachian range, which is as wide an area as we propose to consider in this paper.

It will be readily seen that this annual rainfall of 42 inches amounts to nearly 732,000,000 gallons on a square mile, so that 1,000,000 gallons per day is almost exactly half of it. To secure this half, however, requires the most complete and perfect system of storage basins possible, and it is not safe to calculate on such an amount as being available for water power by any possible and economical means of storage.

It is possible, however, by practicable means of storage, to secure about one-third of the rainfall, and as water for power purposes is usually measured in cubic feet per minute, or per second, instead of gallons, we will now adopt this mode of computation.

An annual rainfall of 42 inches is equal to 267,409 cubic feet per day on a square mile, or 3.09 cubic feet per second, and if we take one-third of this, or 1 cubic foot per second, from each square mile of drainage area, we arrive at the supply which can usually, by the aid of storage, be relied upon.

The late James B. Francis, for many years the engineer of the Locks and Canals Company at Lowell, on the Merrimac River, once gave me the following data as the result of many years' observation of the flow of the Merrimac River, which, however, does not take in the few days of "spring freshets," when the snow is going off from the mountains, and the river so high and swollen as to be practically unmeasurable:

	Cu. ft. per min. per sq. mile.
Spring flow	90
"June flow," about the average	55
Minimum flow in Aug. and Sept	30

The minimum flow has, however, been less than that once or twice in recent years, as, in 1881, it was only 26.7 cubic feet per square mile drainage area, or .445 cubic feet per second. This diminution has been due to the destruction of the forests around the head-waters of the river, and such forest destruction must be borne in mind by every engineer as a probability when making estimates on a projected water-power.

It will be seen that this 30 cubic feet per minute, or 0.50 cubic feet per second, the minimum flow, is but one-sixth of the rainfall, and in order to secure the one-third, which I have considered as available, a sufficient "pondage" must be secured above the dam, at the proposed water-power, or in some other convenient location, to store the night flow, if the water is used in the daytime, or vice versa, so as to get a double quantity during working hours without too much diminution of the working head.

This is practically accomplished at Lowell, where the observations on the water-power of the Merrimac River have been longer continued and are more complete than any others of which I am aware, by the pond made by the dam. This pond is 18 miles long, with an average width of 500 feet. The drainage area of the Merrimac, above Lowell, is 4,093 square miles, and if we take the minimum flow as 0.50 cubic feet per second, we have a total flow of 2,000 cubic feet per second.

Col. James Francis, who has succeeded his father as agent and engineer of the Locks and Canals Company, informs me that, with 3 feet of "flashboards" on the dam, giving a fall of 34 feet, they can store in this pond, at a depth of 1.50 feet, 71,874.000 cubic feet of water, which, if drawn down the 18 inches in 10 hours, would give them 6,165 horsepower, which, added to the daily flow of the same 2,000 cubic feet, would give at low water a total of 12,330 horse-power. The original estimate of the power available at Lowell was 10,000 horse-power on 30 feet fall; but by raising the dam above, and removing obstructions below, this power has been increased. as shown.

The net effect of the present turbines in Lowell is here taken at 80 per cent. There are, however, in place at Lowell turbines enough to utilize 20,000 horse-power, for which water is furnished for a portion of the year, but which have to be supplemented by steam-engines, to supply the deficiency, when the water is reduced to a minimum flow, as above quoted.

In addition to this, the mills at Lowell, Lawrence and Manchester, N. H., have also derived great benefit from the use of the water stored in Lakes Winnepesaukee and Winnesquam, in New Hampshire, where the outlets were deepened, and weirs and gates put in below, enabling the water-power companies to draw down these lakes in the summer to a depth of 12 feet below the full height in spring, or 6 feet below their normal summer level. The area of these lakes above the Lake Company's dam is 71.8 square miles; and Col. Francis gives me the following data of the amount of water furnished by them for several consecutive years:

Year.	Horse-power furnished for 3 months.	Depth drawn at lake.
1878	659	4.20 feet.
1879	809	5.16 "
1880	1,299	8.28 "
1881	1,600	10.20 "
1882	1,506	9.60 "
1883	282	1.80 "
1884	1,845	11.76 "
1885	69	0.44 "
1886	1,067	6.80 "
1887	0	0 "

The variation in seasons is seen to be considerable.

Leaving this branch of the subject, with the repetition of the statement that, by storage, one-third of the rainfall can be relied on for power for day or night, I now take the question of turbines.

The modern turbine is the evolution of ages from two distinct types, one of which delivers the water in a tangential direction to radial arms or vanes, projecting from a central shaft, without confining it in any way; the other conveyed it in a closed tube to hollow radial arms, through which it passed, and, leaving them in a tangential direction, gave, by the reaction pressure, a rotary motion to the whole apparatus.

We can trace both systems back to such remote antiquity that it is useless to attempt to find the origin; and as the principal developments of both have been made within the present century, we need go back no farther. As we shall devote much less time to the second of these types, or the "outward discharge," we shall consider it first, and simply refer to the well-known "Barker Mill," or the "Whitelaw & Sterret," sometimes called the "Archimedian" wheel, as the first modern type of this style.

In 1827, Mr. Fourneyron applied this principle of the outward discharge from a pipe to a wheel with curved buckets placed outside of the apertures of discharge, so as to receive the water in a direction perpendicular to the first and inner element of the curve, which appears to be practically cycloidal, and which, revolving from the action of the water, finally discharged it at its outer element at the circumference, with its force exhausted; i. e., the best results obtained from this form of turbine were shown by Mr. Francis, in his "Hydraulic Experiments," to be when the circumference of the wheel *at the point* of discharge had reached the velocity due to the water under the fall, or 62 per cent. of the *theoretical* velocity due the head, from the action of gravity, this being the result of what is known as the "contracted vein." At this velocity of the wheel the water falls away dead into the pit, to take a new direction due to the fall in the "tail-race."

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* Abstract of Paper read before the American Society of Mechanical Engineers, December, 1895.

In the Fourneyron turbine, the tube, or feeder, which supplied the water, was closed at the bottom by a concave cone surrounding the wheel shaft, which passed up through it in a pipe, and was not exposed to the water. This cone was surrounded by a number of guide plates, curved like the buckets, but in the opposite direction, and fastened to the cone; and these delivered the water to the buckets in the proper tangential direction. This first turbine of 1827 was followed by another, in 1834, of 7 or 8 horse-power, which worked at times under a head of only 9 inches.

Then came several others, under higher heads, of 63, 79, 126, and 144 feet respectively, giving from 71 to 87 per cent. net effect of the power of the water.

In 1837 came the celebrated one of St. Blasien, 20 inches in diameter, weighing 105 pounds, under a head of 72 feet, and this was followed by one of 13 inches diameter, under a head of 354 feet. The width of this wheel across the buckets was only 0.225 inches, and it made 2,200 to 2,300 revolutions per minute. It is said to have driven 8,000 cotton spindles, with the other accessory machinery, which would require from 100 to 120 horse-power, and to have given from 80 to 85 per cent. net effect. The apertures of the buckets were so small, however, that the water was all filtered before entering the feeder, to avoid clogging them.

The success of these wheels led to their introduction to this country by the late Uriah A. Boyden, who placed the first ones in Lowell, in 1844, and these were rapidly followed by others, until their use became almost general in the large manufacturing towns of New England. Those built under Mr. Boyden's instructions gave as high as 80 per cent. net effect, and he claimed to have got 88 per cent. at the Atlantic Mills in Lawrence.

Their manufacture was taken up by a number of builders, but they did not all obtain such high results, and owing to the multitude of buckets, with the small apertures, they were liable to become choked by chips and leaves and other floating obstructions, not to speak of fish—for at Fall River the first turbines are said to have been stopped by eels, on their annual migrations to the sea, from Watuppa Lake.

The net effect at partial gate was also very poor, owing to cutting off the water by the sharp edge of a cylinder, as shown by the writer in a paper presented to this Society, and included in Volume III of the Transactions.*

Attempts have been made to obviate this by introducing diaphragms in the buckets, so that only a part of the bucket is affected by this sharp cut-off, and this is shown in the Swiss turbines now being introduced at Niagara Falls, but this division only reduces the dimensions of the apertures, and renders them more liable to choke from obstructions. This form of wheel, as built by Mr. Boyden, was also enormously expensive, and they have generally given place, as they wore out, in forty or more years' use, to the "inward and downward flow" turbine, which we shall now proceed to trace. This, as we said in the outset, comes from the old "flutter-wheel" of radial vanes inserted in a central shaft, which supported a grindstone, or "millstone," on top of it, and which is one of the earliest traces of mechanical application of force to be found in history. India, Egypt, Syria and Europe all appear to have used this primitive water-wheel to grind their corn. It is impossible to determine when the modifications of this form began, but, in 1804, a patent signed by Thomas Jefferson was granted to Benjamin Tyler, of Lebanon, N. H., for "an improvement in water-wheels" in which he claimed "hooping the wheel with iron hoops," and specified the proper angle at which to set the buckets, "made of winding timber."

Similar improvements were early made in the mountainous districts of France, where metal buckets, curved either vertically or horizontally, were bolted to a central shaft, and were known either as "*rouets a cuve*," or "*rouets volants*," and in common parlance with us were known as "tub-wheels." The water was applied to all these wheels "tangentially," by a trunk or spout which delivered it at the circumference. Next, this trunk was made in the form of an Archimedian screw, which applied the water equally all around the wheel, the top being closed, and the discharge at the bottom. A wheel of this sort was patented by John Tyler, grandson of "Benjamin," above referred to, in 1855. I have no record of the dates of the European improvements in this direction, but, as early as 1843, Elwood Morris, of Philaldelphia, experimented with and reported on what is generally known as the "Jonval turbine," in which the radial buckets are curved vertically, and the water directed to them by a set of stationary guides, curved in the opposite direction, and fixed to the interior of the tube or feeder which supplied the water. This form of wheel has also been known as the "Koechlin" and as the "Froment" turbine; the name of "Jonval," I believe, only applies properly to the "draught tube" arrangement, which was patented in this country by Zebulon and Amasa Parker, of Licking, O., in 1840.

These wheels were sometimes, in cases of low heads, set directly in the bottom of the wooden flume or forebay, in other cases supplied by an iron feeder pipe. The Froment turbine, which the writer saw in the London "Crystal Palace" of 1851 was of the former character, and the gates were a series of "plungers," which fitted down between the guides. J. P. Collins, of Norwich, Conn., has adopted this form of gate; others, as Mr. Geyelin, of Philadelphia, have used what is known as the register gate, a term derived from the common hot-air heating apparatus. Still another form has been a sliding telescopic tube, outside, which throttles the water after leaving the wheel, and seems to the writer objectionable, but has been applied to the turbines at Niagara.

This class of wheels, known as the "downward flow," has proved effective and economical, and they are particularly suited for large and constant powers at low heads, but are deficient at partial gate, if the gate is of the register or telescope pattern. The writer has obtained 84 per cent. net effect with two "Geyelin" turbines, in different localities, when at "full gate."

We must now turn to a different form of wheel, the "inward flow," patented in 1838 by Samuel B. Howd, of Geneva, N. Y. In this the action of the Fourneyron wheel is reversed, and the converging guides, which were straight, were placed outside the wheel, which had curved buckets, revolving inside the guides, and was, in fact, only one form of the old "tub wheel." Mr. Francis has stated (see "Hydraulic Experiments") that a similar wheel was suggested by General Poncelet, in 1826.

In the Howd wheel, the regulating gates were placed outside the guides or "chutes." The buckets were cast iron, fastened by bolts to wooded top and base plates, and the discharge was central.

In 1849 Mr. Francis took this matter up, and built, for the Boott Mills in Lowell, an inward discharge wheel, in which he employed the carefully designed curves of the "Boyden" wheel, and which gave excellent results, nearly equal to those of the outward discharge.

This type of inward discharge gave much greater facilities for operating the gates, and was followed by a number of variations, notably the "American Turbine," of Stout, Mills & Temple, of Dayton, O., in which the form of gate adopted gave much better results than were obtained when partially closed, by the cylinder between the guides and buckets, which Mr. Francis copied from Mr. Boyden. This wheel at the Boott Mills lasted until 1875, when it was replaced by a "Swain wheel." In 1855, A. M. Swain, a mechanic who had been employed at the Lowell machine-shop in the construction of the Boyden and Francis wheels, conceived an idea which produced the prototype and exemplar of all the modern American turbines. He combined the inward and downward flow wheels, curving the buckets both laterally and vertically, and discharging the water mainly downward, where a reversed curve in the base on which the wheel rested threw it outward again, so that the path of the water was a semicircle. He adopted a form of gate which, instead of cutting off the water abruptly, closed the orifice by which it entered the wheel, by lifting the lower side of the tube, so as to contract the passage, which still retained a rounded aperture. The result produced by this was marvellous; instead of 30 per cent. effect at part gate, or half water, he got 66 per cent., and 83.4 per cent. at full gate, when the wheel was finally perfected in 1875.

The Swain wheel had, however, given excellent result as far back as 1862, and from that date down to about 1878 the number of turbines was legion, in all sorts of variations of curve of bucket and form of gate, but all containing the same general features of inward and downward discharge. Of these, the Leffel wheel combined both forms of bucket, separated by a diaphragm in the same wheel, and has given excellent effects.

The general result of this change from the Fourneyron type, as first introduced, has been to furnish the public with turbines of equal power, in one-half the space and at one-fifth the cost, being single castings of iron or bronze, instead of built up of many parts. The general line of evolution, beginning with the Swain wheel, has been that of fewer and deeper buckets, with wider openings to avoid obstruction by floating matter, and in some of the wheels like the Hercules the narrow openings of the "chutes" have been retained, preventing such matter from entering the wheel itself.

This latter wheel brings us to the date of 1876, when what is known as the "new departure" wheels were introduced. The first of these was the "Hercules," designed by John B. McCormick, of Brookville, Pa., who brought it to the Holyoke testing flume to be tried, and the results were such that the Holyoke Machine Company at once entered into its manufacture.

The principal feature of this wheel was a much smaller diameter, with longer buckets and deeper openings, for any proposed amount of power.

This wheel was at once followed by the "Victor," made by Stilwell & Bierce, of Dayton, O., on the same general lines, but differing in form of bucket and gate; and many of the older wheels have been since changed or improved in the same direction, and the following table will show the difference in quantity of water used and power obtained by a number of wheels of nearly the same diameter, under the same head of 26 feet, beginning with the "Boyden Fourneyron," and ending with the "Victor":

	Inches Diameter.	Cubic feet Water per sec.	Horse Power.
Boyden Fourneyron	36	22.95	55
Risdon	36	35.45	89
Risdon "L. C."	36	48.27	121
Risdon "D. C."	36	80	199
Leffel, Standard	35	40.45	96
Leffel, Special	35	60	148
Tyler	36	40.7	95.8
Swain	36	58.2	140
Hunt, "Swain bucket"	36	48.8	121
Hunt, New Style	36	96	239.74
Leffel, "Samson"	35	109.1	264
"Hercules"	36	107.6	253.5
Victor	35	108.8	266

This enormous difference in productive effect in wheels of the same diameter shows the great economy of the later type of turbines, particularly as all the wheels above named have a *proved* efficiency of 80 per cent., and some of them have given more; such as 87 per cent. for the Risdon, tested by Mr. Edward

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* Efficiency of Turbines as Affected by Form of Gate. Vol. III, p. 84, No. 61.

Sawyer, of Boston, at Crompton, R. I., and by the writer at the Centennial; 87 per cent. for the Hercules, tested by Professor Thurston; 84 per cent. for the Collins, by the same authority; 84 per cent. nearly for the Swain, by Mr. Francis; 84 per cent. for the Geyelin and the Hunt, tested by the writer, and 88 per cent. for a 15-inch "Victor," by the same, but this was so small a wheel that the test cannot be depended on. Later tests of large wheels at the Holyoke flume give over 80 per cent., and to these may be added the "Success" of E. Morgan Smith, York, Pa., and the "Humphrey," Keene, N. H., and the wheel of Gates Curtis of Ogdensburg, N. Y., also the "New American" of the Dayton Globe Iron Works, Dayton, O. Here all questions of selection must be governed by other reasons than that of mere efficiency, as all the above seventeen wheels have been proved to give 80 per cent. or over net effect. Nearly all these wheels have been adapted to horizontal shafts, for high heads, where the belt pulleys can be kept out of water, and so far as they have been tested show no difference in economy from that given on vertical shafts. A "Hunt" wheel, tested by Mr. Francis, *in situ*, in a mill at Lowell, only varied a fraction of 1 per cent. on a horizontal shaft from the result obtained on a vertical one by Mr. Herschel at the testing flume in Holyoke.

While the writer has expressed a preference for the "downward flow" wheel when the head was low and bevel gears necessary, he would prefer the new type of small diameter wheels for horizontal shafts under high heads, as they give a greater initial velocity to the shafting, the friction of bevel gears is avoided, and if set in pairs, to thrust against each other, step friction, which is very destructive in muddy streams, is also done away with.

The first instance in which turbines were placed in pairs in this manner, in the writer's memory, was in 1875, when A. M. Swain installed a pair at Ticonderoga, N. Y., which were very successful. Since then all the prominent wheel builders have adopted it, and it has become very general in all cases where the head was sufficient to keep the pulleys out of water. It also gives the advantage of easy and immediate access to the wheel for examination or repairs, by a manhole in the case, if the head-gates to the feeders are closed. The writer installed a pair of Risdon turbines for the Nashua Manufacturing Company in this way some time since, and, asking the man who had charge of them, after two years' use, "if anything had been required to be done to them?" he answered, "Nothing but to oil the stuffing-boxes, and open and shut the gates." Like all other water-wheels, the turbine is somewhat slow in answering to regulation under a variable load, as it takes more time to open and close the gates than it does to trip the "cut-off" in a Corliss engine, but the "Snow" and "Schofield" governors are very effective, and can be recommended.

Among the other points mentioned in the schedule is the testing of turbines "*in situ*," and in regard to this the writer would say that a few points need careful attention. The friction pulley should be flanged, to keep the brake in place, and amply strong, and a safe size for it is to allow 1 square foot of surface motion per second for every 3,000 foot-pounds per second lifted; this gives a pressure of a little over 20 pounds per square inch. The brake should be of timber, fitted to the pulley, one-third the circumference on each edge, leaving two openings of one-sixth circumference for lubrication. The best lubricant is strong, thick soapsuds, about the consistency of molasses, and this should be constantly fed from a can or cans in a stream the size of a quill, and may be diluted in use by a jet of cold water from a hose or pipe, played in through the openings, to cool the pulley. The brake lever is most convenient if made the radius of either a 33-foot or a 66-foot circle, that is, practically, 5 feet 3 inches or 10 feet 6 inches long from center of shaft to point of attachment of weight. The whole apparatus should be perfectly balanced at rest before commencing operations.

When we come to the matter of cost, we find it to vary much in different localities, according to the expense of development. The cost at Lowell, when the first "mill powers" were opened, had been only $40 per horse-power for dam, land and canals. This was increased $50 per horse-power by the new canal, which gave more certain head and enabled the mills to use the surplus water which ran to waste part of the year, and the total cost has probably been $100 per horse-power, to which another $100 is to be added for the expensive Boyden wheels and massive masonry pits. At Augusta, Ga., the canals, nine miles long, cost the city, which leases the power, $90 per horse-power. At Columbia, S. C., for five miles of canals the cost to the city has been $72 per horse-power.

In many cases of smaller enterprises it has been less than $50 per horse-power, and the total cost, including wheels and pits, less than $100, and we will now give the data of the cost of water-power as developed within recent years at three different points, showing the outlay, and a fair allowance for interest and running expenses.

The first instance we shall give is that of the Concord Water Power Company, on the Merrimac River, at Concord, N. H. Here the power developed is at a minimum 3,300 horse-power, on an average 5,000 horse-power, from a fall of 22 feet. The wheels are "Rodney Hunt" turbines, set in pairs on horizontal shafts of 400 horse-power each. The cost has been as follows:

700 acres Land, and Flowage Rights	$20,000
Dam and Abutments	141,015
Canal, 60 feet wide	27,363
Head Gates	16,675
Waste Weir	5,220
Making an investment for water of	$210,273

or $63.72 for the minimum amount of power, or $42.05 for the average amount of power. To this is to be added pits and foundations put in for 2,000 horse-power, $15,000, or $7.50 per horse-power; wheels put in for 1,600 horse-power, $12,225, or $7.66 per horse-power; making a total for the minimum flow of water of $78.88 per horse-power, and for the average flow of $57.75 per horse-power.

Now, if we base our calculation of cost on the minimum flow, and allow interest 5 per cent., sinking fund 2½ per cent., repairs 1½ per cent., taxes, etc., 1 per cent., we get a total annual *cost* of 10 per cent., or $7.89 per horse-power, to which add oil and attendance, 75 cents, making $8.64.

As this power is to be transmitted, in part at least, to Concord by electricity, the cost of such transmission, on which I do not assume to be authority, will have to be added to this. If, on the other hand, it is to be partially used near at hand, it is safe to say that the cost of transmission by shafts and belts would not increase it to over $10 per horse-power.

If we assume the average flow of 5,000 horse-power the cost of the power at the wheels would be only $5.72, but we should then require the additional expense of a steam plant, and its operation, to produce the 1,700 horse-power deficiency at low water.

We will now take a large Southern mill, the John P. King, at Augusta, Ga. Here the water is purchased of the city at a rental of $5 per annum per gross horse-power.

The wheels are 3 Geyelin turbines, on vertical shafts with bevel gears, estimated at 1,835.5 gross horse-power. These wheels, by my own test *in situ*, netted 84 per cent. Calling the average 80 per cent., it gives 1,468 net horse-power. This cost of plant was for wheelpits, 42 feet deep, in rock, head race, 200 by 40, tail race, 800 feet to river, about $25,000, and the wheels and jackshaft cost the same, or $50,000 in all. This, for 1,468 net horse-power, is $34.20 per horse-power, or, at 10 per cent., $3.42; water rent, $5.50 on 1,835.5 gross horse-power, equal, net, $6.88; attendance and oil, 75 cents; making a total cost of $11.05.

The next case is also a Southern one, that of the Columbia Mills, at Columbia, S. C. Here the water is also leased at a rental of $5 per horse-power. For quantities less than 500 horse-power, the charge is $7. The fall is 27 feet, and the power is furnished by Victor turbines, on horizontal shafts, and is transmitted by electricity to the mills.

Quicksands made the wheelpits very expensive, by the quantity of concrete masonry required. so that for all expenses of pits, races, power-house, etc., we have $55,000 for 2,000 horse-power. The wheels cost $20,000 more, so that we have a total expenditure of $75,000 for 2,000 horse-power, or $37.50 per horse-power. This, at 10 per cent., as before, gives $3.75 per horse-power; water rent, $5 per horse-power; attendance and oil, 75 cents; making a cost at wheels of $9.50 per horse-power.

As the water rent paid in the last two cases covers interest and depreciation, while the cities which furnish the water also obtain their own supply for other purposes, it will be seen that it covers the cost, and that the estimate of Mr. Samuel Batchelder, fifty years ago, that the cost of water-power in Lowell, including land, was under $15 per annum per horse-power, was substantially correct, and will cover the cost of water-power with modern turbines, under fair circumstances, to-day, with plenty of room to spare for heating.

The Storage Battery.*

A DISCUSSION OF ITS APPLICATIONS BY THE MEMBERS OF THE A. I. E. E.

PRACTICAL EXPERIENCE WITH STORAGE BATTERIES IN CENTRAL STATIONS.

BY C. L. EDGAR.

Mr. Edgar's paper dealt mainly with the experience of the Edison Electric Illuminating Company of Boston in the use of storage battery as a central station adjunct. In his discussion of the subject he made the following classification of the uses to which the storage battery may be applied in central station work: To carry the peak of the load at maximum hours; to carry the entire load at minimum hours; to act as an equalizer or reservoir, and for the equipment of annex stations.

In carrying the peak of the load, Mr. Edgar summarized the experience of his company as follows:

"We have found that if we divide our maximum load of the year into two parts the upper half exists only for about two hours under ordinary circumstances, and four hours under exceptional circumstances for the five winter months. Computing the kilowatts in these two halves, we find that the lower half contains 90 per cent. of the K. W. hours manufactured, whereas the upper half contains only about 10 per cent. This would prove the position taken by some engineers that if an extremely large station was to be constructed it would probably pay to equip it with two types of apparatus—50 per cent. to be of the best economy and most expensive class known to the art. This to do the 90 per cent. of the work. The other 50 per cent. to consist of crude, cheap, uneconomic but reliable apparatus, to do the 10 per cent of the work. The saving in interest on the lesser investment in the second class would be much greater than the extra cost of running this half, due to its poor economy.

"In our particular case we find ourselves in precisely this position. Our company installed in years past about 4,000 H. P. of high speed, belted, bipolar apparatus, reliable, but of poor economy. Some three years ago it changed to the other extreme and commenced to equip with the highest priced and most economical apparatus to be found in the market, and to-day there is about 4,000 H. P. of this apparatus in use.

"Ninety per cent. of our kilowatts have been manufactured by the vertical, triple expansion, multipolar units, and yet the total capacity of this apparatus is not over 50 per cent. of our maximum output for the winter.

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*Abstracts of communications read at the 101st Meeting of the American Institute of Electrical Engineers, New York and Chicago, November 20, 1895.

"The application of the storage battery to these conditions is obvious. What we need, and what all companies under generally like circumstances need, is a piece of apparatus capable of doing two hours' work per day which is cheap, and which has fair economy. If storage batteries could be used under no other circumstances than these, it is, perhaps, somewhat doubtful whether it would pay to install them, but yet I am inclined to think that considering their first cost and the efficiency which we can obtain from them, it could be fairly proved that it would pay to use them rather than what I have designated as the cheap type of apparatus.

"At the time our first battery was purchased, our standard unit was 650 H. P. We therefore called for a battery of 650 H. P. capacity for two hours. We eventually, under stress of circumstances, reduced this to one and a half hours and found that it cost considerably less than a first-class steam plant.

"As all apparatus has to be installed for the express purpose of taking care of the maximum load, it seemed to us very clear that if we could save in our first investment by installing storage batteries which cost less than a steam plant, we were going to be able to do a given amount of work with a less amount of capital by this means than by any other. We thus decided to install a battery to take care of the peak even if we obtained no other advantage from it.

"I think that the nature of the load curve in America is against the use of batteries to carry the entire load at minimum hours to anything like the same extent as abroad. With us there is only about six hours of minimum load, whereas, owing to the lack of motor business in Europe, the minimum there extends some days from midnight until three o'clock in the afternoon.

"Our generating department has gone through some exhaustive experiments, running first the engines for 24 hours a day, charging the battery at minimum load, and then turning around the next week and shutting down the steam plant for the six hours from midnight until six o'clock in the morning, and depending entirely upon the battery. The general conclusion seems to have been arrived at that the former is the cheaper method. Admitting this, the indirect advantages of the former, by which the battery is charged during the night, and can be used during the following day, are very much greater than if the battery were discharged during the night, as it could not be completely charged again until the middle of the afternoon of the following day. I do not consider our conclusions final, as the local conditions might materially change the result.

"It is the use of the battery as an equalizer or a reservoir with which we have been particularly pleased. In order to understand, it is perhaps desirable to explain the needs which a modern station has for apparatus of this kind. Years ago a distribution company was equipped with one station, furnishing electricity through a system of feeders, supplied from one 'bus bar. All this is changed. To-day the modern station manufactures electricity in various places, transfers it from one station to the other at will, sends it out through a system of distribution at three or four pressures supplied from 'bus bars of varying potential. At the minimum hours of the day the electricity is manufactured by one set of dynamos, part of it being delivered to the 'bus bar in the station in which the dynamos are located, the remainder being sent out over tie lines to various annex stations and delivered there to the local 'bus bar.

"The fluctuations of load on central and annex stations are everyday occurrences, and if we were not equipped with a battery, it would be almost an hourly question as to what it was necessary to do next, whether to start dynamos, stop them, change boosters or any other of the innumerable combinations which might be made. In a very large degree the battery answers all these questions or at least makes them unimportant. It makes it possible to determine beforehand what the regular day's work of the steam plant is to be, to decide how many and at what time boilers are to be put in service, when engines are to be started or stopped, and in general to operate the plant to its best economy, knowing that daily or hourly inequalities in the load, or uncertainties caused by the weather will be taken care of by the battery. It is kept in multiple with one or the other or all 'buses at all times. It is supposed, for many hours of the day, to be standing idle with the ampere meter at zero, but it may, without a moment's warning, be called upon to either give or take anywhere from one to 3,000 amperes on a side. It is possible in this way theoretically to keep every engine which is running loaded up to its maximum economy at all times. Having satisfied ourselves in the beginning that with a given amount of capital we could do more work with the battery than without it, we by actual practice came to the conclusion that we could by the same means do this same amount of work more cheaply. When we remember that we installed the battery for the express purpose of taking care of the maximum load, we are, of course, particularly pleased at the very great use we can make of it for this purpose of equalization, and yet, in addition to this we have made enough tests to prove to our own satisfaction that we do not lose anything in fuel economy by this particular use of the battery. The watts lost by the inefficiency of the battery are made up more than fourfold by the better economy of the steam plant. We have taken typical winter days and figured out exactly the cost of running our system with the battery and without, and have proved that the actual coal consumed with the battery is a material amount less than without it. If, in addition to the fuel, we take into account the very great saving in the labor, the added reliability and the better service given, we will see that these uses of the battery are even greater than those for which it was originally installed.

"I do not think it is possible to overestimate the advantages of storage batteries for the purpose of giving regularity and reliability to a system of distribution. With very sudden fluctuations in the load, which are continually taking place, it is almost impossible with dynamos alone to regulate the 'bus pressure so quickly that the pressure throughout the system remains constant. The uses of the battery very much simplify this problem. Very many times where in the past it was necessary to change the magnetism of the fields of dynamos, it is now necessary to do absolutely nothing, the battery acting as a reservoir, giving out quantities of current without any apparent change in pressure for the time being.

"This question of regularity is very closely connected with the one of reliability. To those of us who are identified with central station work, there is a great sense of security when we realize that whatever may happen to the steam plant we have sufficient battery to carry us over a few minutes of disorder. In our particular case, we have at the present time sufficient battery to run 60,000 lamps for five, ten or fifteen minutes, depending upon how great is the emergency. This advantage of the battery may not appeal to an outsider. I do not think they can realize the intense nervous strain to which all connected with the successful detail operation of the station are subjected. If a battery and a steam plant were on a par in all other respects than this, I should personally feel very much inclined to install it for this reason alone."

In the Boston station there has yet been no occasion to make use of the battery in the equipment of annex stations. Of this use Mr. Edgar said:

"When we realize that it makes very little difference to which end of a tie line a storage battery is connected, we can see at once the special advantage which this type of apparatus gives us. If of such value that it will pay to install them, it is a matter more or less immaterial whether they are installed at the main station or at an annex station connected to the main station by tie lines. The fixed charges of running a battery room are very small as compared with those of a steam station, and there would not be any very material increase of fixed expense between one large battery located in a central point and a half dozen small ones distributed throughout the city.

"Storage batteries, therefore, lend themselves particularly to the location of a 'central' station at some convenient point upon the water front, and the building up of small centers of distribution scattered throughout the city, consisting of storage batteries with or without a steam adjunct and connected together possibly, but certainly each one connected to the central station.

"Our company has used the first battery 20 months, and one of double its capacity for six months, entirely too short a time to come to any conclusion about the depreciation, but it has given us ample time to satisfy ourselves as to the economic value. It is sufficient for me to say that if a need should arise to-morrow for additional capacity, either at our main station, at either of the annexes or in any new part of the city, within reasonable distance of our center of distribution, we should consider the question along the lines which I have just indicated. We should eliminate entirely from the discussion the question which has distracted the public mind for so many years and decide it entirely upon its merits, placing the battery side by side and on an equality with other modern and improved apparatus."

Gold Medals for the Westinghouse Company.

(From the Atlanta Constitution.)

The Westinghouse Electric and Manufacturing Company of Pittsburg, Pa., has come off with flying colors at the Exposition. This well-known and extensive concern was awarded two gold medals by the Exposition board of highest awards. One medal was awarded for photographs, plans and descriptions of the two-phase generating plant recently installed at Niagara Falls. The other medal was awarded for induction motors and dynamos illustrating the two-phase alternating system for the transmission of power.

These awards were a recognition of the company's high standing in the electrical world and of the precedence it has always had as manufacturers of electrical supplies.

The full significance of this victory by the Westinghouse Company will be understood when it is stated that only five gold medals were awarded in the Electrical Building, and of these five, two were given to the Westinghouse Company.

The exhibit of this company has attracted considerable attention and much favorable comment ever since the opening of the Exposition, and the awards of the board will meet with universal indorsement so far as the decision made in favor of the Westinghouse Company is concerned.

Electricity, especially in the way of lighting, has made generous sanitary contributions which deserve appreciation. Dr. Saunders, the medical officer of the London Board of Health, says the electric light in general use has accomplished a great deal in making the employees of commercial and manufacturing establishments healthier. Faces that were pale and wan from work in gas-lighted basements, stores and shops are much improved since the introduction of electricity. The heat from the gas jets and poor ventilation are responsible for much sickness. It is also shown that in the same city the electric light has lessened crime. Darkness breeds wickedness and light dispels it.

A real Indian chief emerges this month in the field of periodical literature. Simon Po-ka-gon, of the Pottawattomies, contributes to the *Review of Reviews* a brief statement of his views about the Indian Territory "Squaw Men" and the question of Indian reservations. His article is sententious and direct and withal not lacking in the picturesque phraseology of the Indian's language.

LEGAL NOTES.

Vice Chancellor Reed has granted an injunction restraining the Union Traction Company of Newark, N. J., from collecting any debts or transferring any stock, and will appoint a receiver to take charge of the company's assets. The company was organized only a year ago, and capitalized at $1,500,000, but it now goes into the hands of a receiver for a debt of $166.66 due Luther Shafer, of Rutherford, for office rent.

At the instance of the General Electric Company of New York, an execution has been issued against the Carbondale Traction Company, of Carbondale, Pa., for $2,760.24, and another for the same amount against the Lackawanna Valley Rapid Transit Company.

The Circuit Court has ordered a sale in equity of the Buchanan Electric Light and Power Company of Buchanan, Mich. The sale is fixed for January 17, 1896. The water power included in the property is derived from a dam 400 feet across the St. Joseph River, with a fall of 12 feet, giving a power estimated from 2,500 to 4,000 horse power. The company was organized and incorporated April 14, 1893, and capitalized at $100,000, but lack of financial support, together with unprecedented hard times has forced them to give up the fight, after spending, according to the statement of the company's officers, the sum of $125 000. Among the franchises is one for lighting the village for ten years at $50 per lamp, also one for the erection of a dam five miles lower down the St. Joseph River.

Wm. L. Dayton, ex-Minister to The Hague, has been appointed receiver of the Asbury Park and Belmar Street Railway Company. The road runs from the Ocean Grove gates to Shark River, Belmar, N. J.

The Elgin (Ill.) Electric Illuminating Company has been notified by the General Electric Company that it is infringing on the latter's patent by using the bridge circuit around a single dynamo and transferring switch.

The Mutual Electric Light and Power Company of Brainard, Ill., has made an assignment to Randall W. Burns. The assets of the company are about $25.000; liabilities a like amount.

An important suit is now on trial in the Supreme Judicial Court of Massachusetts. The style of the action is Mary B. Howe et al. vs. the West End Street Railway, and the issue involves the question of electrolysis, damages for which the plaintiffs have received no restitution. It is held that while the act of 1887 gives the railroad a right to operate by the electric system, there was no provision in that act allowing the abutters to receive compensation for injury to their property. The suit will in fact determine the constitutionality of this law.

PERSONAL.

Among our out of town visitors this week have been Messrs. C. J. Mayer and F. A. Estep, of the Nuttall Company, Allegheny, Pa.; E. L. Babcock, Falls Rivet Machine Company, Cuyahoga Falls, O.; John Dick, Phœnix Iron Works, Meadville, Pa.; J E. Keelyn, President Western Telephone Construction Company, Chicago; J. H. Rhotehamel, President Columbia Incandescent Lamp Company, St. Louis, and Morgan Brooks, President Electrical Engineering Company, Minneapolis, Minn. Messrs. Dick and Brooks were attendants at the annual meeting of the American Society of Mechanical Engineers.

New York Electrical Society.

A meeting of the New York Electrical Society will be held at the "Marble Church," 29th street and Fifth avenue, New York City, on Thursday, December 12, at 8 P. M., when Mr. George G. Wacker, the well-known organ builder, will deliver a lecture accompanied by instrumental illustrations on the subject of "Electricity in Organ Playing." Mr. Wacker will be assisted by Mr. R. T. Percy, the organist of the church, who will play the illustrative selections and also one or two pieces, including the overture from "William Tell," which will demonstrate the perfection attained, through the aid of electricity, in performing on separate and distant instruments from one keyboard.

OBITUARY.

Thomas McCoubray.

Thomas McCoubray, who died December 5, 1895, was born in the District of Columbia, May 20, 1847, of Scotch-Irish stock on both sides. His early life was spent in Baltimore, Md. He graduated from Baltimore City College. He became a prominent member of the Free and Accepted Masons; was five times elected Master of St. John's Lodge, twice elected High Priest of St. John's Chapter, and Eminent Commander of Baltimore Commandery No. 2, Knights Templar. He served as Grand Inspector for one term; was one of the organizers and the first Grand Potentate of Boumi Temple, A. A. O. N. M. S.; was a thirty-third degree Mason of the A. A. Scottish Rite, having held offices in each of the bodies, and was secretary of the board of relief.

At one time Mr. McCoubray was secretary of the National Electric Light Association, and subsequently held several positions of trust in the commercial department of electrical enterprises. Of late he gave his attention to invention and developed the auto-telephone system.

Association of American Manufacturers.

The annual meeting and banquet of the above Association was held at the Grand Central Palace, this city, on the evening of December 5. The object of this Association is to increase the international trade of American manufacturers in various lines.

The officers of the Association are as follows: G. Martin Brill, president, Philadelphia; F. E. Myers, Vice-President, Ashland, Ohio; Lucius S. Bigelow, Secretary, Harrisburg, Pa.; J. Horace McFarland, Treasurer, Harrisburg, Pa. Executive Committee: D. R. Morse, Chairman, New York; H. W. Anderson, Harrisburg, Pa.; E. J. Pearson, Hartford, Conn.; F. P. Williams, Brooklyn, N. Y.; F. H. Cutler, Buffalo, N. Y.; H. J. Heinz, Pittsburg, Pa.; J. A. Jeffrey, Columbus, Ohio.

St. Louis Electrical Men Eat and—Talk.

The fourth annual banquet of the St. Louis Electrical Club was held on the 7th inst., Capt. Robert McCulloch acting as both chairman and toastmaster. Col. Ed. Meier, C. E. Randall, Walter Flower, Capt. O. J. Schultz, Prof. F. Nipher, of Washington University, and H. A. Wagner spoke on various topics allied to electrical interests and on the recent assistance given by electricity to the other sciences.

The Next N. E. L. A. Convention.

The Executive Committee of the National Electric Light Association has formally selected Tuesday, Wednesday and Thursday, May 5, 6 and 7, 1896, as the time and the New York Industrial Building, described in ELECTRICITY last week, as the place for holding the next or Nineteenth Convention.

Second Annual Ball.

The associated employees of the firm of Zimdars & Hunt. 127 Fifth avenue, New York. will hold their second annual ball in the Central Opera House, on 67th street. on Monday evening, December 16. The ball room has been appropriately decorated for the occasion with special electrical designs.

Henry Electrical Club.

Prof. Francis B. Crocker will deliver a lecture on "Methods of Driving Dynamos" at the Henry Electrical Club, American Institute Rooms, on Friday evening, December 13.

Thomas M. Kenna, of New Haven, Conn., has devised a mechanism to obviate the jolting of electric cars and pounding of the rail joints. The device is a simple one and consists of four small auxiliary wheels two on each side of the car and located between the wheels proper. With them a car will run smoothly over all deflections in the rails and passengers will escape the jar occasioned when the wheels meet the ends of rails.

GENERAL NEWS.

What is Going On in the Electrical World.

Arcadia, Wis.—The Milling Company has decided to put in an electric plant to light the streets and business places.

Baraboo, Wis.—The flouring mill of J. G. Heaton was destroyed by fire recently; an electric light plant in the mill was ruined.

Hull, Mass.—At a special town meeting held a few days ago, the sum of $5,000 was voted for additions to the electric light plant.

Key West, Fla.—Work on the electric railway here will soon begin. An expenditure of $125,000 will be made in building and equipping the road.

Holyoke, Mass.—The Hadley Thread Company has decided to run a part of its plant by electricity, and the contract has been awarded for the plant.

Bath, N. Y.—The Albany, Greenbush and Bath Railway Company has applied to the trustees for a franchise to run its cars in the streets of this village.

Birmingham, Mich.—Work has begun here on the Oakland Electric Railway, the promoters of which propose to run their line from Detroit to Pontiac.

Sistersville, W. Va.—The city council has granted a franchise for the establishment of an electric light plant in this city to McGhie & Morse of East Liverpool, Ohio.

Sleepy Eye, Minn.—This place has confirmed the appropriateness of its name by voting against the bond scheme to raise $5,000 to pay for an electric light plant.

Lancaster, O.—H. B. Peters, receiver of the Lancaster street railroad, says the entire franchise will soon be sold to a new company who will improve and operate the road.

Boston, Mass.—The agitation in favor of municipal lighting seems to be increasing in this city, and Brookline and other towns in this neighborhood are discussing the subject.

Crowley, La.—An electric plant has recently been put in operation at the Crowley rice mills and gives great satisfaction. The mills are extensive, having a daily capacity of 3,000 barrels.

Batavia, N. Y—The aldermen have voted to give A. B. Wilgus until August 1, 1896, in which to build and have in operation at least three miles of his electric street railway in Batavia.

Purcell, I. T.—The Purcell Electric Supply Company turned on electric lights in this town on the 3d inst. Purcell is the first place in the Chickasaw Nation to adopt electric lighting.

Vancouver, B. C.—The city council has let a ten-year contract for arc street lighting to the Western Electric Lighting, Heat & Power Company, a branch of the Western Electric Company of Chicago.

Pittsburg, Pa.—The force of workmen at the Westinghouse electric works has been increased, the foundry department having been put on double turn, necessitating the employment of 150 additional men.

Spokane, Wash.—It is probable that the council will authorize the purchase of an electric lighting plant for the power house, head gates and dam at the new waterworks; the board has recommended that course.

Bainbridge, O.—It is understood here that a New York syndicate have had an inspection made of the route of the proposed electric road between this place and Chillicothe, and that the inspector made a favorable report.

Knoxville, Tenn.—The sale of the Park Street line of the Knoxville Electric Street Railway has been confirmed by Judge Clark at Chattanooga to J. E. Chamberlain, the sale having been assigned to him by W. G. McAdoo.

Fairbury, Wis.—The Fairbury Electric Light & Power Company has sold its franchise and plant to the Water Works Company and the two plants will hereafter be under one management. A new power house will be built.

Independence, Mo.—C. W. Baker, a practical electrician of Kansas City, has purchased the electric light plant here and will operate it under the name of the Western Lighting Company. He will furnish the city with lights.

Staten Island, N. Y.—The fight between the Staten Island Electric Railroad Company and the Midland Company over a franchise to run electric cars in certain streets in New Brighton has terminated in the granting of a franchise to the first named company.

Port Jefferson, L. I., N. Y.—The Port Jefferson Electric Light Company has been organized to furnish electric light for this village with a capital stock of $7.500 fully subscribed. The company expects to have the plant in operation within ninety days.

Niagara Falls.—A report is current here that New York capitalists are having surveys made for a new electric road from Echota to Sanborn, thence to North Tonawanda, and from there to Buffalo. The road is intended to carry freight as well as passengers.

Cleveland, O.—December 10 has been set for the opening for traffic of the Cleveland & Elyria electric railroad. Mayor M. H. Levagood, of Elyria, has extended an invitation to the officials of the road and to others to attend a banquet and celebration to commemorate the event.

Waukesha, Wis.—Application has been made to the village board by the Milwaukee & Waukesha Electric Railway Company for a franchise to operate an electric street car system in this village. Should the franchise be granted, work will begin on the road early in the spring.

Berkley, Va.—A corps of engineers has been at work in Princess Anne county in the last few days surveying a route for an electric railroad from Berkley to deep water on the Currituck Sound, and it is reported that the laying of the track will be commenced by the first of the year.

Buffalo, N. Y.—The Niagara Falls Power Company has accepted the amended franchise proffered by the city authorities, the 14th clause, providing for the annulment of the grant on 30 days' notice of failure in carrying out its provisions having been changed to 90 days' notice.

Hoboken, N. J.—An ordinance granting the Jersey City, Hoboken and Rutherford Electric Railway Company a franchise to run cars through First and other streets to the New York ferry has passed its first reading in council. The company offers a lump sum of $20,000 for the franchise.

Columbus, O.—As the present contract for lighting the streets expires in February, bids will be advertised for at once. Specifications made by Director Bliss have already been published. The contract will be for ten years, all night lighting, and underground wires in the business portion of the city.

Topeka, Kan.—Representatives of a Chicago electrical company have been here figuring on the cost of new boilers and dynamos for the city electric light plant, the intention being to extend electric lighting to the suburbs covered by the contract with the Vapor Light Company which expires on the 14th inst.

Watertown, N. Y.—Col. J. A. Lawyer of this city has been appointed receiver of the Watertown & Brownville Railroad Company, on the application of the Central Trust Company of New York as trustee of a $75,000 mortgage against the railroad company. The latter operated all the electric lines in this city and Brownville.

Medford, Mass.—A special commission will investigate the cost, economy of maintenance, advantages and disadvantages of a municipal electric plant, and is to report to the city council all the facts and data secured. The commission is to have the right to employ electrical and engineering experts as they shall deem requisite.

Newark, N. J.—The executive committee of the directors of the Newark Electric Light & Power Company have recommended to the directors that a general reduction be made in arc lighting of about 5 per cent., in incandescent lighting of about 7 per cent., and in the cost of electrically generated power of about 10 per cent.

Brooklyn, N. Y.—The new electric road proposed from the end of the Kings County Elevated to Jamaica and Far Rockaway is expected to be completed by June. The contracts have been awarded and iron has been ordered from Pittsburg. It is proposed to extend the line to Hempstead next year, and thence on to Babylon.

Bloomfield, N. J.—The street-lighting committee of the Bloomfield township committee have advertised for proposals for lighting the streets of the town with arc and incandescent lights. The bids will be opened at the regular meeting of the township committee on the evening of December 16.

Los Angeles, Cal.—A local paper says that one of the finest and most perfectly managed lines of suburban railway in the United States is that of the Pasadena and Pacific line, which connects Los Angeles with adjacent suburban cities and towns. On the west the line reaches the coast, while to the east and north the fertile valley of San Gabriel is traversed.

Norristown, Pa.—Several capitalists are said to be back of the scheme to build a trolley road from Phœnixville to Pottstown, via Royersford and Spring City, and an inspection has lately been made of the route. The prospects are that the road will be built and eventually extended from Phœnixville to Valley Forge and on to this borough.

Ottawa, Ill.—The Ottawa Electric Street Railway, including all real and personal property, has been sold by the receiver, in obedience to an order of the United States Circuit Court at Chicago, to the General Electric Company, the only bidder, for the nominal sum of $7,500. The company, unless the local capitalists take the plant off its hands, will tear it up and remove it from the city.

Warren, O.—It is reported that plans are being made for an electric railway from Warren or Leavittsburg to Ravenna, which would give the Mahoning Valley lines connections with the A. B. C. road, which runs from Akron to Cleveland. If this is done, as it is believed it will be, Cleveland and Pittsburg will soon be joined by electricity, as lines are already arranged for between Youngstown and Beaver Falls.

Roanoke, Va.—This city may be considered one of the most enterprising municipalities in the South. It is lighted by gas and arc and incandescent electric lights. It has fourteen miles of street railway now operated by electricity. It is connected with Salem, seven miles, by electric cars, and Vinton, four mills, by electric cars. The Roanoke river affords first class power for manufacturing purposes.

Long Island City, N. Y.—The announcement is made that a syndicate of Philadelphia capitalists has acquired the entire street railway system and electric lighting plant of this city. There are about sixty miles of trolley road in operation and additional mileage will shortly be completed; besides which the system's electric lighting privileges are quite extensive. It is understood that the deal represented a transaction of nearly $2,000,000.

Vevay, Ind.—The city council has made a contract with Alex. S. Schulman, of Cincinnati, for putting in an electric light plant which is to consist of 40 street arc lights, each of 1,200 candle power, and 800 incandescent lights, each of 16 candle power. The contract requires the plant to be in running order by February 15, 1896, at which time the present contract for the lighting of the streets expires.

Owosso, Mich.—The official name of the new corporation running the motor line between Owosso and Corunna, which is being changed into an electric line, will be the Owosso & Corunna Traction Company. President J. D. H. Ralph states that the change was made to give the business world notice that the new company has no connection with the former company, which has passed into the hands of a receiver.

Westport, Conn.—The Westport & Saugatuck Street Railroad Company has equipped part of its four miles of road with a third rail electric system. An important feature of the new system is that the feed rail only becomes charged as the car passes over it. The feed, or third rail, is located in the center of the other two rails and a circuit to the motor is obtained by means of a trolley underneath the car.

Fort Wayne, Ind.—Within a week the Fort Wayne Electric Corporation has made several important shipments of machinery, among them a 1,000-light alternator to Yoakum, Tex.; 800-light dynamo to Lexington, O.; 125-light Wood arc dynamo to the Manchester Electric Light Company, Manchester, N. H.; a dynamo and fixtures to the University of Wisconsin at Madison, Wis.; a steamboat plant to the Marmet Company at Cincinnati, and a 600-light incandescent to Thompsonville, Mich.

Chicago, Ill.—The General Electric Railway Company of this city has received propositions from the Siemens & Halske Company of America and from the General Electric Company of Schenectady for equipping an underground trolley system in the South Side streets, but holds these propositions in reserve until a trial is made of the Brandenburg system, which the company has definitely decided to use.

Shreveport, La.—Proposals for lighting the city by electricity for a term of five or ten years will be received until December 12. From 50 to 70 arc lights will be required. The contractor must agree to erect and operate within the limits of the city an electric plant sufficient for such public lighting, and also such machinery, appliances and power as may be needed to furnish lighting and power for residential and commercial uses.

Schenectady, N. Y.—The rumors of a threatened strike at the General Electric works seem to have a substantial foundation. At a meeting held lately by the workmen an organization was formed taking in every man who was not already a member of some union, and much dissatisfaction was evinced among those in attendance because of the low wages paid by the company. Some of the workmen say that they have been cut in their wages so that they can hardly earn a living.

Chattanooga, Tenn.—Considerable interest is being manifested as to the sale on December 23 of the Chattanooga electric street railway, because of the uncertainty as to who will control the valuable property after that date. It is learned that a move is on foot among the local people who are concerned in the road to purchase it when sold and make some extensive improvements in the service. One of the contemplated improvements is the extension of the Harrison avenue line.

Fresno, Cal.—The "Exposition" speaks in glowing terms of the approaching completion and opening of the new power line. It says: "On February, 1896, will begin the calendar of a new life for our fair city. Then will disappear the mists of uncertainty and the fair, smiling Goddess of Progress will beckon our people onward into the sunshine of a glorious future. Such will be the transition inaugurated by the transmission of electric power from the San Joaquin river, thirty-three miles distant, to the city, for on that date the first current will be sent from the company's powerhouse to the substation in Fresno, and thence over the network of wires which will then be strung through the city."

Montreal, Can.—Work has been started upon the Napierville Junction Railway, an electric system which is chartered to carry freight and passengers and will run from St. Remi to Stottsville, through the parishes of St. Michel, St. Edward, St. Phillippe, St. Jacques, Douglassburg and Napierville, connecting with the Grand Trunk Railway at Stottsville. The Dominion Government has granted a bonus of $3,200 per mile for the twenty-two miles of the line, while the following municipalities have voted money to assist the enterprise: Napierville, $10,000; St. Edward, $2,500, and St. Remi, $2,000. Hon. J. G. Laviolette, of this city, is president of the company.

New York.—One of the witnesses who appeared before the Assembly Committee on Railroads in this city last week was George J. Gould, president of the Manhattan Elevated Railroad Company, whose knowledge of the financial and practical operation of railroads in general gave interest to the investigation. Among other things Mr. Gould said he considered an elevated road equipped with electricity the best road for rapid transit in a city. —One of the handsomest electrical displays lately added to the attractions of the big dry goods stores in Sixth avenue is that at O'Neill's, where the tops of the towers at both ends of the building are encircled with brilliant zones of electric lights, and over the main entrance of the store the National flag is electrically represented as if waving in the breeze, the undulatory effect being produced by an ingenious transition of light and shadow.

Alexandria, Va.—The Washington, Alexandria and Mt. Vernon Electric Railway Company has awarded the contract for the building of the new cars to the J. G. Brill Company of Philadelphia. The new cars are to be forty feet in length and handsomely fitted up. The seats will be wider and all the conveniences of the steam railway car will be found in them. They are all to be equipped with motors that will give them a guaranteed speed of forty miles an hour, so that they will be able to make the run between the two cities in about fifteen minutes, including stops. A car equipped with one of these motors, is now in the shops of the company in Alexandria, and when tested made a speed of forty-one miles per hour.

St. Louis, Mo.—The "Republic" says: "Within a week the Board of Public Improvements will be ready to submit its ordinance providing for putting electric wires underground. This ordinance is being prepared not on any resolution of the Municipal Assembly, but in compliance with the suggestions given by Mayor Walbridge in his recent message. The ordinance will, as far as practicable, follow the plan outlined by his Honor to have all the wire-using companies of the city join in constructing one general subway in which each company will have separate ducts for their respective wires, the companies to contribute pro rata, according to the space used, for the expense of construction, but the city to have entire supervision of the subway."

Kansas City, Mo.—The Metropolitan Street Railway Company is now perfecting plans for the erection of a mammoth electric power station near Riverview, from which power will be furnished for running all the lines of the company west of Main street, with the exception of the Twelfth and Ninth streets cable lines. The extensive plans of the company contemplate the changing of the motive power of the Fifth street line, and of all the cable lines in Kansas City, Kan., from cable to electricity, and running the whole system, comprising over thirty miles of street railway, from this one immense power house.—A deed from Herman Brumback, special master, conveying to the Metropolitan Street Railway Company the rolling stock, right of way and entire belongings of the Kansas City & Independence Rapid Transit Railway Company, has been filed with the recorder of deeds. The deed is the final transfer of the property, which was sold by order of court on October 19 to satisfy mortgages held by the Central Trust Company of New York. The consideration named in the deed was $600,000.

Baltimore, Md.—A blanket mortgage of $6,000,000 has been placed on the Columbia and Maryland Railway Company to secure the issue of 6,000 bonds of a par value of $1,000 each. The mortgage was placed with the Central Trust Company of New York by Thomas M. Lanahan, the president, and R. Stanley Carswell, the secretary of the railway between Baltimore and Washington which is to be operated by electricity.—The Diamond Ice Company will shortly put into operation at its artificial ice works an apparatus with which to cut ice into cakes by electricity, instead of by steam as at present. It will save labor, reduce waste and make a cleaner cut than the steam saw now in use. The electric saw consists of a simple looking iron bar, backed with asbestos. One of the great advantages of it is the fact that it will not require the constant presence of two men while making its way through the thick and heavy pieces of ice. It is self-operating.

TELEPHONE AND TELEGRAPH.

C. L. Mosley has been granted a telephone franchise in Bedford City, Va.

A telephone company is being organized at Griffin, Ga., on the co-operative plan.

The Southern Bell Company has reduced rates at Mobile, Ala., to $20 and $12 per year.

The Moosehead Lake Telegraph Company will erect a telegraph line from Ashland to Oakland, Me.

W. H. Nixon, general manager of the Nixon Telephone Company, is endeavoring to establish a local exchange at Westerly, R. I.

The ordinance granting rights to the Drawbaugh Telephone Company in Philadelphia has been referred to the city solicitor.

The ordinance granting rights to the Pennsylvania Standard Telephone Company in Philadelphia has been referred to a sub-committee.

The Georgetown, S. C., Telegraph Company has rejected the proposition of Frederick Boon, of New York, to again lease its line for two years.

The projectors of the Rossland Electric Light and Power Company, Rossland, B. C., intend to establish a telegraph line between Northport and Rossland.

Morgan T. James has secured necessary franchise rights from the city council of Youngstown, O., for the construction of his proposed independent telephone exchange.

The Central New York Telephone Company has completed the extension of its long-distance line from Utica to Watertown. The line is 91 miles long and cost upwards of $40,000.

The business men of Medina, N. Y., have organized a co-operative telephone company to supply service at $1 per month, after the first payment of $40 is made to enter the company.

The East Jersey Telephone Company is constructing a branch line in New Brunswick, N. J., to connect with the long-distance line of the New York and New Jersey Telephone & Telegraph Company.

An agreement has been made between the local telephone companies of Merrill and Wausau, Wis., to build a toll line to connect the several cities and towns of the Wisconsin valley at an early date, and thus make them independent of the toll line of the Wisconsin Telephone Company.

The Canadian Pacific Telegraph Company has completed direct connection from Winnipeg to Minneapolis, St. Paul, Duluth, West Superior and all points south. This is the last link completing the comprehensive system of direct telegraphic communication from Central and Northern Canada to all parts of the world.

The Delmarvia Telephone Company, recently organized at Wilmington, Del., has asked for a franchise. The officers of the company are: Joseph L. Carpenter, Jr., president; J. Augustus McCaulley, secretary and treasurer; J. H. Hoffecker, Jr., counsel; Lindley C. Kent, Francis E. Gallagher and Dr. Willard Springer, directors.

The Union Telephone Company of Lake Odessa, Mich., has been absorbed by the Coo.perative Telephone Company. The new company has been organized with a capital stock of $50,000. The line of the company connects with Lansing, where it has over 500 patrons, and is now being extended to Mason. It is the intention of the management to push through to Detroit and Grand Rapids. The officers of the company are: President, Wilson Elliott; vice-president, F. B. Nims; secretary, E. F. Colwell; treasurer, W. J. Percival; general manager, George A. Weed; auditor, J. J. Ross.

New Companies Incorporated.

A charter has been granted to the Harmony Grove and Athens Telephone Company of Harmony Grove, Ga.

The Mutual Telephone Company, Bloomfield, Ill. Capital stock, $1,500. Incorporators: Deane N. Funk, E. D. Funk, Jacob Funk, B. F. Funk.

The Ellsworth and Kanopolis Telephone Company, Ellsworth, Kan. Capital stock, $200. Directors: John S. Judson and C. E. Jennings, of Kanopolis; G. A. Collett, G. L. Levitt and C. W. Flanders, of Ellsworth.

The Kalamazoo Telephone Company, Kalamazoo, Mich. Capital stock, $30,000. The directors are as follows: Charles H. McGurrin, William A. Doyle, Henry F. Hodgman, Charles A. Peck and J. B. Balch.

Articles of incorporation for the Automatic Telephone Company, with a capital of $100,000, to begin business with $500, in New York City, have been filed at Albany. The directors are: Henry M. Whitney, Silas B. Dutcher and James P. Pierce, of Brooklyn; Geo. M. Hard, Ernst Thalman, R. T. Wilson, Jr., and W. E. Chase, of New York City; J. W. Hinkley, of Poughkeepsie, and J. G. Dorrance, of Nyack.

COMMERCIAL PARAGRAPHS.

The Bryan-Marsh Company closed an order this week for 200,000 lamps, which, it is claimed, breaks the record.

The Beacon lamp having grown so much in favor among Canadian users, the Beacon Lamp Company has found it necessary to establish an agency at Montreal. The Royal Electric Company has been commissioned sole agents for the Canadian Provinces.

Gardam & Burchett, mechanicians and electricians, have established an office at 58 Ann street, New York. They will develop inventors' crude ideas, prepare estimates, etc., and manufacture tools and special machinery.

The increase of the Electric Storage Battery Company's business in the West has necessitated more commodious office quarters, which are now provided by a handsome suite on the fifteenth floor of the Marquette Building, Chicago. Mr. C. W. Woodward is the Chicago representative.

It "Got There" With Ease.

Once again the Lundell Motor has gained well merited distinction for its superior qualities. This time it piloted to a successful finish the electric carriage manufactured by Messrs Morris & Salom of Philadelphia, which was entered in the recent motocycle contest held in Chicago. The coveted gold medal was awarded to Messrs. Morris & Salom.

Safety, ease of control, absence of noise, vibration and heat and general excellence of design and workmanship were some of the factors which the Lundell machine had to meet, and did meet successfully.

The Interior Conduit & Insulation Company of New York, who manufacture the Lundell Motors, are again to be congratulated upon this the latest popular recognition of the merits of their machines.

Testing Westinghouse Engines.

In a pamphlet entitled "Something About Westinghouse Engines," recently issued by the Westinghouse Machine Company, an interesting description is given of the methods employed in testing engines before shipment:

"Every engine, from the five horse-power Junior to the seven hundred horse-power Compound, after being assembled, is taken to the testing room and run continuously for several days under full load and with every condition of actual service. From there it is removed to the overhauling floor and taken entirely to pieces. An examination of the piston and valve rings is then made to ascertain if they bear properly all around; the journals and wearing surfaces are inspected to make sure there is no tendency to heat or cut; and a final and exhaustive search is made for defects of any nature. When everything is known to be right the parts are reassembled, all adjustments made permanent and the engine is then ready for jacketing, painting and shipment.

"Inasmuch as the Compound Engine is more particularly the exponent of high economy, we put each individual engine of this class through a complete economy test in addition to the above described running test. All the engines on one side of the testing room are shut down, with the exception of the one under test. The exhaust is turned into the condenser, full load is applied and measured by means of a friction brake, and indicator cards are taken simultaneously.

"The first test is made without vacuum, as good performance is more difficult of attainment under this condition than with vacuum. Occasionally a second test is run under a vacuum maintained by an independent air pump. All the steam used by the engine is condensed, and drains down into the weighing tanks, where it is weighed at regular intervals. The rate per hour being obtained, it is divided by the indicated, and the brake or net horse-power, giving the economic performance in the generally accepted units of measurement. The difference between the indicated and brake horse-power determines the frictional losses in the engine. If the friction loss is excessive, or if the economic performance falls short of our standard, the cause is sought out and removed and the engine retested before it is passed."

INCORPORATIONS.

The Phœnix Electric Company, Phœnix, N. Y.--to make and supply electricity. Capital stock, $15,000. Promoters: E. B. Powell, R. S. Sloan, O. F. Gaylord, Oswego, N. Y.; S. D. Greene, Schenectady, N. Y.

The Long Island Illuminating Company—to supply light and heat in the towns of Flatlands and Jamaica, N. Y. Capital stock, $100,000. Directors: Charles M. Lockwood, of Jamaica, and R. F. Rhodes, J. H. Holmes, Jay S. Jones, and Eugene Seamann, of Brooklyn, N. Y.

The National Electric Carbon and Manufacturing Company, Portland, Me—to manufacture, buy and sell carbon machines and carbons. Capital stock, $500,000. President, William A. Holmes, of Boston, Mass.; treasurer, Charles F. Clark, of Boston, Mass.

The Atlantic City Light, Heat and Power Company, Atlantic City, N. J.—to furnish light, heat and power by means of oil, gas and electricity, etc. Capital stock, $250,000. Promoters: W. E. Findlay, New York City; James R. Merritt, Philadelphia; John M. Kelley, Camden, N. J.

The Bronson Electric Light Company, Bronson, Mich.—to manufacture and sell electricity. Capital stock, $10,000. Promoters: H. P. Mowry, J. S. Sheneman, J. F. Werner, Bronson; Wm. H. Bond, F. C. Rhenbottom, Union City, Mich.

The Upper Alton Water Works, Chicago, Ill.—to construct water works, electric light plants, electric heat, light, and power plants; manufacture and supply light, heat and power. Capital stock, $2,500. Promoters: Geo. C. Morgan, Arthur H. Morgan, Henry A. Gardner.

The Standard Electric Car and Power Company, Portland, Maine—to develop a certain invention for improvements in electrical railways and cars therefor. Capital stock, $500,000. Promoters: Lewis A. Drake, John K. Wightman, Boston, Mass.; Leon O. Dion, Natick, Mass.

The Milner Electro Gravitation Motor Company, Charleston, W. Va.—to manufacture and deal in motive power, machinery and engines of all kinds, etc. Capital stock, $500 minimum, $5,000,000 maximum. Promoters: Wm. E. Conway, Silas H. Berry, James F. Atkinson, Thos. Hanson, Brooklyn, N. Y.

The Flathead Copper Mining Company, Kalispell, Mont. —to engage in manufacturing, mining, agricultural, chemical, electrical, mercantile, commercial and milling business, and reduction of ores, etc. Capital stock, $100,000. Promoters: James A. Coram, Benton D. Hatcher, Frank R. Miles.

The South Sioux City Traction Company, South Sioux City, Neb.—to maintain and operate one or more lines of street railway. Capital stock, $50,000. Promoters: T. L. Eaton, Henry J Taylor, C. A. Benton, D. L. Plumer, E. H. Burgess.

The Central Traction Company, Sioux City, Ia.—to construct improvements in that city, electric light and power plants, street railways, etc., steam power. Capital stock, $500,000. Promoters: Howard S. Baker, C. M. Swan, Geo. P. Morris, Sioux City, Ia.

The Metropolitan Electric and Power Company, Allegan, Mich. Capital stock, $50,000. Incorporators: Frank A. Mackin, Samuel Clark, Frank E. Semon and others.

The Parry Sound Electric Light Company (Limited) at Ottawa, Can. Capital stock, $20,000.

The Woodhaven Electric Light Company, Jamaica, N. Y. Capital stock, $25,000. Directors: J. H. Smith, James Cochran, J. C. Milligan, of Brooklyn, and others.

The stockholders of the Wayne Electric Light Company of Wayne, Pa., have increased the capital stock of the company from $75,000 to $100,000.

The Elmhurst Electric Light and Power Company of Elmhurst, Ill., has certified to an increase in capital stock from $15,000 to $30,000.

The stockholders of the Pontiac and Sylvan Lake Electric Railway Company, of Pontiac, Mich., have decided to issue $10,000 in 21-year bonds to Comstock & Company, the Chicago construction contractors.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

DECEMBER, 1895.

DATE.	LIGHT.	DATE.	EXTING.
1	4.10 A. M.	1	6.00 A. M.
2	No light.	2	No light.
3	"	3	"
4	5.00 P. M.	4	8.00 P. M.
5	5.00 "	5	9.00 "
6	5.00 "	6	10.10 "
7	5.00 "	7	11.30 "
8	5 00 "	9	12.40 A. M.
9	5.00 "	10	1.00 "
10	5 00 "	11	1.50 "
11	5.00 "	12	3.00 "
12	5.00 "	13	4.20 "
13	5.00 "	14	5.30 "
14	5.00 "	15	6.20 "
15	5. 0 "	16	6.20 "
16	5.00 "	17	6.20 "
17	5.00 "	18	6.20 "
18	5.00 "	19	6.20 "
19	5.00 "	20	6.20 "
20	8.00 "	21	6.20 "
21	9.10 "	22	6.20 "
22	10.10 "	23	6.20 "
23	11.00 "	24	6.20 "
24	11.00 "	25	6.20 "
25	...... "	..	....
26	12.10 A.M.	26	6.20 "
27	1.10 "	27	6.20 "
28	2.10 "	28	6.20 "
29	3.20 "	29	6.20 "
30	4.20 "	30	6.20 "
31	No light.	31	No light.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DECEMBER 3, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

550,683. Trolley-Wire Crossing. John C. Kinney, San Antonio, Tex. Filed April 17, 1895.

550,775. Speed-Indicator and Alarm. Franz Blumenstein and Ernest Bobsien, Mount Vernon, N. Y. Filed May 13, 1895.

ELECTRIC LIGHTS AND APPLIANCES.

550,574. Electric-Arc Lamp. Thomas E. Adams, Cleveland, Ohio. Filed March 14, 1895.

550,600. Electric-Arc Lamp. Stefan Doubrava and Josef Donat, Brunn, Austria-Hungary. Filed Feb. 2, 1895.

550,860. Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed Jan. 7, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

550,663. Dynamo-Electric Machine for Plating. William M. Thomas, Chicago, Ill. Filed March 25, 1893.

550,666. Dynamo-Electric Machine. Henry P. White, Kalamazoo, Mich., assignor of three-fourths to Charles D Fuller, same place. Filed Jan. 29, 1895.

550,692. Armature. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Aug. 31, 1895.

550,703. Commutator. Henry P. White, Kalamazoo, Mich., assignor of three-fourths to Charles D. Fuller, same place. Filed Jan. 29, 1895.

550,782. Method of Distributing Electricity to Electric-Lighting Systems. Charles M. Davis, Chicago, Ill. Filed April 14, 1892.

TELEPHONE AND TELEGRAPH APPARATUS.

550,658. Permutation-Selector. Almon B. Strowger, Chicago, Ill. Filed June 14, 1894.

550,728. Automatic Telephone-Exchange System. James G. Smith, New York, N. Y. Filed Feb. 18, 1893.

550,729. Automatic Exchange System. James G. Smith, New York, N. Y. Filed Feb. 20, 1893.

550,765. Signaling Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 16, 1895.

MISCELLANEOUS.

550,577. Electric Switch. Christoph Bach, Jr., Milwaukee, Wis. Filed April 12, 1895.

550,638. Electrical Protective Appliance. Alfred H. McCulloch, Boston, Mass., assignor to the New England Telephone and Telegraph Company, of New York. Filed Sept. 14, 1895.

550,670. Signal-Circuit. John V. Young, Boston, Mass., assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed July 8, 1893.

550,673. Cross-Over Insulator. Frank G. Beron, Waterbury, Conn., assignor of one-half to James F. Gaffney, same place. Filed Feb. 18, 1895. Renewed Oct. 4, 1895.

550,682. Voltmeter, Frank Holden, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Aug. 31, 1895.

550,686. Electric Cigar-Lighter. James F. McLaughlin, Philadelphia, Pa. Filed April 24, 1893.

550,688. Electrotherapeutic Apparatus. Charles Palmleaf, Seattle, Wash. Filed April 1, 1895.

550,733. Electric Safety Device. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. Filed May 19, 1887.

550,743. Adjustable Igniter for Explosive-Engines. Thomas G. Cantrell, San Francisco, Cal. Filed April 8, 1895.

550,812. Holder for Electroplating. Elbert R. Allen, Wallingford, Conn., assignor to Simpson, Hall, Miller & Co., same place. Filed Sept. 30, 1895.

550,822. Self-Winding Electric Clock. Charles M. Crook, Chicago, Ill. Filed March 25, 1895.

550,823. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Filed May 22, 1895.

550,841. Electrical Measuring-Instrument. Herschel C Parker, Brooklyn, N. Y. Filed May 9, 1895.

550,857. Electric Time-Alarm Attachment. Max Wolff, New York, N. Y. Filed July 3, 1895.

550,866. Electric Furnace. Frederic Chaplet, Laval, France. Filed May 29, 1894.

550,868. Automatic Electric Switch for Railways. Robert V. Cheatham, Louisville, Ky. Filed March 7, 1895

ELECTRICITY.

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EDITORIAL NOTES.

Gas Engine Men and Business.

Electricity has from time to time noted, and the correctness of our observations has been confirmed by all who have sought to add to their knowledge of the gas engine business in America, that it is next to impossible to obtain from manufacturers such information as will enable one to compare the performance of the gas engine with any other type of prime mover used in power generating plants. Of electrical publications Electricity was the first, as it has been the only journal, to point out to the at times obtuse, but always over-cautious, gas engine manufacturer the possibilities of the gas engine in the electrical industry. If the experience which has come to us as a result of our labors in the gas-engine-electric missionary field has been discouraging and disgusting, it has been none the less so for one of our contemporaries, to whom the honors of prophecy are quite as fittingly due.

Progressive Age, the zealous champion of the gas interests, profiting not by the lessons Electricity has learned, recently sought to secure information, the publication of which was intended for "the benefit of gas-engine purchasers in general and the gas companies in particular," and the aim of which was to give "the exact status of the gas engine market of the day so far as could be done with the necessary exclusion of all questions of price." The conclusions reached by our contemporary are so interesting that we give them somewhat at length:

> The compilation of the article in question revealed a surprising lack on the part of the gas-engine builders of two important features of equipment for the business. One was any apparent anxiety or desire, excluding individual exceptions, to publish information concerning their engines; and the other was a wofully apparent lack of that information.
>
> The first cannot be explained away by any modest reservation on our part as to the value of publication in these columns, because the insertion was to be free and therefore of unbalanced desirability; while either lack of interest or of data led to a corresponding paucity of information in their regularly distributed circulars. Out of eighty odd makers to whom application was made, less than five took the trouble to point out the desired characteristics of their product, the majority replied with catalogues while a few either openly refused co-operation or let pass unheeded repeated applications enclosing samples of the work in progress. Perhaps the weeding thus accomplished automatically was more perfect than could have been attained by scientific comparison.
>
> The lack of exact knowledge of their own engines, as evidenced by these circulars, is almost without exception. In a great many cases there was barely sufficient idea of the operation, valve-motion, etc., given to enable one to classify the engine properly; any estimate of its probable value was out of the question. The circular usually started off with a disquisition on the desirability of gas-engines in general, and ended with assertion of the superiority in every respect of this one in particular. If statements of fuel consumption were made, they generally took the form of "so and-so per cent. better than any other engine," words which, we blush to explain, are absolutely meaningless, except that to the shrewd buyer they would demonstrate a desire to substitute circumlocution for candid statement. When figures are given they become equally meaningless, because all mention of the conditions of the test—the quality of gas, the size of engine, the character of load, the precautions taken against error, etc., etc.—is omitted. Indicator-cards, though not frequent, never contain the data requisite for proper use, and the further refinements of friction-tests, missed-ignition records, etc., are never thought of. The circulars even rarely contain cross-sections of cylinder or valves, and very few give any adequate idea as to methods of construction, material, etc.

For Electricity to have declared that "the gas engine manufacturer, as a business man, has been unique," may not savor as much of *lese majeste* as for *Progressive Age* to express such an unfavorable opinion of his sagacity, technical knowledge and business competency, but it is quite as near the truth.

* * *

The Wiring Question in England.

A discussion has been inaugurated in electrical circles in England over the relative merits of concentric and conduit wiring for interior work, which, if it serves no other purpose, makes apparent the fact that the champions of the respective systems are agreed as to the faults of the present English practice, but differ as to the methods to be employed in securing a higher standard of work. The discussion had its inception at the recent meeting of the London Institution of Electrical Engineers, when two papers, embodying the views of Mr. Samuel Mavor and Mr. Fred. Bathurst were presented, the former urging the advantages to be gained from the employment of the concentric system, the latter pleading the cause of interior conduit.

As stated, both authors candidly admit that the state of the wiring art in England falls far short of that standard of excellence which engineers and others, uninfluenced by considerations of first cost, have long held, in both England and America, to be essential to the highest degree of safety. In this respect "their strictures," says the London *Electrical Review*, "are not one whit too severe, nor do they even touch the worst examples to be found." Viewed from the local standpoint, or at least as the views are reflected by the London technical press, it would appear that "a warm exchange of opinions," and "an informing debate" will ensue before our English friends have determined which is the safer and better system of interior wiring to be used. It is plainly evident that the question of cost will be an important, if not controlling, factor in this discussion, it being contended for the concentric system that "no consideration except its greater cost could have prevented its general use" while "the great objection to any conduit system is the expense attaching to its adoption."

Interesting as this discussion may be to English electricians, the decision to be eventually reached will have more of interest to electricians in America than will the arguments advanced by the respective advocates. In this country the questions involved in the discussion have long been settled. It is certainly true that to-day there are few, if indeed any, American engineers who would seriously consider, much less advocate, the use of the concentric system for interior wiring. Their conclusions would not be influenced by the question of cost, but rather by the insuperable mechanical difficulties inherent in the system. The interior conduit has solved the problem of efficient, safe and economical wiring here. Without claiming gift of prophecy, we may venture to assert that our English brethren will sooner or later reach the same conclusion.

* * *

Scientific Fiction. With persistent regularity certain of the lay press, whose knowledge of electrical and mechanical science and art is as fearlessly expounded as it is wonderfully conceived, astonish the world and amuse the profession of engineering by an exposition of heretofore unheard-of wonders soon to be accomplished. Unknown sources of power and methods for utilizing them are revealed by these tireless searchers after untruth, with an elaborateness of detail rivalled only by the writings of Jules Verne. Keely, Pennock, Van Choate and other discoverers who have ruthlessly cast aside the limitations of the laws of physical science and accomplished the impossible and improbable, are to these chroniclers of scientific fiction veritable well-springs of joy, if not of inspiration.

To our erudite contemporary, the *Transcript*, of Boston, the scientific world in general, and New York City in particular, must ever be indebted for a solution of a problem which has long perplexed our ablest engineering talent. Reference is here had to the utilization of the wave-power along the water front of this city for purposes of generating electricity, practically without cost, to do "all the mechanical work in the factories and machine shops, and to run all the railroad lines in the city and suburbs." Startling as it may seem, "this power is wasted." But the waste, which has continued for a period antedating even the founding of Boston, or the later birth of the editor of the *Transcript*, is to cease, for "all that is required is to store this immense power, and turn it into profitable use." Just how this "greatest feat of modern engineering" is to be accomplished is thus explained by our New England exchange:

> The problem presented differs somewhat from that of Niagara. The tides are periodic, and not constant, and the power would have to be collected at the times of its greatest exertion and stored for later use. The Niagara people have already proposed to run a line to New York to do what the tides of the Hudson and East rivers would accomplish right at home. Either undertaking is a large one, requiring the expenditure of millions of dollars. But the results would more than justify the outlay. An inexhaustible supply of power from outside would prove a blessing that could hardly be appreciated to-day. The present cumbersome delivery of coal to factories and private houses would be abolished, and a clean, neat, pleasant method substituted. The plant could be located at some convenient place in the suburbs or along the river front, where the city air would not be vitiated and poisoned by coal gases, dust and smoke.
>
> The present outlook is that the Niagara Falls power company will in time run an electrical conduit to New York to supply the motive and lighting power of the city and suburbs, unless some enterprising body of capitalists undertakes to utilize the wasted power of the tides nearer home. A conduit capable of bringing 100,000 to 200,000 horse-power from Niagara would cost more than a four-track steam railway. The investment of a similar amount in collecting and storing the power of the tides in the North and East rivers ought to yield better results.

Engineers may find in the above an absence of detail ordinarily found in a description of gigantic engineering works, but the fact must be borne in mind that the proposed enterprise is not an ordinary one, nor is the originator of it an ordinary person.

* * *

Trolley Progress in Connecticut. The annual reports of the street railways of Connecticut, recently filed, show that the street railway financier and promoter has not been unmindful of his opportunities in the Nutmeg State. That the 147 miles of street railroads in the State have increased to 302 miles within the short space of 33 months, and that the horse has become obsolete for purposes of street-car traction, are of themselves interesting facts. Striking as these evidences of the increasing growth of the industry may be, a study of the financial status of the operating companies is of more absorbing interest.

To the statistically inclined the following tables are commended as providing vast possibilities for purposes of comparison. Incidentally they show the amount of the capital stock of the companies, the amount of stock issued for cash, and the amount of bonds floated and the floating debt:

	Stock issued.	Floating debt.
Middletown St. R. R. Co	$75,000	$6,368
Derby St. R. R. Co	150,000	24,300
Norwalk St. R. R. Co	50,000	......
New Haven & Centerville R.R Co	300,000	9,908
Winchester Avenue R. R. Co	400,000	88,576
New Haven St. R. R. Co	100,000	......
West Shore R. R. Co	50,000	73,339*
Fair Haven & Westville R. R. Co	600,000	120,000
Bridgeport Traction Co	2,000,000	70,000
Bristol & Plainville R. R. Co	100,000	90,000
Central R. R. Co	600,000	13,780
Danbury & Bethel St. R. R. Co.	315,000	.....
Westport & Saugatuck St. Ry. Co	15,000	15,000*
Waterbury Traction Co	600,000	86,028
Stamford St. R. R. Co	92,240	58,517
Hartford St. R. R. Co	200,000	302,000
Meriden Electric R. R. Co	1,000,000	156,518
Norwalk Tram Co	180,000	......
Norwalk St. R. R. Co	50,000	6,000
Hartford, Manchester & Rockville Co	200,000	.....
Hartford & West Hartford R. R. Co.	247,000	120,498
New London St. Ry. Co	150,000	5,000
Norwich St. R. R. Co	250,000	14,000
Southington St. R. R. Co	20,000	1,700
Total	$7,774,240	$1,186,177

* Includes cost of construction and equipment.

	Stock Issued for Cash.	Bonds Issued.
Middletown St. R. R. Co	......	$75,000
Derby St. R. R. Co	$150,000	150,000
Norwalk St. R. R. Co	50,000	110,000
New Haven & Centerville R. R. Co.	......	325,000
Winchester Avenue R. R. Co	......	500,000
New Haven St. R. R. Co	......	850,000
West Shore R. R. Co	50,000	80,000
Fair Haven & Westville R. R. Co	600,000	......
Bridgeport Traction Co	......	1,500,000
Bristol & Plainville R. R. Co	100,000	.....
Central R. R. Co	86,000	533,000
Danbury & Bethel St. R. R. Co	100,000	200,000
Westport & Saugatuck St. Ry. Co.	15,000	......
Waterbury Traction Co	......	600,000
Stamford St. R. R. Co	......	750,000
Hartford St. R. R. Co	200,000	1,344,000
Meriden Electric R. R. Co	80,000	500,000
Norwalk Tram Co	......	200,000
Norwalk St. R. R. Co	50,000	110,000
Hartford, Manchester & Rockville Co	......	90,000
Hartford & West Hartford R.R. Co.	247,000	105,000
New London St. Ry. Co	150,000	110,000
Norwich St. R. R. Co	250,000	265,000
Southington St. R. R. Co	20,000	20,000
Total	$2,048,000	$7,367,000

From these tables it will be observed that by selling $2,048,000 worth of stock for cash, and on the issue of $5,726,240 for construction and other purposes, the Connecticut financiers have been able to bond the street railways of that State to the extent of $7,367,000, while at the same time a floating debt of $1,186,177 has been incurred.

Elaborate calculations are therefore not required to show that the capitalization liabilities of the 24 operating companies aggregate $16,327,177, an average, in round numbers, of $53,000 per mile of track. The actual cost of construction and equipment, as certified by the companies' reports, was $10,550,868, or approximately $35,000 per mile. The capitalization is thus seen to be about $18,000 per mile in excess of the entire cost of the roads.

Beyond this fact it is not necessary to go when seeking to discover why but thirteen of the twenty-four roads paid dividends out of the earnings of the year. Interest on bonds alone cost $238,963. Adding to that the cost of operating expenses, taxes, etc., there remained of $2,098,583 gross earnings only $171,206 for dividends, or a trifle over 2 per cent. on the entire capital stock issued.

Under the Searchlight.

Views and Opinions on Timely Topics.

The Finale at Ottawa.

B. E. Sunny Buys and Will Remove the Ottawa Street Railway.

(From the Free Trader, Ottawa, Ill.)

Saturday afternoon, before a crowd of curious spectators, Al F. Schoch, receiver, offered the real estate and personal property of the Ottawa Electric Street Railway, including its franchise, according to order of the United States Circuit Court directing the sale of the property under the foreclosure of the Mercantile Trust Company's $75,000 mortgage, to the highest bidder for cash, the purchase being subject only to a tax deed of $1,222, the taxes of 1894, for which the road was sold under an agreement last spring. The sole bidder was the General Electric Company, owner of three-fourths of the stock and bonds, which, by its agent, B. E. Sunny, its Western manager, bid $7,500, presumably as a "starter."

Receiver Schoch looked into the faces of the crowd with a half sad, half amused smile and pleaded for a bid of $8,000 but the crowd was silent. Mr. Sunny refrained from raising his bid—no one expected he would do so—and the road was given to the General Electric Company without opposition.

Interviewed by the *Free Trader* Mr. Sunny said:

"The General Electric Company cannot operate this railway at a profit and does not intend to try. If it is not purchased of us before we are ready to dispose of it in our own way, we will tear it up and remove it from the city. We would have done so long ago were it possible."

"When do you expect to do this?"

"Shortly after the court confirms the sale."

Mr. Sunny is the personal mouthpiece of the General Electric Company and its will is expressed through him. Ottawa need expect nothing from him or it for she will receive nothing. The company, according to Mr. Sunny, wished to remove the tracks and machinery from the city when it ceased operating the road but was prevented from so doing by legal obstacles in the shape of claims and bondholders and creditors. He states, as he stated some time ago, that the road can be purchased of his company for $25,000, as the material of which it is constructed, together with the machinery, is worth that amount at second hand.

But, whether or not it is worth $25,000 or $50,000, or 25 or 50 cents, it is unquestionably a stubborn fact that the General Electric Company will not operate it in Ottawa now or at any other time. Whether or not it has committed fatal errors in management does not alter the situation in its eyes—it does not desire to operate—it will not operate.

Subsequently to the sale Receiver Schoch filed a report in the Federal Court, recommending the acceptance of Mr. Sunny's bid.

* * *

The Mayor of Port Huron and the Mayor of Detroit.

Some Fun Anent Pingree's War on Street Railroads.

The following letter has been mailed to all Mayors of Michigan cities by the Hon. N. S. Boynton, Mayor of Port Huron:

My Dear, Good Mayor: I am sure you, as well as myself, realize that the good Mayor of Detroit is having an unprecedented struggle with that octopus, the Citizens' Street Railway Company. We all hope that he will succeed in his determined and undying efforts to secure "eight for a quarter" tickets and put down the street car strike or boycott which is now on in that city.

I am further quite sure all the really good and peaceably inclined and well disposed citizens everywhere desire that this long drawn out and stubbornly fought contest or strike should come to a close, so the daily papers of the metropolis of the State of Michigan can give some of their space to international, political, social, religious and other burning questions of the day.

Now, therefore, in the interest of peace, harmony and good fellowship, and with a view of assisting the Mayor of Detroit in amicably bringing about a peaceable solution of the controversy, the Mayor of Port Huron would ask all the other mayors of all the other cities in Michigan and adjoining States to join with him in tendering to the good Mayor of Detroit their diplomatic services and influence in securing a cessation of hostilities long enough to arbitrate the differences between Detroit's mayor and Tom Johnson, or, if possible, secure a treaty between the two on the lines of the treaty of 1817 between Great Britain and the United States. In doing this, the Mayor of Port Huron is only following the example set by the good Mayor of Detroit in calling upon all the Mayors of the country to assist him in arbitrating the great railroad strike of 1894, and going there himself to accomplish that result.

The undersigned sincerely hopes you will not turn a deaf ear to this appeal, but will respond quickly. The present condition of things in the beautiful city of the straits demands prompt action. If the bitter controversy is not settled by arbitration or treaty, the Mayor of Port Huron fears that every street car on every line in that city will be turned into a land war ship, bristling with all the modern armaments of war vessels, flying respectively the union jack and the stars and stripes, carrying destruction and death in their wake.

What do you say? Shall we make an effort to bring peace on this part of the earth and good-will toward man and womankind throughout this nation? Awaiting an early and favorable reply, I remain yours, very, very truly.

* * *

Encouragement for G. E. Stockholders.

(From the Boston News Bureau.)

The General Electric Company is doing a little better than $1,000,000 of gross business per month, and is striving for a fair manufacturing profit, but is not getting it on all lines. It is probable that the gross business for the fiscal year will foot up slightly above $13,000,000, which at prevailing prices means a very large tonnage of electric goods.

There ought to be $2,500,000 manufacturing profit in this, but it is doubtful if such will be found when inventories are taken at the close of the year. However, it is expected that 8 per cent. will have been earned upon the common stock this year besides interest and full dividend on the preferred. Nothing, however, will be done this year toward the payment of any dividend on the preferred stock. They will be allowed to accumulate thereon for some time. It is felt that the matter can be better adjusted when the company has clearer views as to dividend policies than at present.

Stockholders may take some interest in comparing the above, which may be said to be a semi-official declaration of the General Electric Company's future dividend policy, rather than a truthful statement of the volume of business being done, with the annual balance sheet of Allgemeine Elektricitats-Gesellschaft of Berlin, Germany. With a capital account of 20,000,000 marks and a debenture account of 4,788,000 marks, this company earned during the past year a net profit of 2,677,318 marks, out of which 11 per cent. dividends were paid; 110,000 marks were devoted to bonuses to the staff and to the pension fund, and 67,318 marks were brought forward to the current year.

In addition to borrowing the name of its German contemporary, the American company would do well to copy some of its business methods.

* * *

THE letter printed below has been referred to in ELECTRICITY. The circular mentioned is the one which has become familiar, designed to awaken enthusiasm among "the boys who are in the real pot," and providing for the greasing of Common Councils:

ALBANY, N. Y., Oct. 25, 1895.

EDITOR ELECTRICAL DEP'T N. Y. HERALD,
New York City.

DEAR SIR: To correct statements made by Mr. Clarkson as stated in clipping from *Herald* of Monday last, I send you herewith circular which came direct from the Standard Telephone Company's office on July 27th last. No paper can expose the inside work of this promotion company as well as the *Herald*, and it should be done to prevent innocent parties being placed in false colors to the public. Ask them what telephone patents they own or control. I am told the Phœnix Interior Telephone Company, 131 Liberty street, has made what few instruments the Standard Company have put out. They may be able to give you some information.

Yours truly, W. V. D.

Why did not the New York *Herald* take this matter up?

* * *

Every Word True.

Why G. E. Stock is Selling at 30.

(From the New York Daily Stockholder.)

In another column of the *Daily Stockholder* we print an article on General Electric, taken from our interesting contemporary ELECTRICITY. It is an able presentment of facts relating to the General Electric Company. Every word is true, and we dare say the officials will not take any exceptions to the journal's statements.

It explains why General Electric stock is selling around 30 with every prospect of lower quotations for it. Our own opinion is that with several years of back dividends due on the preferred stock, the common will have to be cut down or assessed, and that at no distant day.

* * *

G. E. Company Wants Its Share.

(From Trenton, N. J., Special to New York World.)

The General Electric Company of New York is trying to make ex-Mayor Frank Magowan, of this city, give up $75,000 of $160,000 he made by a little scheme. Frank L. Maguire is a co-defendant.

The contracts for the electric lighting in Trenton were about to expire in 1892, when Magowan organized the Edison Light and Power Company, with himself, Maguire and William P. Hayes as stockholders. Only about $500 was spent in the enterprise.

Magowan succeeded in getting franchises that so frightened the People's Electric Light and Power Company, which had the contract from the city, that it paid him $150,000 for the franchises and $10,000 for organising his company.

The General Electric Company alleges that Maguire was acting as its agent in dealing with Magowan and that it is entitled to one-half of the $150,000.

* * *

More G. E. Combinations.

The Schenectady *Union* volunteers the information, said to have come from "a very high source," that the officials of the Schenectady Locomotive Works and the General Electric Company have taken steps toward a consolidation of interests as far as the manufacture of electric locomotives are concerned.

Assessment of Patent Rights Held to be Illegal.

The argument on the application of the Edison Electric Light Company of Brooklyn to review the assessment on its personal property was heard by Justice Bartlett of the Supreme Court this week. The board of assessors had assessed the real estate of the company for the year 1895 at $794,699 and the personal property at $1,070,650. In opposing these figures the company alleges that it total gross assets are $3,179,841. That from this sum $2,190,971.81 must be deducted as invested in real estate here and in the State of New Jersey; $945,000 as invested in patent rights; $500,000 in bonded indebtedness and other items, which in all make the exemption claimed exceed the gross sum of $706,597.

The assessors fixed the value of the patent rights not at their actual value, but at the value allotted by the company on its own books. The board would not agree to deduct $50,000 for the capital stock not yet issued, and pretended to assess the personal property at $1,070,650. This the company alleges, was a grossly unfair discrimination, as no other corporation had ever had its patent rights assessed before. The company claims that the tangible personal property liable to taxation is only $173,520.69, yet the assessment of $400,000 had been levied on it. That was at an increase of $200,000 over the figure set for last year.

Attorneys for the company contended that taxation on patent rights was contrary to law and without authority of any kind. Judge Bartlett reserved his decision.

For a Government Postal Telegraph.

Perhaps one of the most important bills that have been introduced at the present session of Congress is one by Senator Kyle, of South Dakota, asking that a Government telegraphic system shall be established within the United States. The bill names the Secretary of State, Secretary of War, and the Postmaster General as a Board who shall cause to be located four trunk lines, which will connect the Northeastern, Northwestern, Western, Southwestern and the Southern sections of the United States with Washington City. Local telegraph offices shall be erected and maintained wherever necessary along the lines.

It is further provided that the Government telegraph shall be operated as a part of the postal system of this country, the operation to be under the direction and control of the Postmaster General. The rates shall be established by the above named Board. The line is to be constructed and kept in repair under the direction of the Secretary of War and through a Corps of Engineers detailed for that purpose, and shall be under the same general provisions of law as other public works of the United States. The sum to be appropriated for this work is $5,000,000. This act will not prohibit individuals or corporations from carrying on the business of operating telegraph lines.

A Hydraulic Air-Compressor.

The *Buffalo Express* states that C. H. Taylor has invented a hydraulic air-compressing system whereby power can be developed at much less cost than by turbines. The air is compressed by the direct action of falling water, without the aid of any moving machinery. The water is conveyed to a compressor by an open flume or through a pipe supplying a tank or stand-pipe round the headpiece of the compressor, where it can attain the same level as the water in the dam or source of supply. There are a number of small, horizontal airpipes around the headpiece. These draw their supply of air through larger vertical pipes, which extend above the surface of the water and open to the atmosphere. As the water enters this down flow pipe and passes the ends of small air-pipes, it draws in the air constantly, in the form of small uniform globules, which become entangled in the descending water, are carried down to an air chamber at the bottom of the pipe, compressing the air by weight of the water surrounding the globules, according to their depth below the tail-race water level, until they reach the point of separation. The air chamber at the bottom is sufficiently large to allow the air to rise to the surface of the water therein. Thence the air is taken through a pipe for transmissions to be utilized as power or for other purposes.

The American Street Railway Association.

At a meeting of the Executive Committee of the American Street Railway Association held in St. Louis, December 9, the Southern Hotel was selected as the headquarters of the Association during the next annual Convention. The meetings will be held in the Olympic Theater, across the street from the hotel. The exhibition hall has not been selected as yet, but will be in the near future.

The local committee at St. Louis are straining every nerve to make the next the most pleasant Convention yet held. The Executive Committee think they have selected subjects for discussion that will not fail to interest the most skeptical. It is suggested that delegates and visitors secure hotel accommodations at as early a date as possible, as Mr. Lewis, manager of the hotel, will make reservations for all who apply.

A Philadelphia Trolley Strike.

The employés of the Union Traction Company went on strike on the morning of the 17th inst., to enforce their demands for shorter hours, extra pay for snow plow and sweeper work, "trippers," recognition of the union, and other grievances formulated by the Amalgamated Association of Street Railway Employés. President Welsh declined to treat with the Association. The various depots of the Traction Company are guarded by special policemen. Cars are being run at long intervals on some divisions of the company's system.

The only line in Philadelphia that is not controlled by the Union Traction Company is the Hestonville, Mantua & Fairmount Passenger Railroad Company, which operates on Arch, Race and Vine streets.

Electrical Engineering at the Cape.

An Electric Lighting and Power Act has recently been passed at the Cape of Good Hope, authorising regulations for the safety of the public.

THE TROLLEY DECISION.

An Abstract of Judge Townsend's Opinion.

Excluding the history of the case, which has already been exclusively published by ELECTRICITY, also the review of various other inventions referred to, the important points in the decision of Judge Townsend in the suit of the Thomson-Houston Electric Company vs. the Winchester Avenue Railroad Company are as follows:

The combination of devices described in patent No. 495,443 is of great utility in the art of electric railroading, and has superseded every known apparatus. The experts for defendant admit that they do not know that any one other than Van Depoele, prior to September, 1885, had proposed to equip the car with a contact device mounted on the end of a long pole upwardly pressed by means of a spring, and to hinge the pole on a car and make it turn on a pivot. . . . The burden of proof is on the defendant to overcome the oath of the inventor, and this it has failed to do. . . .

The new problem presented was how to make practicable the electrical propulsion of an electric railway by a continuous contact under all the conditions presented by crowded streets, sharp curves, complicated switches, rough roads, reversed lines of travel, and the necessity of a continued upward pressure of from eight to fifteen pounds. The solution was accomplished by a long rigid arm upwardly pressed and capable of a universal movement. "This arm," says the inventor, "possesses substantial practical advantages over any other means yet proposed for establishing moving contact between a vehicle and a stationary supply conductor, in that by the use of a hinged flexible arm much greater freedom of movement is compatible with the maintenance of a positive mechanical connection and electrical contact between the vehicle and supply conductors."

Prior inventors in the same art had shown a similar contact with a rail under the car, but they failed to indicate or claim the element of spring pressure or capacity for lateral motion. Prior inventors in an allied art had shown by paper patents the principle of continuous or interrupted contact with such limited provisions for lateral or vertical motion as to be impracticable. Prior inventors in a remote art had shown in tethers for animals and in office chairs, spring pressure and universal movement. But the inventors in the art of electrical propulsion, signals, or telegraphs had failed to provide for an operative contact device at a distance from the car required for the operation of the under-running trolley road, except by unwieldy and impracticable structures on the roof of the car. They had failed to adequately provide for considerable variations from practically straight lines of travel. In their later attempts to do so they had constructed or adopted contrivances which departed from the earlier devices now claimed to show lack of patentable novelty, and thereby furnished strong proof that the changes made by Van Depoele were not obvious ones. Defendant's expert is forced to admit that the advantages of an underrunning trolley were not obvious, and that the earlier constructors must have been in doubt as to the efficiency of such a system, and that the prior underrunning overhead devices would have led a person away rather than towards an upwardly pressed hinged conductor. In these circumstances the use of old principles does not fall within the rule of a double use. The old use was not intended for nor adapted to the conditions of the new use; it produced in part only the results of the new use.

Van Depoele discarded the elevated wheel and springs of his earlier patent and broke away from his own towed trolley and those of Siemens, Finney, Henry and others, and reversed the underrunning trolley of Daft and Edison, and added lateral motion thereto, and went back to the overlooked art of animal tether or the limited and impracticable art of railway signals, and selecting and combining certain elements of these various contrivances, modified and adapted them to a new purpose, and thereby disclosed to the public a practically operative means such as the whole world of electrical inventors had theretofore sought in vain, and which has gone into universal use throughout the country. He made an invention within all the rules applicable to this question. I have been unable, therefore, to adopt the view of counsel for the defendant that the art of conducting electricity from a conductor to a translating device on a moving vehicle was sufficient to enable the skilled mechanic to construct the device of said patent.

The defendant, while denying patentable novelty and urging that even if there be an invention it is substantially the same as that covered by former patents, chiefly relies upon the claim that within the meaning of Miller versus Eagle Manufacturing Company, the invention of the later patent is inseparably involved in the invention of the earlier one.

In the case at bar the special combination described and claimed in the earlier patents was distinct and separate from that of the later generic invention. They stated the new problem presented to the inventor in the practical development of his invention, the construction of an improved switching plate device, and the means for its application which the patentee had a right to protect. While they were dependent for their operation upon the original broad invention of the earlier application, but later patent, they were not otherwise inseparably involved.

In Miller versus Eagle Manufacturing Company the function of increasing lifting effect . . . was involved in the patent in the sense of identity of structural combination and action. The patentee attempted by a later patent to extend the monopoly of an effect essentially brought into operation. . . .

The decision in Miller versus Eagle Manufacturing Company merely affirmed the well settled law that two patents for the same invention could not issue to the same patentee. There is nothing involved therein which affects claims in suit herein. If any departure from the settled rules of construction is justifiable in any case, it should not be allowed for the purpose of destroying a meritorious invention embodying a construction which first made practicable the operation of the trolley railway under all conditions, and which is now employed on more than five hundred electric railways in this country, representing an invested capital of about $500,000,000.

Of the second patent, No. 495,383, Judge Townsend, after a review of the case, said:

The reason for the adoption of the device of this second patent follows as a corollary of the foregoing conclusions. Its adoption results not from its patentable novelty but from its practical utility in connection with the main invention. The doctrine that utility in the absence of patentable novelty is immaterial is especially applicable where the sole foundation for the claim of utility lies in the mere mechanical adaptability of a well-known device to a novel invention protected by a valid patent.

English Definition of Low Pressure.

Lord Kelvin, Mr. W. H. Preece and Major Cardew, the committee of experts appointed by the London Board of Trade, have presented their report on the questions which were referred to them as a result of the recent conference on the proposed new electric lighting regulations. The principal matter on which the committee were asked to advise was as to the definition which should be officially laid down to constitute "low pressure." As presented to the conference, the revised regulation of the Board of Trade proposed that a pressure which could not at any time exceed 300 volts if continuous, or the equivalent of 150 volts if alternating, should be deemed a low pressure supply; but the Institution of Electrical Engineers urged that 600 volts should be accepted as the low pressure limit. The Electrical Committee of the London Chamber of Commerce advised that the low pressure limit should be raised to 500 volts, and other experts considered that, in view of the advance made in electrical science, it was no longer necessary to draw any distinction between alternating and continuous currents.

Claim That the Patents are Unlawful.

Some time ago Elias E. Ries and Albert H. Henderson brought suit against the Metropolitan Railroad Company of Washington City for using certain electric appliances on its cars in violation of patents issued to the complainants. The company has filed its answer, claiming that the inventions were already patented here and in foreign countries before the alleged improvements, therefore the patents upon which the suit was brought were unlawfully issued.

Our London namesake states that the congregation of a Presbyterian chapel at Nottingham have celebrated the introduction of the electric light into their place of worship by a special service, in which the light was duly extolled and appropriate morals drawn from its superiority to all other known illuminants. A special preacher was brought down from London for the occasion, who seems to have treated his subject in a philosophical spirit very unusual in such places.

LEGAL NOTES.

Another Feeder Patent Suit.

John I. McDuffee, trustee for Susan E. McDuffee, Alfred H. Williams and William M. Schlesinger Selwyn, formerly William M. Schlesinger, through their attorneys, have filed a bill in equity in the United States Circuit Court at Philadelphia in a suit against the Union Traction Company of that city for alleged infringement of patent. It is claimed that the patent controls the operation of trolley roads by means of the sectional feeder system.

In the bill the Philadelphia Traction Company, which forms a part of the Union Traction Company, is exempt from liability under the suit, for the reason that while the former company was operating independently suit was brought against it for infringement of this patent. After considerable testimony was taken the suit was settled by the Philadelphia Traction Company buying a license under the patent.

A jury in the United States Circuit Court in Brooklyn, N. Y., has rendered a verdict for $6,899.33 in favor of the Abendroth & Root Manufacturing Company, who were defendants in a suit brought by the Edison Electric Lighting Company of Philadelphia for $34,035.39 for damages alleged to have been caused by defective boilers.

The Court of Appeals of New York State has decided that street railroad companies are liable for damages occurring to passengers who may be injured while riding upon the platforms of surface cars and smoking, provided that the company affected, while prohibiting smoking inside closed cars, allows smoking on either platform and collects fares from persons occupying either platform.

At Cincinnati a damage suit brought by Mary A. Wolfe against the Cincinnati Edison Electric Company for loss of rent and damage to property which the plaintiff claimed was due to the jar and noise of the machinery in the defendant's power-house, rendering her building untenantable, was recently given to a jury in Judge Buckwalter's court, whose verdict was in favor of the plaintiff on the following basis: "Present market value of the property, if no nuisance existed, $13,500; its present value $6,000; diminution because of nuisance, $7,500; damage from loss of rent, $1,900; personal damage to plaintiff because of ill-health and discomfort, $705; total, $10,105."

Judgment for $5,239.00 has been entered against the Elizabethtown Electric Light Company, Elizabethtown, Pa., in favor of the Westinghouse Electric and Manufacturing Company.

W. H. Bennett has been appointed receiver of the West Side Street Railway Company, Milwaukee, Wis.

E. R. Anson has been appointed receiver of the Consolidated Street Railway Company of Salem, Ore. The appointment was made upon petition of the First National Bank of Salem, which held accommodation notes for $8,712 due and unpaid.

Gas Engines in Switzerland.

The electric railway at Lausanne, Switzerland, is operated from a power house in which the dynamos are driven by two gas engines of 130 H. P. each. These engines use producer gas. The dynamos are belted to the flywheels. The working is said to be very economical, and the best result obtained has been an expenditure of 1.2 lb. of anthracite coal per horse-power hour in ordinary service. The engines are run on an average 18 to 20 hours per day. A careful calculation has shown that the amount of fuel used is 4.5 lb. of anthracite per car-mile.

A Postal Car Excursion.

A short excursion was given by the Brooklyn Heights Railroad Company on Monday, December 16, at 3:30 P. M., in the new postal cars which have been built by the company for the use of the Post Office authorities in Brooklyn.

A 3-Cent Fare if no Seat is Provided.

A set of resolutions was introduced in the City Council of Chicago this week providing for a 3-cent street car fare for all street car passengers for whom seats are not provided. The resolutions were referred to the Judiciary Committee.

TESTS OF A 10 HORSE-POWER DE LAVAL STEAM TURBINE.*

BY WILLIAM F. M. GOSS.

The De Laval steam turbine experimented upon constitutes part of the permanent equipment of the Engineering Laboratory of Purdue University, and the present paper is based upon data secured chiefly through the assistance of Charles E. Bruff, B. M. E., author of the thesis "Tests of a 10 Horse-Power De Leval Steam Turbine."

In the De Laval steam turbine jets of steam, delivered from suitable nozzles, are made to impinge against the buckets of a light turbine wheel. The steam enters the buckets from one side of the wheel, and passing through is discharged or "exhausted" from the opposite side. The arrangement of nozzle and wheel is shown in Fig. 1. The motion of the turbine shaft, which under the actions of the jets is extremely rapid, is communicated by gearing to a heavier and slower-moving driving shaft carrying a fly-wheel of small diameter, from which the power of the engine is delivered. Regulation of speed is secured by means of a throttling governor, which controls the pressure of steam admitted to the nozzles.

The important moving parts, with approximate dimensions, are shown in Fig. 2. The turbine wheel is built up of sixty-three steel segments, each carrying a bucket and a portion of the light outside rim. The segments are held in place by means of suitable collars, which grip them on either side. The wheel is mounted upon a long, slender shaft, having sufficient flexibility to allow the system at speed to revolve about its center of gravity, even though this may not agree with the geometrical axis of the shaft. The gear upon the turbine shaft is of steel, solid with the shaft; that upon the drive shaft has its teeth formed in a bronze ring, which is carried by a solid iron center. The smaller gear has twenty-one teeth, the larger one two hundred and eight teeth, giving a ratio of 1 to 9.90476.

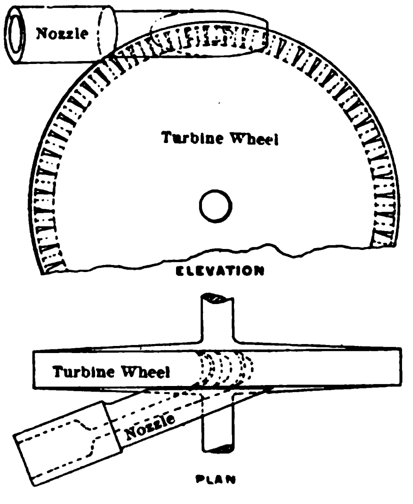

FIG. 1.

The shafts run in bronze boxes completely lined with babbit or other soft metal. To assist in the distribution of oil a spiral curve, the pitch of which is about half the diameter of the journal, is cut into the metal of the bearing. The outboard bearing on the turbine shaft is closed at the end, and a small pipe runs from the closed end to a point over the gears. The pumping action, resulting from the presence of the spiral oilway, gives a constant, though small, supply of oil upon the gears. The gears do not dip in oil, though the case which encloses them receives drainage from all the bearings.

The governor is connected with the driving shaft, of which, at first sight, it appears to be but an extension. It is shown in detail in Fig. 2. The weights, *W W*, with their arms, *C C*, are in the form of a split cylindrical cup. Upon the outside and at the base of each weight a knife edge, *E E*. is found, which bears upon a suitable surface in the governor frame, *A A*. A spiral spring is fitted at its inner end with two projecting pins, which bear upon the arms, *C C*, of the governor weights. The outer end of the spring is connected with the frame by the threaded plug *D*. When the governor is at rest the concave surfaces of the weights are in contact with the frame, and the tension of the spring keeps the knife edges upon their seat. When the governor is revolving at speed the weights are under centrifugal action and move outward, swinging upon their knife edges against the resistance of the spring. The motion of the weights is taken up by the pin *F*, by which it is communicated, through suitable mechanism, to the governor valve above the engine.

The nozzles which serve to deliver steam to the wheel are four in number, and are so fixed in the frame of the engine as to act upon the turbine at points which are equally distant from each other. Two of the four are provided with stopcocks, which, when closed, put out of action the nozzles with which they are connected. By means of the stopcocks, therefore, the engine may be run under the action of two, three, or four nozzles at the will of the engineer.

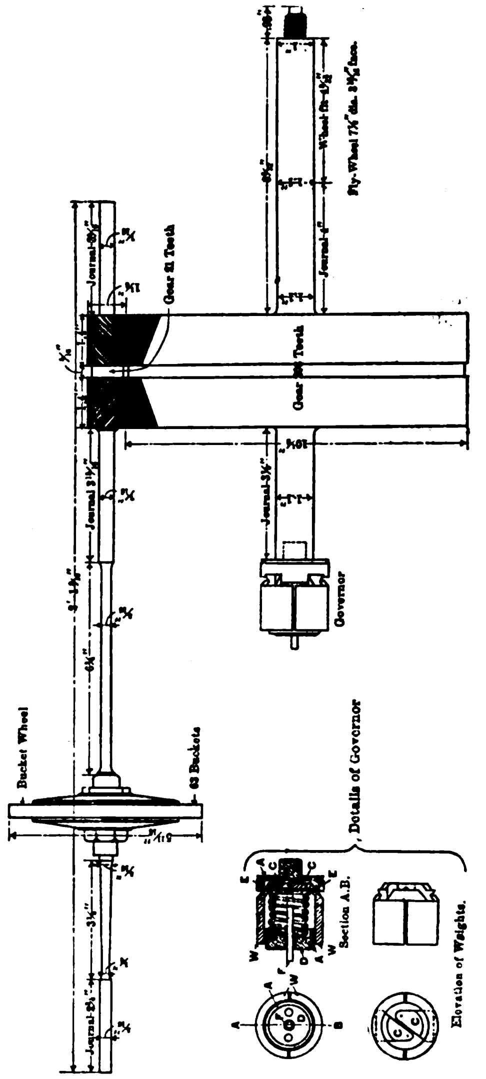

FIG. 2.

The distinguishing feature of the engine is, perhaps, to be found in the form of the nozzles. All are diverging, the throat being approximately two inches from the discharge end. Three have a diameter of 0.138 inch, and one a diameter of 0.157 inch.

THE TESTS.

The power of the engine was absorbed by a pony brake, cooled by constant streams of water. The exhaust steam was piped to a Wheeler condenser, open to the atmosphere. The water resulting from condensation was drained into tin buckets, which were changed and weighed at regular intervals. Gauges were used to show the steam pressure both above and below the governor throttle, the former giving the pressure available at the engine, and the latter the pressure under which, in consequence of the action of the governor, the steam was admitted to the nozzles. A manometer was also attached to the exhaust pipe, but as this pipe is large (3 inches diameter) and the connection with the condenser close, the observed pressure was never appreciably different from that of the atmosphere.

The boiler pressure for all efficiency tests was 130 pounds by gauge, for which pressure the particular nozzles used were designed. The rated speed of the fly-wheel is 2,400 revolutions per minute (23,771 for turbine wheel), but this standard was not maintained for all the tests. The governor was adjusted several times as the work progressed, and it was not until several tests had been run that the proper speed was secured. It is believed, however, that the differences of speed recorded do not materially affect the value of results for purposes of comparison.

The tests are grouped into three series, the first including those for which all four nozzles were in action, the second those with three, and the third with two. The several tests in each series were intended to vary from each other only in amount of power delivered from the wheel. All tests were of thirty minutes' duration, and all observations were taken at five-minute intervals.

With all four nozzles in action, and with the engine developing a little more than its rated power, the steam consumption per horse-power hour was as low as 47.8 pounds. In comparing this result with results obtained from other engines, the small size of the engine tested should be kept in mind, and also the fact that the rate of consumption stated is based upon brake power. The efficiency of the engine falls off rapidly as the load is decreased, and, as would be expected, the effect is not marked when all the nozzles are in action. This may best be seen by the heavy curves shown in Fig. 3. Assuming the nozzles to be cut out of action one at a time, as soon as the reduction of load becomes sufficient to permit the work to be done without them, the minimum steam consumption at different loads, for the boiler pressure and speed employed, is represented by the broken line *fgdebc*, Fig. 3. Again, if instead of four nozzles, an infinite number could be employed, and if the governor could be arranged so as to regulate the number in action rather than the pressure admitted to them, the steam consumption of the engine in question might be made to follow a line somewhat similar to the light broken line *gec*. But the heavy lines indicate the results which were actually obtained.

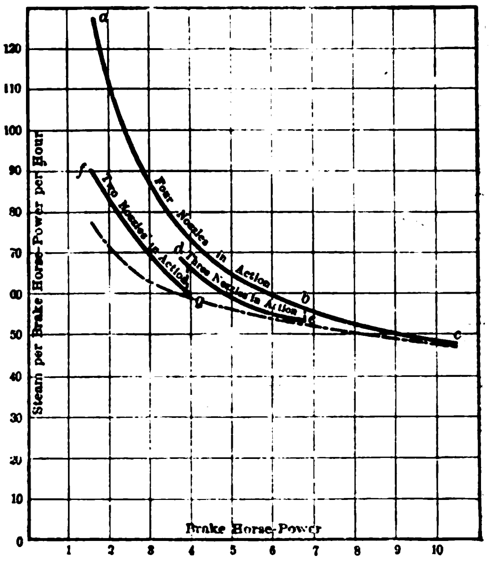

FIG. 3.

The engine requires very little attention and is almost noiseless in action. The governor is quick to act, and its speed regulation appears to be fair, except when changes of load are large and suddenly made. After such a change, the engine requires a little time before settling down to steady running under the new conditions.

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*Abstract of a paper read at the New York Meeting of the American Society of Mechanical Engineers, December, 1895.

As the speed of the De Laval engine is high, it is evident that the force in action must be comparatively low. To determine the maximum resistance under which the engine might be expected to start, the brake was clamped upon the fly-wheel so that the latter could not turn within it. Steam was then admitted to the engine, and readings were taken from the scale under the brake arm. The result of this process, of course, depends upon the steam pressure and the number of nozzles in action. With all nozzles, and with a steam pressure of about 125 pounds by gauge, the maximum starting-power is equal to a force of 30 pounds acting at a radius of one foot. With three nozzles the equivalent force was but 21 pounds; with two nozzles 14 pounds.

EUROPEAN INCANDESCENT LAMPS.

Commenting upon the test of European incandescent lamps made by Mr. D. Paisley, the results of which were published in ELECTRICITY October 2, our London contemporary, *Industries and Iron*, says in a recent issue:

> It appears to us as the old question of the test of an engine and boiler on the trial trip and under ordinary working conditions. The test of the engine and boiler is on the trial trip the maker's test, and their test in going across the Atlantic is the owner's test. So it is with lamps. A show test of incandescent lamps selected and sent in by the manufacturers would be a maker's test. The test made by Mr. Paisley of lamps bought in the ordinary way, at the prices which he has marked down, is a purchaser's test. It was meant for this. We did not present the tables as being anything else, and they are very valuable to the public as such.
>
> In the explanatory article we pointed out that the price of the lamp was not the only factor to be considered. The amount of current consumed, and the fall in the lighting power of the lamp, were of the highest importance in view of the low primary cost of the lamp. There was the voltage and the amperes consumed, and these had their commercial value. In fact, the energy or watts consumed by the lamp during its life had to be included in any estimate of value of the lamp. Before we can properly estimate the value of an incandescent lamp, we must know four things—
>
> 1. The primary cost.
> 2. The cost to him of a watt.
> 3. The candle-power of the lamp for the time under consideration.
> 4. The length of life of the lamp in hours.
>
> When these things have been determined, and the tables we gave supplied them, then the purchaser is in a position to know exactly what lamp under his conditions will suit him best.
>
> The question, of course, to the consumer is: What is the total price of a candle-power per hour for any lamp to me? Into this comes the primary cost, the candle-power, the life, and the cost per watt to the purchaser of the lamp. Writing this in mathematical terms we have—
>
> Price per C. P. per hour = primary cost of lamp × cost of watt × number of watts per C. P. ÷ life of lamp in hours.
>
> The table referred to gives the primary cost of each lamp, the number of watts used per candle-power at different stages of the life of the lamp, and the life of the lamp in hours, and therefore all the elements supplied for estimating the value of any lamp in the way shown above. What, of course, is required is the cost of a candle-power for each lamp per hour. We do not propose to set up a comparison between the lamps made by manufacturers, but to show how the value to the purchaser and consumer may be determined. For this purpose we take three lamps made by three manufacturers who have been referred to in this and contemporary journals. The three names are the "Robertson," the "Sunbeam," and the "Edison and Swan," and as it is merely an illustration, we do not select any particular lamp, but those marked 1 in the first set of tests.
>
> Taking, then, the Edison and Swan first, and number 1 lamp of the old manufacture, we find that at the beginning of the test the watts required per candle are 3.83 and 4.7 at the end. The average watts per candle-power is thus 4.26. Assume that the cost of a Board of Trade unit is 8d. The life of the lamp is given as 600 hours. Hence, applying the rule, we get—
>
> Cost of C. P. per hour (Edison-Swan) = primary cost of lamp × cost of watt × number of watts per C. P. ÷ life of lamp in hours
>
> $$= \frac{21}{600} \times \frac{8}{1,000} \times 4.26 = .00119 \text{ pence.}$$
>
> Secondly, taking the Sunbeam number 1 lamp, we find that at the beginning of the test the watts required per candle are 3.5, and at the end 5.7 watts. The average watts will then be 4.6. Taking the same cost, per Board of Trade unit, namely 8d., the life of the lamp is given as 600 hours, and the price 15½ pence. Applying this rule we have cost per C. P. (Sunbeam)
>
> $$= \frac{15.5}{550} \times \frac{8}{1,000} \times 4.6 = .00095 \text{ pence.}$$
>
> Lastly, taking the Robertson number 1 lamp, we find that at the beginning of the test the watts required per candle are 3.94, and at the end 4 watts; the average watts required per candle-power will then be 3.97. Taking the same cost per candle power, namely 8d., the life of the lamp is given as 600 hours, and the price as 16 pence. Applying the rule, we have cost per C P. (Robertson)
>
> $$= \frac{16}{199} \times \frac{8}{1,000} \times 3.97 = .000807 \text{ pence.}$$
>
> Reference has been made in a letter from Mr. F. Walker, referring to the Gabriel & Angenault lamp. The average number of watts required for this is 3.28 per candle power per hour, and the price is 12 pence; so, cost per C. P. per hour
>
> $$= \frac{12}{600} \times \frac{8}{1,000} \times 3.28 = .000528 \text{ pence.}$$
>
> As we said above, we do not put forward these values for the purpose of comparison, but only as an illustration of the manner in which the value of a lamp must be obtained before it can be of any practical value to the purchaser. If an average for all the lamps in the above were obtained and tabulated, the values so obtained would be of considerable practical value to the purchaser.

Subsequently to the appearance of the above, *Industries and Iron* published the following supplementary table, which shows the cost of maintenance of the several lamps tested by Mr. Paisley:

	C. P.	Watts per C. P.	Price.	Tot'l cost per 600 hours at 6d.
			s. d.	s. d.
Gabriel & Angenault, Paris.	13 98	3.51	1 0	15 8
Daylight	14.33	3.61	0 11½	16 5½
Brush Company, Vienna	11.85	4.42	1 0	16 9
Stearn	13.29	4 10	0 11½	17 2½
Hard	13.76	4.01	0 10	17 4
Pope & Goosens	14.50	3 84	0 9½	17 5½
Siemens & Halske	14 23	3.87	1 0	17 6
Edison & Swan (New)	13.73	4.01	1 9	18 2
Sturm & Co	12.05	4.73	0 8	18 2
Robertson	14.76	3.86	1 4	18 5
Phaeton	15.42	3.85	0 9	18 6
Gebruder Pintsch	16.29	3 79	1 0	19 6
Edison & Swan (Old)	15 16	3.93	1 9	19 7
Allgemeine	14 43	4.49	1 0	20 4
Sunbeam Company	12.55	5.29	1 3½	21 0½
Svea & Co	15.18	4.56	1 0	22 3

The conclusions arrived at by the London *Electrical Review* in discussing the tests of English lamps (the results of which were reproduced in ELECTRICITY December 4) has called forth a protest from Mr. John W. Edmundson, managing director of the Sunbeam Lamp Company, London. In a letter to that publication he urged the objections that the tests had been made "without authority" and were unfair because no information was given regarding where the experiments were carried out or by whom they were conducted.

Answering Mr. Edmundson's objections, the *Review* says:

> We were aware that the figures are due to Mr. D. Paisley, whose name we have come across at various times as a contributor to the technical press, and the responsibility for their correctness must rest with that gentleman; but the description of how they were obtained was so straightforward, and the skill required for work of a practical kind is so small, that we see no reason for disputing the data beyond the fact that some of the results do not quite fall in with our preconceived ideas.
>
> Our article was, however, based on more than this. The writer had at various times made tests of incandescent lamps on his own account, and the general results were in accordance with the tenor of what Mr. Paisley gave as his At the same time we must admit that the method of testing is not fully described, and we are not told where the lamps were tried, or the source from which the current used in the test was taken. It is only fair to assume that the measurements were made with commercial instruments of a recognized type, and such instruments do not require any great skill in their use; otherwise it would be necessary to ask for some guarantee that technical skill and ability of a fairly high order were employed, and that the apparatus used was of a suitable kind. But it is expressly stated that the apparatus was checked against standard instruments at frequent intervals, and unless the good faith of the investigator is called into question, one cannot very well criticise direct statements of this kind. One may be permitted to give figures obtained in this way, and offered as being of a practical kind, where others submitted as representing with rigorous exactness certain facts would require a very much more reliable substantiation than has been given so far.
>
> It is at the same time most desirable that tests should in all cases "be made by persons whose names are known, and whose position is a guarantee at once for absolute independence and high scientific attainment." We can judge of these qualifications to some extent by the means taken to publish experimental results. Well known scientific men choose the journal of a learned society, others the columns of the technical press. The authentication of results largely depends on the fulness with which information is given as to the means adopted to obtain data, and the corrective factors introduced.

VARIATION IN ELECTRICAL CONDUCTIVITY OF METALLIC WIRES IN DIFFERENT DIELECTRICS—II.*

BY FERNANDO SANFORD.

The following table gives the change in resistance observed in the above-mentioned wire [see first part of article in ELECTRICITY, Dec. 4] in eight different dielectrics, and the temperature change necessary to account for such variation in resistance upon the hypothesis advanced by *The Electrician*:

Dielectric.	Resistance change.	Equivalent temperature change.
Petroleum	—0.00006 ohm	—0.43°
CS_2 and turpentine	—0.00003 ohm	—0.2°
Wood alcohol and benzine	+0.00005 ohm	+0.36°
Absolute alcohol	+0.00006 ohm	+0·43°
Wood alcohol and petroleum	+0.000075 ohm	+0.53°
Laboratory burning gas	+0.000058 ohm	+0.4°
Chloroform vapor	+0.00005 ohm	+0.6°
Ether vapor	+0.000083 ohm	+0.6°

Following the publication of my first paper upon this subject, a number of measurements were made with a silver wire 1.1 mm. in diameter, using as dielectrics air, petroleum, wood alcohol, absolute alcohol, ether vapor, chloroform vapor, laboratory burning gas, and a mixture of wood alcohol and petroleum. While the same phenomenon was observed as with the copper wire previously used, the variation in resistance was not so great. The most important difference, however, was in the different order of arrangement of the dielectrics with reference to their influence upon the conductivity of the wire. While the copper wire had shown a lower resistance in petroleum than in air, the resistance of the silver wire was very slightly increased in petroleum; and whereas the resistance of the copper wire had been greater in sulphuric ether vapor than in any other dielectric used, the resistance of the silver wire was less in the ether vapor than in any of the other dielectrics. The following table will show the results of the measurements made upon the silver wire:

Dielectric.	Resistance change.	Equivalent temperature change.
Petroleum	+0.00002 ohm	+0.2°
Absolute alcohol	+0.00003 ohm	+0.3°
Wood alcohol	+0.000045 ohm	+0.5°
Wood alcohol and petroleum	+0.000046 ohm	+0.5°
Ether vapor	—0.000025 ohm	—0.3°
Chloroform vapor	+0.000025 ohm	+0.3°
Laboratory gas	Uncertain. Resistance slightly greater than in air.	

The copper wire already mentioned will hereafter be referred to as C_1. Its diameter, as before stated, was approximately 1 mm. In order to observe any possible effect of an increase of surface of the wire, the same tube was provided with a copper wire, of

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* From the *Physical Review*, Vol. III, No. 4.

1.27 mm. in diameter, hereafter designated as C. The resistance of this wire and tube when the tube was filled with air at 20° C. was 0.02618 ohm. The resistance when the tube was filled with the mixture of air and gasoline vapor used as burning gas in the laboratory was 0.02626 ohm, showing an increase in resistance of 0.00008 ohm.

With the wire C_1, which was of the same length in the tube, the resistances of these two media at the same temperature was respectively 0.03375 ohm and 0.03381 ohm, showing a change in resistance in the burning gas of 0.00006 ohm. This showed that while the surface of the wire had been increased about 30 per cent. the difference in resistance had been increased about 30 per cent.

In order to determine whether all the dielectric in the tube was concerned in the resistance change, or only a thin layer of it in contact with the wire, the wire was withdrawn from the tube, and its surface was very thinly coated with paraffin oil, after which it was replaced in the tube, and a second set of measurements was made with the same dielectrics as before. These measurements gave exactly the same resistance in the two dielectrics. This, together with the fact, mentioned in my first paper, that after the tube had contained a liquid dielectric the wire frequently required a considerable time before it returned to its air resistance, has led me to believe that the phenomenon is due to a very thin film of the dielectric adhering to the surface of the wire, and possibly absorbed to some extent by the wire.

In order to observe whether any effect would be produced by increasing the surface of a given wire, another wire, C_3, 1.27 mm. in diameter, was cut from the same spool as C_2, and was hammered flat to increase its surface. This wire was placed in the tube, and its resistance was measured in the two dielectrics which had been used with C_2, but no increased resistance could be observed in the gas. The wire had been much hardened by hammering, but what change had been produced in its surface is not known.

The next wire used was 1.66 mm. in diameter, and instead of giving an increased difference of resistance corresponding to its increase of surface, its resistance change in burning gas was less than that of either C_1 or C_2. Another copper wire, C_5, 1.27 mm. in diameter, was cut from the same spool as C_2, and was amalgamated upon the surface by immersing it a short time in a solution of mercuric chloride. Its resistance at 20° was 0.02640 ohm in air, and 0.02646 ohm in ether vapor.

The apparatus was next fitted with a copper wire, C_6, about 0.35 mm. in diameter, and its resistance was measured in air, burning gas. and petroleum. In this wire, a change of temperature of 0.1° corresponded to a change in resistance of 0.00008 ohm, so that any resistance change in the different media was marked by possible temperature differences. The mean of fifteen measurements in air, and five in burning gas, seemed to indicate an increase in resistance in the gas of about 0.00001 ohm, but this was probably purely accidental. In petroleum, no difference could be observed.

Thus far I have offered no explanation of the above-mentioned phenomenon. The only hypothesis which I am able to advance, while it would suggest the probability of a difference in resistance in different dielectrics, would hardly account for the irregularity observed in different wires. It will be noticed, however, that while the irregularity in quantitative results is very great, the variations in resistance with wires of the same material are always in the same direction. This is true of the copper wire before and after having its surface amalgamated, and of the silver wire before and after being copper-plated. In the results already referred to, which have been published by Signors Grimaldi and Platania, the variation observed between the air and petroleum resistances of the copper wires used, while less than some of the variations observed by me, were in the same direction. Since the hammering of a wire or the oiling of its surface may produce such a marked change in the degree to which its conductivity is affected by different dielectrics, it is not strange that different observers working with different samples of wire should get very different results; and there is accordingly nothing contradictory in Professor Carhart's results and my own.

The only explanation which I am able to offer is based upon the assumption that the passage of a current through a metallic conductor is accomplished by means of disruptive discharges from molecule to molecule through the intervening ether. These discharges would, like the discharge of a Leyden jar, be of an oscillatory character, although the discharge in one direction would be of much greater intensity than in the opposite, and their rate of oscillation would be affected by the elasticity and density of the intervening ether. While I am not aware that the rate of oscillation of a condenser discharge has been observed to vary in different dielectrics, it is known that the capacity of a condenser does so vary, and this would necessitate a variation in the rate of oscillation of its discharge. In the case of the outer layer of molecules of a wire, the surrounding dielectric would influence the rate of oscillatory discharge between contiguous molecules. If the dielectric should penetrate for some distance into the wire, the rate of discharge of a correspondingly great number of layers of molecules would be affected. That gases at least frequently do penetrate for some distance into metals is well known. In the case of some of the dielectrics used by me, something of this character seemed to take place. This was especially noticeable in the case already referred to of the sulphuric ether vapor and the copper wire. If, however, the dielectric should penetrate to a definite depth into the wire, the difference in resistance should be more marked in fine wires than in coarse ones, since a larger proportion of the molecules would have their rate of discharge influenced by the surrounding dielectric. My own results are too irregular to enable me to decide whether this is the case or not, but the variation in resistance observed in the fine wire used by Grimaldi and Platania was much greater in proportion to the cross section of the wire than in any of the wires used by me.

It seems probable that after a current has been once established in a wire all the molecules in a given cross-section will receive their charges at the same time and part with them at the same time. This would necessitate the same rate of discharge for both external and internal molecules. It might, nevertheless, occur that the hastening or retarding of the rate of discharge of the external molecules would affect the rate of all the molecules of the wire.

One conclusion which seems necessarily to follow from this hypothesis concerning conductivity is that the variation in resistance in different dielectrics should be greater for alternating than for direct currents. I have not, however, been able to verify this conclusion, owing to the difficulty experienced in measuring resistance accurately by means of alternating currents.

In my first paper I published the results of some attempts to find a relation between the effect of the different dielectrics upon the conductivity of the copper wire surrounded by them and their refractive index for light. In this attempt I was unsuccessful, but scarcely more so than have been the other attempts to establish a relation between the refractive index and the specific inductive capacity. Aside from the general discrepancy observed between the values of these two properties of dielectrics, it seems probable that neither Fresnel's nor MacCullagh's theory of the propagation of light in material bodies will give a complete explanation of the phenomenon, and that the refractive index of a substance will not alone enable one to judge of the elasticity or the density of the ether in that substance.

In a similar manner, if some dielectrics are absorbed more than others by the surface of a conductor, a mere knowledge of the specific inductive capacity of a dielectric will not enable one to foretell its effect upon the conductivity of a wire immersed in it.

I am aware that this hypothesis as to the nature of metallic conductivity leads to certain conclusions not experimentally established as to the nature of the field of force surrounding the current. If such oscillatory discharges as are here presumed take place between the molecules of a conductor, the entire field about the conductor would be filled with Herzian waves of very short period. Whether the magnetic field about a current can be accounted for on the assumption of the existence of these waves, I do not know. The velocity of the electro-magnetic induction could be satisfactorily explained in this way, and it is certain that very rapid ether vibrations of this kind can produce magnetic effects, but whether the magnetic polarity of the field may be accounted for by the greater intensity of the discharges in one direction than in the opposite. I do not know.

The Search Light in Coast Defence.

In the report of Brigadier General D. W. Flagler, Chief of the Bureau of Ordnance, just submitted to the Secretary of War, interesting reference is made to the use of the electric searchlight in coast defence, being the results of experiments made at Sandy Hook during the past summer. The lamp used in these experiments has a parabolic reflector with a diameter of 59.05 inches, and the total intensity of light claimed is 194,000,000 candle power. The focal distance of the parabolic mirror is 25.5 inches. The diameter of the illuminated area at a distance of 1,111 yards is 84 yards.

The light with the necessary accessories complete was installed at the Sandy Hook proving ground on a tower which places the light 100 feet above sea level. In carrying out the tests no difficulty was experienced in controlling the direction of the beam by an operator stationed at a distance from the light, by means of an electrical apparatus furnished. In the trials made to test its efficiency as a telegraph instrument, it was found that signals could be easily read at a distance of sixteen miles and probably considerably farther, but that they were invisible at forty-two miles. Trials were made to determine the effect of the color of the object, of the visibility of the fixed objects in known positions at different distances and of known moving objects; also for the detection by search of fixed and moving objects. These trials, while far from being complete, lead to this conclusion among others: that for efficient service the distance at which the light can be effectively used against boats seeking concealment is probably not greater than one and a half miles. Further trials will be made with the light placed at an elevation of about forty feet above sea level, as it is thought that the present elevation is too great to permit of the most efficient use of the light. Tests were also made as to the relative advantage of different positions of the observer with reference to the light. No satisfactory trial was had of the utility of the beam at different angles of dispersion of the rays. It is probable that the best use of the light in guarding areas such as torpedo fields would be in connection with the dispersing lens.

Electric Lights for Hindu Temples.

The *Times* of Ceylon states that it is in contemplation to introduce the electric light into the Sivan Hindu temple at Kochicadde, on the main road to Mutwal, Ceylon. The premises of the Hindu place of worship are at present lighted by gas. and the trustees propose to substitute the electric light for gas, a matter which is now under their consideration. It is said that if the Sivan Hindu temple introduce the innovation the trustees of the equally wealthy temple of the Natukotta in Sea street "are sure to follow the example set by their more enlightened brethren." There is no question that the coming "Light of Asia" is the electric light. The temple event is one that Siva, when Brahma and Vishnu were absent, would probably have termed Parbutta—auspicious.

CONCENTRIC WIRING.[*]

BY SAM. MAVOR.

It is a characteristic of the business of electric light wiring that it is peculiarly liable to the risks attending bad workmanship. Internal wiring is a comparatively simple matter. Apart from the distribution of lights and arranging the circuits and their routes, it is not work which must necessarily be done by a highly trained and skilled tradesman. On the contrary, any man who can use his hands may with very short experience, learn to joint wires and fix switches, and then call himself a wireman. The inevitable result is that such labor can, and always will, be cheaply purchased.

The business of electric light wiring has thus several features peculiar to it making for unreliable workmanship, which, in the absence of competent supervision and careful inspection, lead to defective work and resulting fire risk. The plumber's and the gasfitter's work is to a great extent self-testing. If a water pipe leaks we see the water, and if a gas pipe leaks we usually smell the gas; but we have no sense—no physiological sense—to enable us to find hidden defects in our electric wiring. A building may be wired in the most dangerously slipshod style, yet the lamps may for years burn none the less brightly, until the latent faults have opportunity to discover themselves.

Insulation tests after the completion of the work, if in dry and well-seasoned buildings, are of little value. The insulation tests of the wiring of an old building might show results three or four times higher than the most stringent rules require, and yet there might be a score of dangerous defects only awaiting opportunity to develop. No tests can be applied for the detection of these defects after the work is completed and covered in. When the prices of experienced contractors estimating for wiring work to a carefully drawn up specification vary, as we know they do, it is not strange that inexperienced contractors tendering in the absence of a specification, and without the prospect of any supervision, should quote prices which would not purchase suitable materials alone. These are matters of primary importance to the fire insurance companies, and they are much too lax in looking to their interests in this regard. Bad work is being carried out every day, and the insurance companies are complacently taking the risk.

There is a steadily growing dissatisfaction with the generally adopted practice of enclosing the conductors in wood casings, and a steadily growing conviction that something better might be done. When the usual double wiring is carried out in situations where moisture charged with acid from cemented or plastered walls of interiors, or in such buildings as paper mills, wet spinning mills, dye houses, breweries, distilleries, chemical works, and the like, the destruction of the insulation is only a matter of time, and the casing, by harboring the moisture around the conductors, hastens the process. After the insulation has broken down, electrolysis, assisted by the acidulated moisture, takes place, and deposits away the copper of one of the conductors, with the consequent risk of heating and ultimately of sparking. The presence of moisture being a necessary condition of the development of such faults, the dampness of the surroundings of the conductors greatly reduces the danger of fire, but that the risk is not absent is proved by the charred and burned casing or woodwork found at such places. It must be remembered, however, that heating due to diminished section of the conductor may occur at a time when the moisture which caused the fault has disappeared, and this is a danger which no amount of fuses will modify. How can you ensure that your wood-cased conductors shall never be subjected to such conditions? And how many of your average wireman's joints would stand 24 hours' immersion in water or soaking in moisture? The miserably futile expedient of attempting to waterproof the casings with putty and varnish is sometimes resorted to; such makeshifts are too childish.

Lead-covered conductors are occasionally used where much moisture has to be encountered. But these for double wiring are a mistake, unless the positive and negative wires are both enclosed in the same lead sheathing. The objection to separate lead-covered conductors is that, if there should be an earth or leak on the negative wire, and the lead and insulation of the positive wire become punctured at a damp situation, the lead becomes charged positively, and will be deposited away over its whole length where moisture is present to assist electrolysis.

After wood casing, with its perviousness to moisture and other attendant disadvantages, the biggest blot on existing practice is the indiscriminate use of fuses. Some insurance people, and wiring contractors too, imagine that the risk of fire varies inversely as the number of fuses. The contrary is more near the truth. Fuses are not only a nuisance, they are apt to be a positive source of danger. The smaller number of fuses used the better; but they must be absolutely reliable, well mounted, and well placed.

It is with a sense of relief that one turns from double wiring and all its attendant ills to the simple mechanical and straightforward methods of concentric wiring with an uninsulated outer conductor. So far as the writer is aware, no system of concentric wiring in which both the inner and outer conductors are insulated has ever been used for indoor work. It appears probable that the difficulties in the way of designing junctions, switches, and other accessories which shall meet the electrical and mechanical requirements within moderate dimensions and at reasonable cost, will prevent the introduction of such a system. Two and three wire concentric cables with each conductor insulated are largely used as mains in connection with two and three wire systems, but in such cases there is no difficulty in providing junction boxes of adequate size. The only system of concentric wiring which has been adopted for internal use has an uninsulated outer conductor, and it is this system that is known as "Concentric Wiring." It is important that it be clearly understood that concentric wiring is not "single wiring," but is something essentially different. This distinction between concentric wiring and single wiring is necessary, because the two have been frequently confused. No method of wiring merits the title "concentric" which is not consistently concentric throughout. In a concentric system the central conductor must be everywhere surrounded over its insulation by a metallic sheathing of conductivity equal to or greater than the core. The switches and fuses should be in the central wire and enclosed in metal cases. These cases or boxes should be electrically and mechanically jointed to the outer conductor and so form part of the continuous metallic envelope in which the central conductor is enclosed.

It has been stated that, owing to one conductor being already earthed, the liability to complete breakdown of the insulation is doubled. This might be true of double wiring, but is certainly not true of concentric. The outer conductor being already at earth potential, there cannot be any risk whatever of shock or spark being experienced from it. There is thus only one vulnerable conductor, and this, with its insulation being encased throughout its entire length in the metallic sheathing formed by the outer conductor, is well protected against injury. The consequences of injury to concentric and to double wiring are essentially different. In the case of the concentric conductor, if it should be crushed or a nail be driven into it, the instantaneous result is a dead-short circuit and the melting of the fuse. If the insulation should be punctured and moisture gain access, the distance across the insulation between the conductors is so small that the fault immediately develops into a short circuit, and the spark passes from the center conductor to the inner surface of the metallic sheathing, and being entirely within the sheathing it cannot communicate fire to its surroundings. Concentric conductors are thus self-testing. Faults cannot endure. They cut themselves out automatically. Or, rather, this is what they would do if faults were experienced, but we never have faults in lead-covered concentric conductors. In concentric wiring there is only one cable to handle instead of two, and this carrying its own protection the necessity for wood casing is abolished.

Perhaps the most conspicuous advantage of concentric wiring is that it may be so easily and so effectually made waterproof. The cables may be enclosed in lead sheathing laid under or over the outer conductor, and hermetically sealed to the various apparatus into which the cables are led. This must appeal to all those who have had a varied experience of wiring.

The next important advantage to be claimed is the large reduction in the number of fuses. The drastic method of abolishing fuses is to maintain the section of the conductors. This can readily be done in concentric wiring to an extent impracticable in double wiring. Conductors of much larger section may be conveniently and safely led into lamp-holders, ceiling roses, and wall sockets, than is possible in double wiring. And thus, by maintaining the section of conductors right into the lamp-holders, many of the objectionable fuses are abolished.

The more difficult the wiring of a building appears to be, the more favorable is the comparison to concentric wiring. The iron roofs, concrete floors, moisture, and other ills that vex the spirit of the double wirer, have no terrors for his concentric friend. For wiring in any situation, from collieries to boudoirs, where difficulties of erection have to be faced, or in situations where the conductors, etc., after erection must endure excessive heat or cold, moisture, acid vapor, or inflammable dust, concentric wiring meets the case. Concentric wiring has this further advantage—that a very simple and easily followed set of rules can be framed which are applicable to wiring to be carried out under widely differing conditions.

For mining work concentric wiring is specially adapted. The mechanical nature of the fittings and the ease with which they and the conductors may be made waterproof are important features. A concentric cable for mining purposes is more safe than two separate cables. A fall of material from the roof may rupture one or two conductors, and if current is passing the inevitable result is a spark at the point of parting. In fiery mines this may have serious consequences. With a concentric conductor, however, the fall would crush the outer conductor in upon the core, and so cause a dead short-circuit and melt the fuse before the cable parted. The spark would thus take place at the fuse at the pit bank.

With regard to the wiring of ships, it is well known that an essential condition of durable wiring is that it shall be water-proof throughout. The Admiralty still adhere to double wiring owing to fancied danger of compass disturbance from concentric wiring. That well-arranged concentric wiring has no effect whatever upon the compasses of a ship has been proved by the most careful tests. The waterproof qualities of concentric wiring and the safety from fire which it ensures peculiarly adapt it for use on board ship.

And now with regard to possible electrolysis due to difference of potential along the outer conductor. In isolated installations where the distances are short the question of electrolysis may be dismissed as having no bearing. In cases where the distances are considerable the risk of electrolysis may be entirely avoided by adopting very simple precautions. The first of these is to so proportion the conductivities of the inner and outer conductors that the fall in volts shall be nearly all in the inner conductor; the copper

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[*] Abstract of Paper read before the London Institution of Electrical Engineers, November, 1895.

saved from the inner conductor being added to the outer in order to reduce to a minimum the difference of potential between its ends. Another method adopted by the writer is to provide between the outer conductor and its lead sheathing a very light insulation, and to earth the outer conductor only at the distant end.

In dealing with distribution for electric lighting purposes we do not have to contend with such large differences of potential at different points of the system, and the difficulties are not at all comparable with those encountered in street car work. A three-wire system with the middle earthed, and concentric wiring on each side with the sheathings connected to the middle wire, is an ideally safe and reliable system of distribution. In a well-balanced three-wire system the fall of volts along the middle wire is negligible, and there is therefore no danger of electrolysis. No disturbance to telephones could take place. Stray currents passing between faults in the conductors would be impossible. The positive and negative conductors being each surrounded by an earthed sheathing, no current can escape from them. Leaks in concentric cables will not endure. The distance between the inner conductor and its sheathing being only the thickness of the insulation, a fault develops at once into a short-circuit which is internal to the sheathing of the cable, and the fuse at once comes into operation. But it must be repeated that faults are much less liable to occur in concentric cables than in double wiring. The importance and safety of the self-testing properties of concentric wiring must be obvious.

BOOK REVIEWS.

Electrical Engineering Leaflets. By Professor E. J. Houston, Ph. D., and Professor A. E. Kennelly, F. R. A. S. Three volumes: Elementary Grade, Intermediate Grade and Advanced Grade. Each 280 pages, 8vo., at $2.00. New York: *The Electrical Engineer*.

The preface indicates the scope of these works so well that we quote it in full:

> The Electrical Engineering Leaflets have been prepared for the purpose of presenting, concisely but accurately, some of the fundamental principles of electrical science as employed in engineering practice. They have been arranged under three grades: namely, the Elementary, the Intermediate, and the Advanced.
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> The Elementary Grade is intended for those electrical artisans, linemen, motormen, central station workmen, or electrical mechanics generally, who may not have advanced sufficiently far in their studies to warrant their undertaking the other grades. Here the mathematical treatment is limited to arithmetic, and the principles are illustrated by examples taken from actual practice.
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> The Intermediate Grade is intended for students of electricity in high schools and colleges. In this grade a certain knowledge of the subjects of electricity and physics generally is assumed, and a fuller mathematical treatment is adopted. These leaflets, moreover, contain such information cencerning the science of electricity as should be acquired by those desiring general mental culture.
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> The Advanced Grade is designed for students taking special courses in electrical engineering in colleges or universities. Here the treatment is more condensed and mathematical than in the other grades.
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> Although the three grades have been especially prepared for the particular classes of students referred to, yet it is believed that they will all prove of value to the general reading public, as offering a ready means for acquiring that knowledge which the present extended use and rapidly increasing commercial employment of electricity necessitates.

These leaflets were originally issued by numbers from the press of the *Electrical Engineer*, and in that form proved so popular among electrical students as to cause them to be put in more permanent form in binding. The language is simple and direct and well adapted to the wants of the several grades of students for which they are intended. The reputation of the authors is such as to inspire confidence that the statements are rigidly accurate, and in most cases we find them so.

One or two minor lapses are, however, noticed. One of these will be found on pages 58 and 59 of the Intermediate Grade, where the "Municipal" series system is wrongly described and wrongly illustrated in diagram. As given, it is a simple straight series arrangement, whereas the "Municipal" series was a multiple series arrangement.

The most serious defect of this otherwise admirable treatise is the incorporation of many technical terms originated by the authors themselves and not in general use. Without attempting at this time to discuss the value of this new coinage, we think there can be no question as to the impropriety of the attempt to force these unused terms upon the readers or students of the books.

Modern Examinations of Steam Engineering, or Practical Theory Explained and Illustrated. By W. H. Wakeman. Cloth, 8vo. 272 pages. Bridgeport, Conn.: American Industrial Publishing Company.

The long-continued and well-directed efforts of the author for the elevation of the position of the practical engineer will certainly meet with substantial reward when the scope and character of this work become fully known. While the book is essentially a manual intended "to give information to those engineers who wish to qualify themselves to pass examinations and take out licenses to run stationary engines in those localities where such examinations are required," it is valuable as a text book for all those wishing to become better informed about the construction, operation and care of steam engines. There is almost an entire absence of abstruse mathematical data, the treatment of all subjects being plain and practical, so as to be readily understood.

This little volume will very materially assist any energetic fireman or engineer who desires to become more proficient in his work, as well as to become more valuable to his employer, to gain an accurate and comprehensive knowledge of the practical theory of the steam engine and its accessories.

SOCIETY NEWS.

American Institute of Electrical Engineers.

By direction of the Committee on Papers, Meetings and Editing, the meeting of the American Institute of Electrical Engineers scheduled for December 18 will be omitted. Due notice will be given as usual of the January meeting. Members are requested to notify the secretary at once of any recent change in address, as a new catalogue is in preparation to be printed in the December issue and also incorporated in the bound volume of 1895.

The Chicago Electrical Association.

The first meeting of the Chicago Electrical Association, held on the 6th inst., was well attended. The meeting was devoted to a discussion of the outlook for junior electrical societies, or societies composed wholly of young men who are anxious to exchange information on electrical topics. The paper of the meeting was entitled "Our Electrical Association," read by Albert Scheible, manager for George Cutter, Chicago.

The topics and leaders for subsequent meetings are as follows:

December 20—"What Next in Electric Railway Work?" J. B. Cravath, Electrical Editor *Street Railway Review*.

January 3—"The Protection of an Invention." W. Clyde Jones, with Barton & Brown, Patent attorneys.

January 17—"Armature Windings for Multipolar Generators." F. A. Muschenheim, designer for Western Electric Company.

February 6—"Lightning Arresters." W. R. Garton, manager Electric Railway Department, Central Electric Company.

February 20—"The Outlook for Electrochemistry. Bertrand S. Summers, chemist Western Electric Company.

GENERAL NEWS.

What is Going On in the Electrical World.

Dardanelle, Ark.—An electric light plant is soon to be added to the improvements now under way in this town.

Bluefield, W. Va.—Contracts are being let for the construction of an electric railway between Bluefield and Graham.

Salem, O.—The Salem Electric Light & Power Company and the Salem Electric Railway Company have been consolidated.

Rome, Ga.—The Rome electric light plant has been sold for non-payment of taxes, and was bid in by Capt. N. H. Bass for $3,000.

Caseville, Mich.—The Caseville Electric Lighting Company has been organized to put in a plant to furnish public and private lighting in this town.

Sharon Hill, Pa.—The council has passed to a third reading an ordinance relating to the issuing of a contract for lighting the village with electricity.

Utica, N. Y.—The common council has appointed a special committee to inquire into the feasibility of the city's owning and operating an electric light plant.

San Bernardino, Cal.—The Santa Fe Railroad Company is planning to have the street car line connecting with its depot run by electricity instead of horse power.

Bath, N. Y.—The management of the Bath & Hammondsport Railway Company are reported to be considering the advisability of substituting electricity for steam.

Hampton, Va.—A survey is being made for a new electric railroad from Hampton to Buckroe, on Chesapeake Bay, where it is proposed to put up a large summer hotel.

Pensacola, Fla.—An ordinance granting Sterritt Tate and his assigns a franchise for an electric street railway in this city has been referred by the council to the city attorney.

Bowdle, S. D.—A company, composed of Clark Hudson, W. W. Brant and the Bowdle Milling Company, has been formed for the purpose of putting in a system of electric lights in this city.

Greenville, N. C.—The proposition of the Greenville Lumber Company to put in an electric light-plant if the town would rent light for the streets has been accepted by the town council.

Nacogdoches, Tex.—R. C. Shindler, the founder of the electric light plant which has just been put in operation here, was honored by a musical serenade on the night of the opening.

Holyoke, Mass.—The Connecticut River Manufacturing Company has ordered an electric plant for 500 lights, arc and incandescent, from the Westinghouse Company's Boston branch.

St. Johnsbury, Vt.—F. C. Kennedy and J. S. Pierson, of Burlington, have been visiting St. Johnsbury in the interest of the proposed electric street railroad and found the people enthusiastic in its favor.

Portland, Ore.—As soon as the city council grants the Portland Traction Company the necessary permission to change the power used in operating its cable road, the work of electrifying the line will be commenced.

Canton, O.—The county commissioners are considering the advisability of putting in an electric light plant at the workhouse, for the purpose of furnishing that institution, the court house and the county jail with light.

Ladonia, Tex.—A stock company, capitalized at $10,000, has been organized here to put in an electric light system. The stockholders are T. V. Richards, J. W. Nail, D. E. Wagoner and J. A. Jackson, all of Ladonia.

Port Jervis, N. Y.—The board of trustees have set January 6 for a hearing relative to the application of the Port Jervis Electric Street Railway Company for a franchise to run electric cars in certain streets of this village.

Whitestone, L. I., N. Y.—Water Commissioner Joyce has a scheme to put in and operate an electric lighting plant in connection with the local water works which will probably be adopted. The present gas lighting contract expires December 31.

Princeton, Ind.—The Princeton Interurban Electric Railway Company, composed of St. Louis, Chicago, Louisville and local capitalists, propose to establish an electrical street railway system in this city, and have applied to the council for a twenty-year franchise.

Leadville, Col.—The Citizens' and the Leadville electric light companies have consolidated, and there is now but one electric light company in this city. The stock of the new company, $150,000, has been divided equally between the holders of the old companies.

Newark, N. J.—The People's Electric Light and Power Company of Newark, which recently secured control of the Newark Electric Light and Power Company has acquired a controlling interest in the Essex County Electric Light and Power Company of Orange.

Elizabeth, N. J.—The Mutual Investment Company is the name of a concern recently organized here for the purpose of placing electric light plants, railways, etc., in Mexico and Central America. John W. Rehill, William F. Stryker and James P. Powers are the promoters.

Kingston, N. Y.—The Colonial Electric Street Railway, which has been in the hands of receivers, has been sold at judicial sale by the referee, John F. Cloonan, for $70,000 to Charles Stewart Davidson, of New York City, who represented a committee of the first-mortgage bondholders.

Bennington, Vt.—The Bennington and Woodford Electric Railway Company has decided to expend $20,000 in extending the line from Camp Comfort in Woodford to "the forks" of the Roaring Branch in Glastenbury, four miles and a half, and in fitting buildings for a summer resort.

Alameda, Cal.—The Alameda city electric light plant is to be increased by the first of the new year by the addition of a 350 horse-power engine and three boilers and dynamos sufficient to give 3,500 additional incandescent lights besides the 1,200 now in use. A few more arc lights will also be added.

New Castle, Col.—The town board recently passed a resolution declaring the need of an electric light plant. Samuel Wraith is chairman of the committee to secure information as to cost. A thousand lights will be used. In the event of satisfactory bids not being offered the town will put in its own plant.

Greensburg, Pa.—A new electric car line is projected here by Hugh Keogh, a contractor of Lancaster; Samuel A. Miller and Edward Saxman, of Latrobe, and some Pittsburg capitalists. It will be run from Derry to Latrobe, touching Youngstown, Whitney, Lippincott furnaces and St. Xavier Academy.

Sunderland, Mass.—The Worcester Construction Company has given an estimate of $75,000 as the cost of building an electric road from Mill Valley to Sunderland. A meeting of those interested in the proposed road has been held, at which a committee, consisting of H. M. McCloud, W. D. Cowles, and H. L. Ufford, was elected to solicit subscriptions.

Sherman, Tex.—It is stated that a prominent syndicate in Ohio is making investigations as to the feasibility of building an electric line between Sherman and Denison, and it is known the right of way can be easily secured. The population of the two cities and a quarter of a mile of territory each way from said proposed line will approximate 35,000.

St. Paul, Minn.—The committee on transportation of the Chamber of Commerce has been directed by that body to inquire into the desirability and practicability of a rapid transit electric line between St. Paul and Minneapolis that shall make few stops, and shall run from the center of one city to the center of the other in not more than thirty minutes.

Ipswich, Mass.—There is a good prospect of an electric road being built before many months that will connect Ipswich with Gloucester and Beverly by the way of Essex. A hearing before the citizens of Ipswich on the petition of the Gloucester, Essex & Beverly Street Railway Company to lay tracks from Essex to the center of Ipswich will be held in the town hall December 27.

Omaha, Neb.—During the past year there have been no fires here traced to electric wires, and in the opinion of the councilmen and others who have taken an interest in the matter a great deal of credit should be given to the present city electrician, Mr. Schurig, who has insisted that all new work put in shall comply strictly with the law and has caused a great deal of defective wiring to be removed.

Edgartown, Mass.—The Martha's Vineyard Street Railway Company, recently incorporated, will petition the next Legislature for authority to build and operate an electric road uniting Edgartown, Cottage City and Tisbury. The promoters of the company are John R. Graham, John A. Dugann, Fred H. Smith, Josiah Quincy, Fred Nichols, William A. Gallivan, John F. Merrill and others.

Washington, D. C.—One of the stockholders of the new Columbia and Maryland Railway expresses the belief that "this line is the American pioneer of electric trunk-line railroads. It is the nucleus of a great system which will connect New York and New Orleans." The primary purpose of the company named is to build an electric road from Baltimore to Washington. Thomas M. Lanahan, of Baltimore, is president.

Hackettstown, N. J.—Surveys are being made for the route of a proposed new trolley line to connect Valley, on the Lehigh Valley Railroad, with Lake Hopatcong. This road will be built by the Lehigh Valley Railroad as a competitor of the New Jersey Central's branch, which connects with the main line at High Bridge. The road will be about twenty-five miles long, and will run through Washington and Hackettstown. The right of way for nearly the whole course has been secured.

Lowell, Mich.—The common council has appointed a committee to ascertain the probable cost of the construction and equipment of an electric plant for light and power. The committee, it is thought, will report it less than $23,000, which is within the bonding power of the city.—The Lowell Water & Light Company have nearly completed their transmission plant and will soon be able to furnish electric light and power for Grand Rapids.

Anderson, Ind.—The bids for the construction of the Gas Belt Electric Railway were opened on the 8th inst. It is specified that work on the road must begin the first of the year. The route, when completed, will include Indianapolis, Anderson, Muncie, Marion, Elwood, Alexander and other gas belt cities. The equipment will be adapted to freight and express traffic. Congressman Henry, of Anderson, is one of the chief promoters of the road.

Detroit, Mich.—Mayor Pingree, who has been conducting a red-hot campaign against the Citizens' Railroad Company because it has failed to fulfil its promises of a reduced car fare, was put off a car of the company a few days ago on his refusal to pay the full fare. The conductor who performed the feat was a black man and the mayor offered little or no resistance. His friends say he didn't care to carry the war into Africa.

South Bend, Ind.—The court has approved the sale of the South Bend & Mishawaka electric railroad to George E. Clifford, president of the Wachusett National Bank, of Fitchburg, Mass. The road includes the electric railroad system of South Bend and the four-mile road running up to Mishawaka on both sides of the St. Joseph river. The price paid was $50,000. Mr. Clifford intends to add materially to the equipment of the road and improve it in every respect.

Jersey City, N. J.—The People's Electric Light and Power Company of Newark has been awarded the contract for the electrical portion of the city lighting. The bid of the company was $90 per annum for each of the 340 arc lights.—The street railway system of the Consolidated Traction Company is about completed. The road from Jersey City to Bloomfield on the north, Elizabeth on the south and the Oranges on the west, measures about 175 miles in all.

Tacoma, Wash.—H. L. Thomas, of Seattle, intends to apply at once to the council for a franchise for a double-track broad gauge electric railroad across the bridge and to the city limits towards Seattle. Application has been made for a similar franchise in Seattle. Mr. Thomas said that a strong company was being organized to build a double-track electric road between Tacoma and Seattle. The line will be called the Seattle, Tacoma & Portland Electric Railway, the company desiring to ultimately complete it to Portland.

Taunton, Mass.—The Fall River and Taunton Street Railway Company has petitioned for an amendment to its charter which will extend its rights as a corporation to July 1, 1903, and which will permit it to build and operate a street railway between New Bedford, Freetown, Acushnet, Berkley and Taunton. Wm. M. Butler is president of the company, and among the railway men interested are Abbott P. Smith, Charles E. Cook and E. P. Shaw of Boston, and Major Pond of New Haven.

Kansas City, Mo.—The plant, property and good will of the Franklin Electric Company of this city has been sold to Hodge, Walsh & Loring, who will conduct the business at the old stand. R. W. Hodge, the head of the firm, is the son of R. H. Hodge, president of a bank at Brunswick, Mo., and is himself a graduate of the electrical engineering department of the University of Missouri; J. E. Walsh has been connected with W. T. Osborne in practical electrical work, and H. L. Loring has had charge of the Franklin Company's construction work for four years.

Philadelphia.—Proposals for furnishing electric lights for the city next year will be received until December 23, on which day the bids will be opened. There are at present 6,228 electric lights paid for by the city, eighty-three furnished for street lighting free by the companies and fifty paid for by the Girard estate. In the estimates furnished the Finance Committee a short time ago there was an item of $50,000 for new lights for next year. It has been intimated that this will not be allowed, and that the regular appropriation for lighting the city will be cut down.

Orange, N. J.—A story is current here that Thomas Nevins, a railroad contractor of this town, has purchased Killeen Castle, in County Meath, Ireland, and has secured a contract to build trolley lines in that part of the county in which his newly acquired property lies. In consideration of the franchise granted to him Mr. Nevins agreed to carry people free for a year, and to give a bond of $100,000 that he would faithfully carry out his contract. It may be proper to add that the offer was made and accepted at a banquet at which Mr. Nevins and members of the town corporation were guests.

Chicago.—Richard E. Sherman, an electrician of this city, has invented and patented a new underground trolley system which, he asserts, will soon be in operation on one of Mr. Yerkes's roads. He says Mr. Yerkes has examined the working model and pronounced it the most practical he has seen in his experience, and has promised to give it a trial.—Referring to the best methods of rapid transit, the statement is made that during the terrific storm of November 25 in this city, the Metropolitan Elevated Railway, which is operated by electricity, experienced practically no delays, while all the other roads were blocked for hours.

New York.—The White Locomotive Works intends to erect a large plant near this city for the manufacture of a new freight locomotive, the invention of Walter W. Scott, of Buffalo, which can be adapted for electrical driving power. Tests of the new machine are said to have shown that it effects a saving of 25 per cent. in fuel and can haul 25 per cent more freight than the ordinary locomotive.—The Manhattan Athletic Club has purchased its club house for a sum stated to be $500,000. The building is to be immediately supplied with a new electric light plant.—The Edison Electric Illuminating Company of New York reports for November: Gross earnings, $179,599; increase, $6,755. Net earnings, $90,755; decrease, $1,739. From January 1 to November 30: Gross earnings, $1,658,976; increase, $165,691. Net earnings, $799,189; increase, $82. 746.

Boston, Mass.—The Brookline Street Railway Company is to be entirely equipped by the Electric Storage Battery Company of Philadelphia. The cars will be 22 feet long and will, it is said, be the most beautiful upon any street railway in America. It is proposed to electrically run, light and heat them by storage batteries. The agreement stipulates that the Storage Battery Company shall operate the road by means of its storage battery system for at least six months to the satisfaction of the owners of the road, and the storage battery people are so confident of the success of their system, which is the same as that now in use upon the Madison and Fourth avenue line in New York, that they will put up a forfeit large enough to cover all costs of the equipment should it prove a failure.

Cincinnati, O.—Mr. Fred Pentlarge, who was appointed a committee by the Board of Transportation to make investigations relative to underground conduits for electric railways, reports that he has been assured by F. Harschitz, M. E., of Vienna and Budapest that he will come to Cincinnati, if his expenses are guaranteed, and undertake the building of an underground conduit electric road that can be operated successfully. Mr. Harschitz built the underground conduit road at Budapest which has been in operation since 1892. The report of Mr. Pentlarge was strongly in favor of the underground conduit system for street railways in this city, and it was approved by the Board of Transportation, who earnestly commended it to the consideration of the street railroad companies, the Board of Administration and the public.

TELEPHONE AND TELEGRAPH.

More Suits by the Bell Company.

The Western Electric Company has brought suit in the United States Circuit Court at Sacramento, Cal., against the Capital Telephone and Telegraph Company of that city for alleged infringement of Leroy B. Firman's patent No. 252,576, dated January 17, 1882, on multiple switchboards, and on the Watson telephone switch patent No. 270,522, of January 9, 1883.

The instruments, 700 in number, used in the exchange of the Capital Company were manufactured and sold by the Columbia Telephone Manufacturing Company, 136 Front street, New York.

The Capital Company, through its attorney, L. T. Hatfield, has filed answer to the bills of complaint in the suits. The answer is a denial of all the specifications in the complaint.

Telephone Conversation as Evidence.

O. A. Cole, an electrician of Stevens Point, Wis., has been subpœnaed as a witness in the famous Stillwell murder case soon to be tried at Bowling Green, Pike County, Mo. When the murder occurred at Hannibal, Mo., December 29, 1888, Cole was connected with the telephone exchange in that city. On the Sunday before the murder Cole was at the switchboard and overheard a conversation between the suspects of the crime, which he leisurely jotted down, thinking probably it would some day be needed. This testimony has never been given to the public and will prove an important factor in the solution of the mystery.

Activity in Western Pennsylvania.

The "Courier," Connellsville, Pa., states that a comprehensive independent telephone system is in course of construction in the southwestern section of that State. The Somerfield Telephone Company, of which Dr. T. J. Jacobs of Somerfield is the leading spirit, is completing a line from Somerfield eastward to the Maryland line. At this point connection will be made with a line now in contemplation from Grantsville and Accident, in Preston County, W. Va. A line is now in operation between Grantsville and Oakland, the county seat of Preston County.

From Somerfield westward, the Somerfield company's line extends to the West Virginia line. Stations will be established at Addison, Somerfield, Jockey Hollow, and Markleysburg, Pa. At the West Virginia line, connection will be made with the Kingwood & Brandonville Telephone Company's line. The Kingwood line will furnish connection with Brandonville, Glade Farms, Kingwood, and thence with Tunnelton, Terra Alta, W. Va., and Oakland, Md. When the line between Grantsville and the Somerfield company's lines is built, which will probably be in the spring, the circuit will be complete. It will include the principal towns in southern Somerset and Fayette Counties, Pa., Preston County, W. Va., and Garrett County, Md.

The Connellsville coke region will eventually be connected with this circuit. There is now a line from Uniontown to Farmington. This line will probably be extended to Brandonville. If it is not, the Somerfield company will extend their line to Farmington in the spring. This will give them a connection with the coke region circuit and with Pittsburg, also with the new line just completed to Morgantown and Fairmount, W. Va.

The Pacific Cable.

The Pacific Cable Company has been incorporated at Albany, N. Y., with a capital of $100,000. The directors are Edmund L. Baylies, H. L. Leroy, C. D. Wetmore, G. A. Mills, Montclair, N. J.; J. M. Robertson and W. H. F. Hughes, of New York, and F. H. Allen, Pelham Manor, N. Y.

Mr. Edmund L. Baylies, has stated that the company would eventually increase its capital stock to $8,500,000 or $10,000,000, and that it intended to proceed with the laying of the cable as soon as the preliminary arrangements had been concluded. The plan contemplates a cable from San Francisco to Hawaii, and thence to Japan and other points on the coast of Asia, with a branch to Australia. The business between New York and San Francisco will be done over leased wires. Steps have been taken to secure the concessions necessary for landing the cable in Hawaii and Japan.

Senator Mitchell, of Oregon, has introduced a bill in the Senate which asks for an appropriation, not to exceed $50,000, to be used for the purpose of constructing a military and commercial telegraphic line along the Pacific coast between Yaquina, on Yaquina Bay, and Port Orford, to connect with Newport, on Yaquina Bay; Alsea Bay; Florence, on Sinslaw Bay; Gardiner, on the Umpqua river; Empire City and Mansfield, on Coos Bay in the State of Oregon.

B. G. Greene, Z. C. Brewster, Willoughby & Fletcher, Carl & Cronk, Thomas W. Robinson, John J. Lillis, Millard D. McNeil, Dr. E. M. Casey, Frederick Rorapaugh, Frank E. Beadle, A. P. Hyde Machinery Agency, Clark L. Webb, F. H. Hendrickson, Charles W. Sherwood and the New York, Ontario & Western Railroad are the parties comprising a co-operative company which has been organized at Oxford, N. Y., to construct a telephone system to connect the New York, Ontario & Western Railroad station, one mile east of the village, with a number of the stores and other business places in town.

The temporary injunction restraining the Wisconsin Telephone Company from erecting poles in the streets of Sheboygan has been continued, thus deciding a case that is of general interest all over the State of Wisconsin. The company is not restrained from operating its telephone line as it exists now, but is prohibited from erecting poles to extend its lines.

At the recent annual meeting of the stockholders and directors of the North American Telegraph Company held at Minneapolis, Minn., the usual semi-annual dividend of three per cent. was declared, after which the old directors and officers were re-elected. The title of H. A. Tuttle was changed from that of general superintendent to general manager.

Mrs. Sarah Lewis, of Sioux City, Ia., who brought suit against the Home Telephone Company of that city for $7.000 damages for injuries sustained by falling head first into a telephone pole hole, has agreed to a settlement upon the payment of $800.

The directors of the American Bell Telephone Company have just declared a regular quarterly dividend of 3 per cent. and 1½ per cent. extra. This makes a total of 15 per cent. declared this year, 12 per cent. regular dividend and 3 per cent. extra, 1½ per cent. being declared June 12.

The directors of the Western Union Telegraph Company have declared a quarterly dividend of 1¼ per cent.

William Blake of Cheboygan, Mich., will build a telephone line between that place and Petoskey, taking in the villages of Millet Lake, Topinabee, Indian River and possibly Wolverine.

The Buffalo "News" says that the poor service of the Bell Company in that city is "driving the patrons crazy."

During the fiscal year just ended there have been 31 telephone and telegraph companies chartered in Ohio with an aggregate capital of $780,500.

N. H. Egleston, Jr., has asked for the right to establish a call and messenger service in Augusta, Ga.

A new telephone system is being constructed in Dover, Del.

The Home Telephone Company of Jersey City, N. J., has applied to the street and water board for permission to lay conduits and erect pole lines.

By order of the court, the Independence Telephone Company's exchange and toll lines at Independence, Kan., will be sold at public sale, December 19.

W. W. Rider, formerly manager of the Mutual District Telegraph Company, New York, has been appointed manager of the Central Union Telephone Company at Indianapolis, Ind.

The board of police commissioners of Albany, N. Y., is considering the advisability of equipping the second police precinct of that city with a signal service.

The United Telegraph, Telephone and Electric Company expects to have its new exchange in Hyde Park, Chicago, in operation by January 15 next.

By the completion of 130 miles of line La Crosse, Wis., has been added to the exchanges of the Northwestern Telephone Company.

E. J. Foote has leased the Luray & Sperryville Telephone Company's lines, connecting Luray and Sperryville, Va.

The toll lines of the new telephone at Wausau, Wis., are to be extended to Grand Rapids, Wis., via Marshfield.

New Companies Incorporated.

The Simplex Telephone Company, of Cincinnati, O., has increased its capital stock from $5,000 to $6,000.

The Rochester Telephone Company, Rochester, Ind., has been incorporated with a capital stock of $10,000. It will operate telephones in the counties of Fulton, Marshall, Wabash, Kosciusko, Pulaski, Starke, Cass and Miami.

The Farmington Telephone Company, Farmington, Ia. Capital stock, $1,000. The incorporators are G. R. Neff, president; W. H. Thero, vice-president, and C. L. Paisley, secretary and treasurer.

A. M. Temple, R. J. Pratt, David Caulkins, J. N. Davis and others of Kansas City, Mo., have incorporated the Kansas City Telephone Exchange, with a capital stock of $200,000, to manufacture telephone instruments, etc.

"The Card" Multipolar Series Reversible Mill Motor.

For operating heavy machinery in rolling mills, foundries, and particularly for swing bridges and traveling cranes—in fact all places where a strong, simple and serviceable machine is required, no power can be more adaptable than the electric motor.

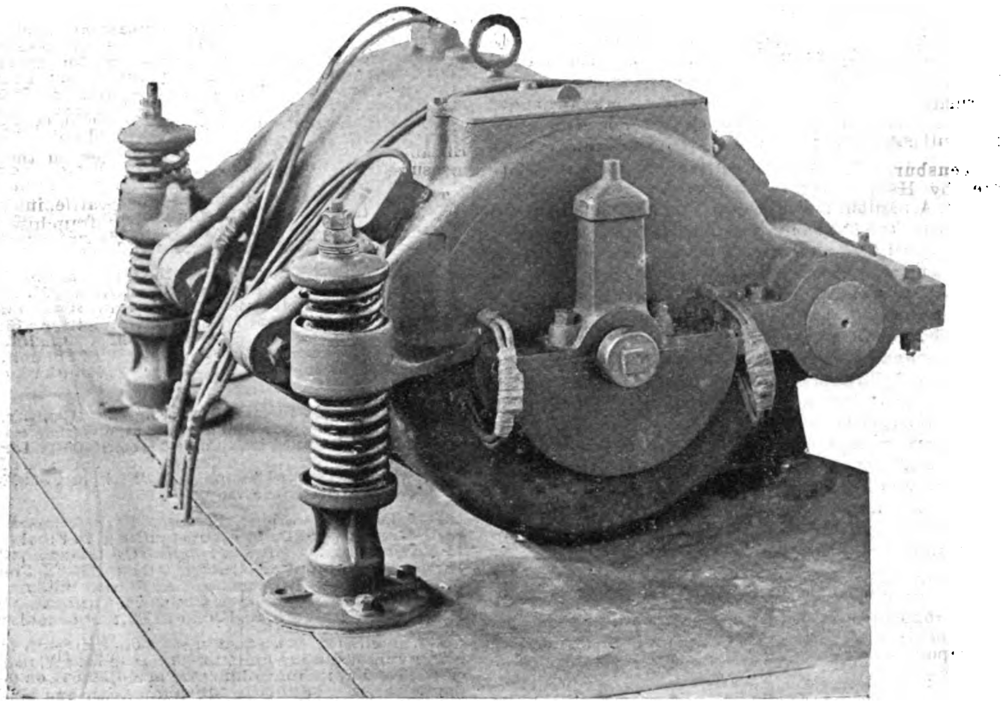

Fig. 1.—"Card" Mill Motor.

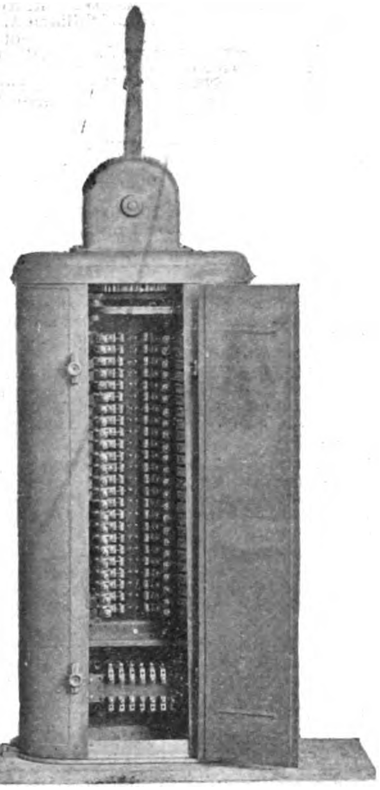

Fig. 2.—"Card" Controller.

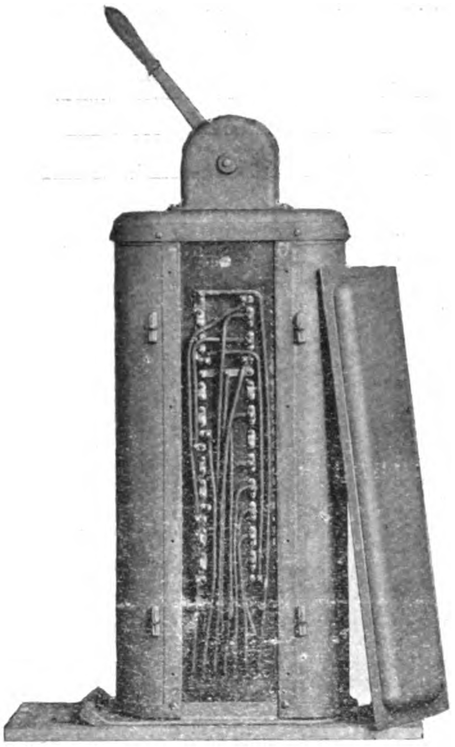

Fig. 3.—"Card" Controller.

The accompanying cuts, Figs. 1, 2 and 3, show "The Card" Series Reversible Multipolar Motor and Controller manufactured by the Card Electric Company, Mansfield, Ohio.

Fig. 1 shows the motor completely enclosed and can be used in places where the open type of motor would soon be destroyed. This motor, in connection with the improved controller and current regulator, makes a very desirable outfit for operating traveling cranes, turn bridges, hoists, bending rolls and other kinds of machinery which require various speeds in either direction. Attention is called to the method of mounting this motor for general work. The front of the motor is supported on a cast iron stand rigidly fastened to the bed-plate of the machine or other foundation, with trunnions on each side of the upper part taken through suitable bearings on the motor case, forming a pivot for the motor to swing on. The rear part of the motor is supported on springs at each side, with springs above, held in compression by bolts through the pedestals which support them and which are also fastened to the bed-plate. The object of this arrangement is to provide a flexible support for the motor and a cushion for the gearing when heavy loads are thrown on the motor or the direction of rotation is suddenly reversed. In practice it has been found to work admirably, and, in addition to saving the gears, gives the motor a noticeable advantage in starting heavy loads at slow speed. Where the conditions are such that the spring suspension is not advisable, brackets are provided on the motor for bolting to the bed-plate or foundation, rigidly.

To satisfy the class of work for which this motor is designed, nothing but the best material can be used with safety and the construction must be as thorough and complete as it is possible, with modern machine tools, to make it. Special pains have been taken in the design to provide large bearings for the armature shaft and other parts subjected to strains and wear, and allow in every part a generous excess of metal for mechanical strength and as a factor of safety electrically.

Fig. 2 shows the controller with the lever in a vertical position for current "off" and the door open, exposing the mechanism for regulating the current.

Fig. 3 shows the back removed, exposing the wiring and connections to contact fingers.

The controller is strongly put together and finished with iron filter or japan as desired. The working parts have received the most careful attention. They are practically self-contained, and with the exception of the operating lever are fastened to a back made in one piece which can be removed from one case to another without disturbing any of the parts.

Each controller is provided with two revolving cylinders, geared together and operated by the lever at the top, on which are fastened a series of contact rings. The one at the right is used exclusively for opening and closing the circuit and has 24 contacts. These contacts are so arranged with reference to the motor winding that arcing is impossible. A separation of 1-16" between rings and contact arms will open the circuit without carrying current across. The cylinder at the left carries the reversing rings and others for regulating the flow of current through the motor. Of these there are 10, and the resistance between them is so proportioned that no spark follows when a change is made, no matter how slowly the lever is moved. Near the bottom of the controller are a series of binding-blocks for making connection to the motor, current regulator and the line. These binding-blocks are plainly marked with letters and figures and correspond with others on the motor and regulator. With each controller is sent a diagram of the wiring. The cylinders for starting and regulating the current are compact and strong, with ample insulating resistance for use on any circuit up to and including 500 volts, and has sufficient metal in the contacts to carry a large excess of current without heating.

A complete installation of the above-described apparatus driving bending rolls will be illustrated in one of the succeeding issues of ELECTRICITY.

To Take Care of Growing Business.

At the annual meeting of the board of directors of the Phœnix Carbon Manufacturing Company of St. Louis, Mo., held on the 10th inst., it was unanimously decided, in view of the constantly increasing demand for Phœnix products, that the capital stock of the company be increased from $100,000 to $250,000. The increase of capitalization will be paid in at once and used for extension and enlargement of the present plant and to give better facilities for the growing business.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

DECEMBER, 1895.

DATE	LIGHT.	DATE.	EXTING.
1	4.10 A. M.	1	6.00 A. M.
2	No light.	2	No light.
3	"	3	"
4	5.00 P. M.	4	8.00 P. M.
5	5.00 "	5	9.00 "
6	5.00 "	6	10.10 "
7	5.00 "	7	11.30 "
8	5.00 "	9	12.40 A. M.
9	5.00 "	10	1.00 "
10	5.00 "	11	1.50 "
11	5.00 "	12	3.00 "
12	5.00 "	13	4.20 "
13	5.00 "	14	5.30 "
14	5.00 "	15	6.20 "
15	5.00 "	16	6.20 "
16	5.00 "	17	6.20 "
17	5.00 "	18	6.20 "
18	5.00 "	19	6.20 "
19	5.00 "	20	6.20 "
20	8.00 "	21	6.20 "
21	9.10 "	22	6.20 "
22	10.10 "	23	6.20 "
23	11.00 "	24	6.20 "
24	11.00 "	25	6.20 "
25	...... "	..	....
26	12.10 A. M.	26	6.20 "
27	1.10 "	27	6.20 "
28	2.10 "	28	6.20 "
29	3.20 "	29	6.20 "
30	4.20 "	30	6.20 "
31	No light.	31	No light.

INCORPORATIONS.

The Charleston Electric Railway and Power Company, Charleston, W. Va.—to own, operate, etc., lines of street railway, plants, etc., supply water, electricity, gas and other illuminating substances, motive power, etc. Capital stock, $500 minimum, $500,000 maximum. Promoters: Neil Robinson, F. L. Buttrick, D. W. Patterson, F. H. Markell, Charleston.

The Ohio Light, Heat & Power Company, Van Wert, Ohio—to manufacture and vend gas and electrical current for light, heat and power. Capital stock, $10,000. Promoters: C. L. Marble, Jno. E. Marble, Geo. Hayler, Jr., O. D. Swartout, Jno. B. Stevenson, Jr.

The Mutual Union Investment Company, Elizabeth, N. J. —to manufacture and supply electric light and power for all purposes, etc. Capital stock, $100,000. Promoters: Wm. S Stryker, Jno. W. Rehill, Somerville, N. J.; Jas. P. Powers, Elizabeth.

The following companies were recently chartered at Harrisburg, Pa.: The Ashley Light, Heat and Power Company, of Luzerne county, capital stock $50,000; the Sugar Notch Light, Heat and Power Company, of Luzerne county, capital stock $20,000; the Warrior Run Light, Heat and Power Company, of Luzerne county, capital stock $10,000; the Citizens' Avoca Light and Power Company, of Luzerne county, capital stock, $20,000. The incorporators in each of these four companies were the same, viz., Geo. McDonald and Geo. W. Milnes, Scranton, Pa.; John S. McCroarty, Wilkes-Barre, Pa.

The Boynton Bicycle and Traction Company of France (incorporated in W. Va.), New York, N. Y.--to acquire letters patent for appliances, devices, etc., for generating light, heat and power, etc., by electricity, steam, etc.; constructing railways in France. Capital stock, $10,000 minimum, $5,000,000 maximum. Promoters: Jose F. de Navarro, Thos. E. Sotolongo, Mariano de Cossio, Geo. R. Cullingworth, New York City.

The Boynton Bicycle Traction Company of Spain (incorporated in W. Va.), New York, N. Y.—to acquire letters patent, etc., for appliances, devices etc., for generating light, heat and power by electricity, steam, etc.; construct railways, etc. Capital stock, $10,000 minimum, $5,000,000 maximum. Promoters: Jose F. de Navarro, Thos. E. Sotolongo, Mariano de Cossio, Geo. R. Cullingworth, New York City.

The Charleston Traction, Light & Power Company, Charleston, W. Va.—to purchase, own, etc., lines of street railway, waterworks, furnishing, selling water, electricity, etc. Capital stock, $500 minimum, $500,000 maximum. Promoters: W. A. MacCorkle, Malcolm Jackson, M. M. Williams, A. W. Watrous, Charleston, W. Va.

The Atlanta, Knoxville & Northern Railroad Construction Company (incorporated at Albany, N. Y.)—to purchase, sell and otherwise deal in railroads and railroad equipment in the city of New York and in the States of Georgia, Tennessee and North Carolina. Capital stock, $92,500. Directors: Charles E. Kimball, of Summit, N. J.; Matthew F. McLanahan and George D. Mumford, of New York City.

The Port Jervis Electric Street Railway Company, Port Jervis, N. Y.—to build and operate an electric street railway seven miles in length. Capital stock, $70,000. Directors: Lafe Pence, George N. McKibben, New York; S. D. Lake, A. G. Haines, George Elston, J. E. Wickham, J. S. March, H. J. Cox and Theodore Shay.

The Brooklyn Bridge, Prospect Park & Eastern Railroad Company—to build a street railroad in Brooklyn and Flatlands, N. Y., 45 miles in length. Capital stock, $500,000. Directors: Anthony N. Brady, Albany, N. Y.; Fred. S. Flower, Edward Browne, Ira A. Place, William J. K. Kenny, Charles H. Werner, George M. Curtis, Jr , Walter H. Turner, New York, and John R. Pettit, of Brooklyn.

The Smethport & Olean Railroad Company—to build a railway line 18 miles long, from Smethport, Pa., to a point on the New York line in Eldred township, McKean County. Capital stock, $400,000. Directors: George J. Wolf, president; A. G. McComb, James George, H. A. Jackson, S. H. Smith and M. G. Raub, all of Bradford, Pa.

The American Machine Company, Cleveland, O.—to manufactnre electrical machines, machinery supplies, power and hand motors, etc. Capital stock, $100,000. Incorporators: Frank Mock, Theodore Bucker, M. D. Williams and others.

The Live Wire Cutout Company, Jersey City, N. J.—to manufacture appliances for street railway and electric light purposes. Capital stock, $250,000. William Kennon Jewett, New York City: Henry K. Wight, Springfield, Mass.; Robert M. Dixon, East Orange, N. J.

The Erwin Manufacturing Company, Greenbush, N. Y.—to deal in mechanical and electrical supplies. Capital stock, :5,000. Directors: John Erwin, W. W. Grey and R. J. Pratt.

The People's Electric Light, Heat and Power Company, Avoca, Pa.—to supply light, heat and power by means of electricity. Capital stock, $18,000 Promoters: Patrick F. Joyce, Pittston, Pa.; C. F. Bohan, Pittston, Pa.; J. T. Lenohan, Wilkes-Barre.

The Pittston People's Electric Street Railroad, West Pittston, Pa.—to construct an electric street railway. Capital stock, $50,000. Promoters: Jas. Flynn, Jos. C. Reap, Michael J. Langan, Pittston.

The Water, Light and Power Company, Herington, Kan. —to put in and operate a plant for electric lights and waterworks in Herington. Capital stock, $30,000. Directors: J. S. Brundage, H. S. J. Towner, T. M. Bixby, P. G. Dayton and R. A. Wilson.

The McKee's Rocks Electric Light Company, McKee's Rocks, Pa.—to supply light, heat and power by means of electricity. Capital stock, $20,000. Promoters: David Shaw, Al. Young, Mckee's Rocks, Pa.; Thos. S. Calhoon, Esplen, Pa.

The Sacramento Natural Gas Company, Stockton, Cal.—to bore for gas, oil and water and manufacture gas, oils, ice and electricity. Capital stock, $120,000. Promoters: Jerome Hass, Henry C. Keyes, Thos. Quayle, Jno. McCormick, Stockton, Cal.

The Electric Railway Hill-Cable Company, San Francisco, Cal.—to construct, repair cable and electric railways, purchase patent rights relating to railways. Capital stock, $1,000,000. Promoters: N. W. Griswold, Wm. H. Birch, Jno. L. Boone, San Francisco.

The Brockville Electric Street Railway Company, Limited, Brockville, Can.—to build a street railway in Brockville. Capital stock, $200,000. Incorporators: W. H. Comstock, W. A. Gilmour, C. S. Cossitt, D. S. Booth, G. J. Mallory, O. K. Fraser and M. M. Brown, all of Brockville.

The Lincoln Street Railway, Traction & Light Company, Limited—to build and operate an electric railway in St. Catharines, Can., and to sell and distribute electricity for light, heat and power. Incorporators: R. H. Hill and H. A. King, Toronto, and J. S. Campbell, Dr. L. S. Oille and George E. Patterson, of St. Catharines.

The Toronto (Can.) Electric Light Company has increased its capital stock from $500,000 to $700,000.

The Syracuse Gas Company, Syracuse, N. Y.—to manufacture and supply both gas and electricity for light, heat and power in Syracuse and the cities, towns and villages within the State of New York. Capital stock, $2,500,000. Directors: Robert C. Pruyn, of Albany; Stephen Peabody, Emerson McMillan, Henry Seligman and A. C. Humphreys, of New York City; William L. Elkins, Jr., of Philadelphia; James J. Belden, John Dunfee, Charles M. Warner, William S. Andrews, Thomas Ryan, William B. Kirk and Hamilton S. White, of Syracuse.

The Akron Street Railway and Illuminating Company, Akron, O.—to acquire and operate a street railroad, using electric or other motive power. Capital stock, $1,500,000. Promoters: J. B. Clews, J. A. Long, F. A. Seiberling, E. B. Gibson, Ira M. Miller.

The Corry Street Railway Company, Corry, Pa.—to build an electric street railway. Capital stock, $25,000. Promoters: G. W. Sill, Chas. B. Ayers, S. J. Franklin, Warren, Pa.

The Port Chester Electric Railway Company—to construct a street surface road about ten miles in length in the village of Port Chester, N. Y. Capital stock, $500,000. Directors: Thomas S. Krutz, John E. Bowles, Theodore L. Cuyler, Jr., Charles P. Bruch, George E. Boucheir, Albert E. Beck, David J. Pearsall, and Henry F. Hawkins, all of New York City.

The Kimball Magneto-Electric Prospecting & Development Company, San Francisco. Capital stock, $500,000. Directors: L. J. Kimball, A. P. Bacon, Frederick Hiller of San Francisco, and J. W. Guthrie and W. F. Jackson of Sacramento.

The Elliott Magnetic Electric Company of Chicago has certified to an enlargement of object of incorporation.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DECEMBER 10, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

550,965. Electrical Conduit Railway. John D. Griffen, New York, N. Y. Filed Dec. 5, 1892.

551,021. Electric Rail-Bond. William H. Wiggin, Worcester Mass. Filed May 22, 1895.

551,145. Switch for Underground Electric Railways. Alfred Rosenholz, San Francisco, Cal, assignor of one-half to Samuel J. Clark and Harvey S. Brown, same place. Filed April 12, 1895.

551,168. Trolley. David Lippy, Ira E. Finfrock, George A Rinehart, and David R. Francis, Mansfield, Ohio. Filed Sept. 24, 1895.

551,169. Trolley. David Lippy, Ira E. Finfrock, George A. Rinehart, and David R. Francis, Mansfield, Ohio. Filed Sept. 24, 1895.

551,334. Electric Railway. Robert Lundell, Brooklyn, assignor to the Johnson Subtrolley Company, New York, N. Y. Filed June 9, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

550,956. Carbon-Holder for Arc Lamps. Hugh J. Farley, Philadelphia, Pa. Filed Dec. 15, 1894. Renewed Oct. 7, 1895.

551,029. Electric-Arc Lamp. William J. Davy, London, England. Filed Apr. 19, 1895.

551,046. Electric-Arc Lamp. Frederic N. Pike, New York, N. Y., assignor to himself and Edward N. Dickerson, same place. Filed June 27, 1894.

551,244. Electric-Arc Lamp. Wm. P. Wiemann, Washington, Pa., assignor of one-third to H. P. Chambers, same place. Filed April 17, 1895.

551,337. Electrode for Arc Lamps. Thomas G. Portis, St. Louis, Mo. Filed May 14, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

551,033 Commutator-Brush. Robert Hirsch and Herman Meminger, Milwaukee, Wis. Filed Jan. 28, 1893.

551,053. Electric Controller. Sidney H. Short, Cleveland, Ohio. Filed Aug. 26, 1895.

551,054. Electric Controller. Sidney H. Short, Cleveland, Ohio. Filed Aug. 27, 1895.

551,263. Antisparkle Commutator Compound. John R. Davis, New Iberia, La., assignor of one-half to Margaret M. Davis, same place. Filed Mar. 30, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

550,982. Harmonic Selective Signal for Party Telephone-Lines. James A. Lighthipe, San Francisco, Cal. Filed June 24, 1895.

551,056. Multiple-Switchboard System. Theodore Spencer, Cambridge, and Thomas C. Wales, Jr., Boston, assignor to the American Bell Telephone Company, Boston, Mass. Filed Mar. 18, 1895.

551,060. Telephone-Circuit. John S. Stone, Boston, Mass., assignor to American Bell Telephone Company, same place. Filed July 6, 1895.

551,192. Telegraph-Relay. Archibald D. MacDonald, Melbourne, Victoria. Filed Nov. 2, 1894.

551,275. Telephone-Transmitter. John Goodman and Henry M. Goodman, Louisville, Ky. Filed June 14, 1895.

551,347. Telephone-Receiver. Alfred C. Brown, London, England. Filed July 11, 1895.

MISCELLANEOUS.

550,959. Electric Clock. Benjamin Franklin, Chicago, Ill., assignor of three-fourths to David H. Fletcher, George H. Merriell, and Calvin R. Beach, same place; Mary A. Franklin administratrix of said Benjamin Franklin, deceased. Filed April 1, 1893.

551,014. Electric Smelting-Furnace. Joseph A. Vincent, Philadelphia, Pa. Filed July 18, 1895.

551,020. Electromagnet. Samuel T. Wellman, Upland, Pa., assignor of one-half to Charles H. Wellman, same place. Filed April 18, 1894.

551,032. Cleat for Electric Wiring. James R. Hemphill, Akron, Ohio. Filed Sept. 26, 1895.

551,087. Mail-Collection System. Charles F. Monson, Baltimore, Md., assignor of one-half to J. W. Couch, Petersburg, Va. Filed Aug. 30, 1895.

551,090. Signaling Apparatus. Bernice J. Noyes, Boston, Mass, assignor to George W. Gregory, same place. Filed Sept. 11, 1889.

551,123. Successive Non-Interfering Signal-Box. William H. Kirnan, Brooklyn, assignor to The Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed Aug. 18, 1890.

551,166. Joint for Insulated Electric Wires. Raymond S. Kelsch, Chicago, Ill. Filed Dec. 22, 1894.

551,170. Switch for Electric Plants. Austin H. Lucas, Pittsburg, Pa. Filed Jan. 4, 1895.

551,203. Electric Switch. John E. Criggal, Springfield, Mass. Filed Jan. 15, 1895.

551,230. Composition of Matter for Insulating Purposes. Rufus N. Pratt, Hartford, Conn., assignor to the Johns Pratt Company, same place. Filed Oct. 31, 1889.

551,284. Electric Sunshine-Annunciator. Leonard Hunt and Frederick W. Duenckel, St. Louis, Mo. Filed May 20, 1895.

ELECTRICITY.

Vol. IX. NEW YORK, DECEMBER 25, 1895. No. 24

ELECTRICITY

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EDITORIAL NOTES.

Isolated Plant Design. That the perfection of the design and details of our large central stations has not entirely engrossed the attention of our constructing and consulting engineers is evident to those of the profession who have given any attention to the installation of isolated plants. The magnitude of many of our large central stations has, perhaps, appealed more strongly to most persons than has the smaller, though none the less interesting, private installations. The opportunities and possibilities for boldness of design and elaborateness of detail are quite as great in one class of installation as another, and have been carried out with equally satisfactory results in either case.

While highest economy of operation has been the chief aim in the equipment of central stations, this desideratum has been subordinated to no demand in the designing of isolated plants. Safety and efficiency are factors of as essential importance in isolated as in central station work. In fact, modern practice, when applied to either class of work, embodies all that is best.

In this issue of ELECTRICITY description is given of some notable isolated installations which will long stand as examples of the highest attainment in the art.

* * *

Some Bugbears of Electric Traction. The *American Engineer and Railroad Journal* has found that the electrical railroad man is not without sorrows, nor is he entirely unacquainted with grief. His woes, our contemporary discovers, are chiefly of a mechanical kind, but they are none the less real on this account. Introductory to an enumeration of them, we are told the story of a king who once made the experiment of running a number of clocks in exact unison. He made such a failure of it that "no one has since had the courage to so much as make the attempt until electricians started in to do practically the same thing by putting two motors upon a single car and hoping, though they knew that there was no ground for expecting a realization of their hopes, that all would work well and satisfactorily."

Evidently expectations have not been realized for "this, and the difficulty existing in the present use of gears for transmitting power from the armature shaft to the axle are the two great bugbears of electric traction."

Our contemporary thinks the difficulties of supporting a motor on the car axle have not yet been overcome, although somewhat mitigated by the most recent designs in motor frames. The rapid wearing of car wheels is considered to be another apparently insuperable fault common only to electrically propelled cars. These and other defects which entail an ever increasing repair account are enumerated as falling exclusively to the lot of street railway men, for whom little comfort is offered inasmuch as "it is difficult to see how a combination can be designed that will obviate all of the troubles that exist." Some encouragement, slight though it be, may be found in the conclusions of our steam road friend: "That the problem will be so solved that all of the difficulties will be removed does not appear to be the promise of the immediate future, but that the evils complained of will be at least mitigated seems to be in the line of general development, and should be the natural result of the efforts that are being made."

Those street railway men whose misfortune it is to have in their care inferior or antiquated apparatus would doubtless be able to augment the list of troubles enumerated by the *Journal*, as well as to subscribe to the correctness of the conclusions reached, but the manager of the modernly equipped electric railway will still incline to the belief that even a complete approximation of steam railroad practice will not eliminate all the "bugbears" of the traction problem.

* * *

The Underground Trolley Problem. Our correspondent "West End," who criticises Capt. Brophy this week for making a somewhat careless statement as to the burial of all trolley wires in large crties, although expressing radical views, has a thorough knowledge of all the various problems confronting practical railway men and can speak with authority.

In mentioning the obstacles standing in the way of a successful underground system for Boston, he tells that in one day more than 100 motors have been disabled on the West End road by running through pools of water in the low-lying districts deep enough to submerge the motor, and that the drainage of these neighborhoods is impossible. This is a condition which the promoters of underground systems and railway men generally should thoroughly consider before making heavy investments in any given locality. The same conditions exist, in perhaps smaller degree, on the streets covered by the Belt Line in this city, which it is proposed to equip with a practical duplicate of the Lenox Avenue system. Whatever may be the possibilities of open-conduit systems for certain localities, there is scarcely a doubt that every dollar expended in streets like West and South streets in this city would be absolutely wasted, and that there would have to be a change of motive power. It is not possible that in such neighborhoods, the storage battery system, no matter what its cost, may be adopted as a last resort? The people demand rapid transit. Horses can not give it. The trolley will not be tolerated in this city. Cables are out of the question on many routes here, as they are in

Boston, on account of innumerable curves. What is there left?

* * *

The Majesty of the United States.

Most readers of ELECTRICITY have given a great deal of thought during the past week to the question of the position which the United States occupy among the nations of the earth. It is a good subject to think of.

The renewal of the declaration by our Chief Magistrate that there shall be no further encroachment by any foreign power on American soil from the Canadian line to the southernmost rock of Cape Horn has had the result of crystallizing American sentiment in a manner which shows that patriotism is not yet dead in this the greatest of countries.

Under an attack from the Shylocks of Lombard street there was some disturbance in the business world, and some few business men, in the irritation of the moment, were led to criticise the action of the President in precipitating a crisis. We believe every one of these misguided gentlemen now regrets his haste in placing himself on the wrong side. In the first place the flurry is over; there will be no panic.

Moreover, if there were a panic and a complete upset of all business and commerce, *that has nothing to do with the question at issue.* The United States are either right or wrong. If we are wrong, criticism should be above business considerations, and if we are right, we should maintain our position at any cost.

The people of the country are practically a unit in support of the position taken by the President—the position taken by all patriots and statesmen for seventy-five years. The people of the United States of America can not be wrong.

The only discordant notes in the grand chorus of practical Americanism have come from a few clergymen whose remarks would rarely be printed if they did not take some outlandish view of a popular subject, and from one newspaper in New York, the *Evening Post*, whose editor, Mr. Edwin Lawrence Godkin, is not, we believe, a naturalized American citizen. Mr. Godkin is a graduate of Trinity College, Dublin, and a man of learning and ability, but since his connection with the *Evening Post* he has managed to land that paper on the wrong side of every international question where America has been concerned. The *Post* says:

"The fact is we have not a friend in Europe to-day. From France, Germany, Italy, Spain, and every other country that has a free press the word comes that we are in the wrong."

From France, *Germany*, ITALY, SPAIN comes the word that the United States are wrong in a dispute where one of the fundamental principles of the the American Republic are at stake! No surer proof could be needed that we are right.

The same paper refers, with an attempted sneer, to those Americans "who have heard of no international law except the Monroe doctrine."

On the subject to which the Monroe doctrine applies, what use has any American for any international law?

No such law has any bearing upon the present controversy.

The Monroe doctrine is *our law*.

In enforcement of that law the United States stand supreme, defiant, unconquerable.

A Cable to Iceland.

The Iceland Althing has requested the King of Denmark to communicate with other nations in regard to laying a cable from Iceland to the continent of Europe. The resolution calls special attention to the importance of such a cable in the interest of meteorology.

The Pacific Cable.

Representatives of New South Wales, Victoria, and Queensland, have decided to appoint delegates to the Pacific cable conference, to be held shortly in London.

Under the Searchlight.

Views and Opinions on Timely Topics.

Extravagance at Catausauqua.

(From the Catausauqua, Pa., Record.)

A short time ago electric lights were introduced upon our streets. This was a prodigious waste of money. With the sun shining at day and the moon at night what a useless expenditure? No, electric lights were not a necessity, and the borough did wrong to contract for them.

* * *

The First Electric Light in an American Theater.

It is believed that the first electric light installed in an American theater was a Jablochkoff candle used as a focussing lamp in the old California Theater in Bush street, San Francisco, in 1878. The managers of the theater at that time were Messrs. Barton Hill, General Barton and Frank Lawler. The play was "Antony and Cleopatra," Rose Eytinge and Cyril Searle taking the leading parts. Mr. A. H. Reece was the engineer in charge of the work.

Seventeen years have worked a complete revolution in theatrical lighting, and to-day there is not a theater in the United States which could dispense with the electric light.

* * *

He Wants Peace.

The entire office force of ELECTRICITY was surprised and pained when the following was received:

6 Joy street,
Boston.

Mr. Robert Treat Paine requests that you do *not* send ELECTRICITY to him as he never opens it or reads it. *Per* Priv. Secy.
December 20, 1895.

Mr. Robert Treat Paine is (or was) a large holder of G. E. and N. W. G. E. stocks. He is also president of the American Peace Society, and from the tenor (or falsetto) of his remarks to us, as from the sentiments expressed in his recent letter to Salisbury, it is evident he wants peace. But there are some things which should not be forgotten. It is just as sure as it was three hundred years ago, when the thought was first expressed by a well-balanced Puritan divine, that

"that peace is an evil peace that doth shut truth out of doors. If peace and truth cannot go together, truth is to be preferred, and rather to be chosen for a companion than peace."

ELECTRICITY is chock full of truth, and there will never be any peace in this trade until the truths inculcated by it are recognized.

* * *

The Standard Viewed from England.

(From the London Electrician.)

An enterprise heralded some months ago in the manner of earlier electrical promotion days seems coming to a crisis. We refer to the Standard Telephone Company, which last April announced with a great flourish its entry into the field as a rival of the Bell monopoly. A capitalization of no less than $160,000,000 was claimed, and a list published of its supporters, which comprised some of the most prominent names in the United States. Mysterious allusions were made to wondrous telephonic patents which in due time would be disclosed, and a telephonic service at a merely nominal price was promised. Thus far, however, the company has made no installations and has given no evidence whatever of the possession of any telephone patents beyond claiming to control some old ones well known in telephone circles, and which have never been supposed to possess any practical value. At present the company is being vigorously attacked, the charge being made that it was merely formed to obtain money from the numerous branch companies which were organized through false representation as to non-infringing apparatus, by means of which it was asserted successful competition with the Bell Company could be undertaken. No satisfactory answer has been made to these charges, and the very respectable gentlemen whose names have been the sole stock-in-trade of the company are beginning to recognize that they may have been used as decoys in a rather disreputable scheme.

* * *

THE difference between General Electric and Westinghouse stocks was made conspicuous by the recent flurry. General Electric shares declined nearly ten points in one day, thereafter making a slight recovery. Westinghouse shares have not moved a point either way.

* * *

THE process of closing up the business of the Brush Company at Cleveland goes on as rapidly as could be expected with such a concern. It is believed by those best posted that the early part of 1896 will see the entire business transferred to Schenectady.

* * *

He Is For War.

The Destructive "Electric Fuse-Train" and its Inventor.

To Edwin Gomez, of 112 East 87th street, New York City, belongs the credit of being the first inventor to enter the electrical field with death-dealing devices, which may be used in sinking English iron-clads or in the more peaceful art of blasting rocks. The invention of Mr. Gomez is called the "Electric Fuse Train," and its object "is to effectually retain the force of exploding gun powder, so that none of it is lost, but simply directing its force to any desired point." The circular announcing this discovery to a war-talking world does not give a detailed description of the invention, but states that the Electric Fuse Train "burns with a sudden and an irresistible flash, the flame and explosion traveling with so great a velocity that it can never be put out by the pressure of water when submerged; and when the flame reaches the torpedo, shell, mine, etc, the coil of fuse train, flashing off, fills the powder-chamber instantly with an intensely hot, confined flame that penetrates the powder and causes every grain to explode at the same instant."

MR. EDWIN GOMEZ.

By employing this apparatus in igniting gunpowder or other explosives, "an entire revolution may be produced" and "results never before attained may be accomplished, because all the grains of powder are fired at the same time, in consequence of the fuse train being coiled all through the powder and producing a sufficient flash to penetrate and fill the spaces between the grains of powder in every portion of the powder-chamber. This fuse-train is perfectly reliable and excels every other means of communicating fire to one or more charges of powder, torpedoes, shells, mines, blasts, etc., either near together or distant from each other—one line of the fuse train only being required for any number of explosions."

American Institute of Eectrical Engineers.

At the monthly meeting of Council, Dec. 18th, the following associate members were elected: Chas. F. Bancroft, Lowell, Mass.; Frank E. Herdman, Winnetka, Ill.; Richard Lamb, New York City; Leon Le Pontois, Pittsburg, Pa.; Harry W. Ludlam, New York City; Samuel G. McMeen, Chicago, Ill.; Frank L. Scidmore, New York City; Joseph P. Stone, Schenectady, N. Y.; Norman W. Storer, Wilkinsburg, Pa.; Chester H. Thordarsson, Chicago, Ill.; Harrison C. Wybro, Los Angeles, Cal.

The following associate members were transferred to full membership, their applications having been approved by the Board of Examiners: George Stephens

Peterboro, Ont.; George White-Fraser, Toronto, Ont., Alex. Dow, Detroit, Mich.; Samuel G. Neiler, Chicago, Ill.; Knowles L. Perot, Phœnixville, Pa.; John Balch Blood, Schenectady, N. Y.; Franklin Sheble, Philadelphia, Pa.; William H. Freedman, New York City; Andrew L. Riker, Brooklyn, N. Y.; John A. Mc Crossan, Rat Portage, Ont.

The following committee was appointed by President Duncan to consider the question of incorporation of the Institute and any revision of the constitution that might be necessary to comply therewith: W. B. Vansize, Esq., Chairman; Prof. H. S. Carhart, Mr. W. F. C. Hasson, Mr. A. S. Hibbard, Dr. Cary T. Hutchinson, Mr. T. C. Martin, Mr. Townsend Wolcott.

CORRESPONDENCE.

CAPT. BROPHY'S ADDRESS.

Is He Working in the Interest of Boston Shoe Dealers?

To the Editor of ELECTRICITY.

SIR: Boston is deeply interested in the boot and shoe business, and being so, naturally desires to encourage walking as much as possible; indeed some of its citizens do not hesitate to advocate the total abolition of all street railway traffic from its streets, or at least counsel legislation which would have this effect if carried out. Amongst the loyal partisans of the local Crispins we must include our old friend Capt. Brophy, who said in his recent speech:

> "As you all know, the State Legislature passed a law applicable to the city of Boston, compelling the owners of all electric wires within a certain prescribed district to place them underground prior to the first day of January, 1900. This includes electric wires of every name and nature, with the single exception of the overhead trolley of the West End Street Railway Company. To the average man, the reason for this exception on the part of the body that sits under the "gilded dome" seems inexplicable. For my own part, I have never been able to fathom the motives that control the actions of our legislators at different times, and as a matter of fact I deem my life too short to attempt to do so. It is plain to me that if the electric light, power, telegraph, telephone, fire and police wires are dangerous enough to be removed from poles and other structures and placed under the surface of the street, the bare trolley should find a similar resting-place. If, as it is assumed, the aim and purpose of this law was to add to the safety of the public, by removing what is considered a serious menace thereto, it falls very far short of its purpose when it permits this class of wires to remain above the earth while all others are placed beneath it."

He added later in the same evening: "There was little or no danger in the 500 volt current used by the railway trolley system."

Now if the Legislature had ordered the trolley wire taken down in the city of Boston at the present time, as Capt. Brophy thinks they logically should have done when they ordered down all the others, it would have resulted in stopping all street railway traffic in that city. There are three alternatives, as far as Boston is concerned, to the trolley system in sight, viz., the underground-conduit system, the storage-battery system and horses. There are closed-conduit systems which will probably be worked out in the future but are altogether in too embryotic a state at present to be considered as a factor.

It would be a physical impossibility to operate an open underground-conduit system in the city of Boston. There are hundreds of places in that city where the conduit would be flooded repeatedly and the system short-circuited, and no system of drainage could prevent it. This is said advisedly. There have been times when upward of 100 motors in a day have been rendered inoperative by running through the pools of water that settle in the low lying spots with which Boston is so well supplied. There are cities where this system can be applied successfully, but Boston is not one of them. Then again, taking the cost (and this has to be considered), the conduit alone would not cost less than $75,000 per mile, and the West End Railroad has upward of 270 miles of track; in addition to this then would be the equipment of cars, adjustment of feeders, drains, etc., and with no addition to revenue no interest on the investment could be shown.

Any known system of storage-battery traction would bankrupt the company in a very few months.

So there only remains the alternative of going back to horse cars or walking. If they go back to horses, the company must resign itself to lose all they have invested in their present plant and raise capital again to purchase a fresh stock of horses and cars.

Instead of being "inexplicable" as Capt. Brophy says, this exception of trolley wire in the general order of removal of wires was both wise and unavoidable, no matter what the "average" man may think.

Both in virtue of his official position and his long and honorable career, Capt. Brophy's word carries weight second to none; his character and attainments compel respect both for his truth and judgment, and it is rather surprising to find him, usually so careful and accurate in his statements, slipping into a bit of "clap-trap" like that quoted. Irresponsible cranks, vague dreamers, interested "inventors," half-baked electricians and others, either through ignorance or thoughtlessness may make such statements with no other effect than that of inducing "that tired feeling" in their hearers, but with Capt. Brophy it is different, and it behooves him, and responsible men like him, whose opinions and advice are likely to be crystallized by action upon the part of those in authority, and who have to rely upon such as him for guidance, to be careful in not making such loose and misleading remarks for the sake of a little temporary effect in a post-prandial address.

WEST END.

Boston, December 20, 1895.

The Peck Electrical Company.

Mr. E. F. Peck the vice-president of the National Electric Light Association, who for the last ten years has been the general superintendent of the Citizens' Electric Illuminating Company of Brooklyn, has formed a company to be known as the Peck Electrical Company, with an office at 15 Cortlandt street, New York. The company proposes to manufacture and deal in electrical specialties and supplies, and also to engage in electrical engineering in all its branches. Mr. Peck's long and practical experience as superintendent of one of the largest and most successful electric lighting plants in the country, together with his recognized capacity as an electrical engineer, will undoubtedly command for the company a large share of public and private patronage.

PERSONAL.

Mr. Westinghouse has taken the Blaine mansion at Washington for the winter.

Mr. James Partridge of the Partridge Carbon Company was a New York visitor last week. Mr. Partridge was with Brush in the latter part of the '70's, and always has a few interesting reminiscences of the early days when light carbons were selling at $160 a thousand.

Mr. Stanley S. Stout of Chicago was in New York and Boston this week taking testimony in the litigation between the Bell Company and the Western Telephone Construction Company.

Mr. W. P. Roberts, of Lynchburg, Va., who has organized several independent telephone exchanges in the South, has been in town this week purchasing supplies.

Mr. E. H. Forst, of the California Electrical Supply and Construction Company, has been spending several days in New York on business.

The Okonite Company's Annual Meeting.

The annual general meeting of the Okonite Company, Limited, was held at the office of the company, 13 Park Row, New York City, on Wednesday last, December 18, at 12 o'clock noon. A number of matters of interest to the company were discussed. The accounts were also presented and passed.

Subway Work in Brooklyn.

The annual report of the Commissioners of Electrical Subways in the city of Brooklyn shows that the aggregate length of electric conductors of all kinds within the city limits is 20,371 miles, of which 3,599 miles were added during the past year. Over 12,000 miles of wire is placed underground or suspended beneath the elevated railways. The underground conduit now in place is 126 miles in length; length of single duct, 343 miles. Until specific appropriation is made the wires of the police and fire departments cannot be placed in subways. The Board of Estimate is called upon to provide a sum for the purchase of new wires and cables for the city's telegraph system.

"The work of the extension of the telephone system during the year," the report says, "has been unprecedented, owing in part probably to the adoption by the company of cheaper rates for a certain class of service, such as the ordinary householder wants, and partly to the natural inevitable growth of the system."

Bimetallic Wires in Germany.

Experiments have recently been made by the German Postal Telegraph Administration with bimetallic wires in order to see if they could compare with bronze wire for telephonic purposes, both in respect to their mechanical and electrical properties. It is claimed for these compound wires that they have important properties. For example, a telephone line with a bimetallic conductor will work much more perfectly than with a conductor of a single metal such as copper. Again, it is claimed that less insulation is needed for such a conductor than for copper or any other material, and hence such wires laid on the earth without special insulation permit telephonic communication to a much greater distance. A number of experiments were recently conducted for the German post-office by its telegraph engineers to ascertain the facts. The results obtained do not go to show that the double-metal wires are any more valuable than the pure copper wire, but that the distance to which telephonic transmission by bare wires laid upon the earth is possible depends mainly upon the size and weight of the wires, presuming all the conditions are similar.

Incandescent Lamps in Germany.

In a recent number of the *Elecktrotechnische Zeitschrift* there appears the report of the commission which was appointed by the Union of Representatives of Electricity Works in Germany to investigate the incandescent lamp question. The report states that "the complaints of consumers that the incandescent lamps are bad—good for nothing—are justified." As the causes of this regretable condition of things it gives: imperfect sorting, false marking, little economy and too short life of the lamps. In 70 lamps supplied by eight makers, which were given as 16 standard candle-power, and whose rate of consumption should have been 3.25-3.50 watts per candle-power, the illuminating power fluctuated between 7.82 C. P. and 22.85 C. P. and the rate of consumption between 2.8 and 6.3 watts per candle-power. One of the very first German firms supplied 20 lamps specially for the investigations. In these 20 the illuminating power fluctuated between 10.21 C. P. and 21.6 C. P., while the consumption in watts averaged 4.1 per candle-power. In ten 16 C. P. 3.5 watt lamps from another first-class firm the illuminating power decreased in the course of 48 hours' burning by from 40 to 60 per cent., while the consumption in watts per candle-power rose on the average to 5.6.

A Boston Failure.

W. B. Southgate & Company, dealers in electric supplies, 146 Franklin street, Boston, have filed a petition in insolvency.

Electric Traction in Spain.

A 60-years' concession has lately been granted to a company for the construction and operation of an electric tramway between Cadiz and San Fernando-Chulara. Work on the establishment of the line has just been commenced.

The Storage Battery.*

A DISCUSSION OF ITS APPLICATIONS BY THE MEMBERS OF THE A. I. E.E.

THE STORAGE BATTERY OR THE GAS-ENGINE AS AN AUXILIARY.

BY NELSON W. PERRY, E. M.

Whether it is economical or not to equip a central station with an auxiliary storage battery plant is a question which must be decided separately for each particular installation. Aside from purely economic reasons, convenience may be controlling, so that it is impossible to state, unless all the conditions are known, whether the storage battery is advisable or not. The price of the battery is an important element of course, but less so than popularly supposed, for the space which it occupies and the cost of maintenance may largely overbalance any gain in first cost over the cost of the extra boiler, engine and dynamo.

In regard to the cost of maintenance, manufacturers are willing to guarantee that it will not exceed 10 per cent. per annum, but it is well to understand just what this 10 per cent. means. It means, in the first place, that if you put in all the battery power that the manufacturer recommends, and take care of the battery exactly as he says, then the guarantee holds good. Under such conditions, the manufacturer is undoubtedly safe, but if we install a plant under these conditions we are pretty sure to find that the economy in first cost of the battery over engine and dynamo has entirely disappeared.

Then it is well to understand beforehand what the 10 per cent. means—10 per cent of what?

Some time ago I had occasion to inform myself accurately on this subject, and to this end entered into quite a correspondence with the president of the leading storage-battery company of this country. As regards the guarantee, he wrote me under date of June 18, 1894, as follows:

> We send you by to-day's mail our illustrated catalogue, and would especially call your attention to the question of maintenance as contained on page 11. We undertake in these cases to provide renewals when renewals are required at a specific price with a guarantee that this will not be required sufficiently frequent (*sic*) to exceed an average of 10 per cent. per annum. We have every reason to believe from our experience so far that the actual cost of maintenance when the batteries are used at normal rates will not exceed 5 per cent.

Turning to page 11 to see what this meant, I found the following:

> This company is prepared to undertake maintenance contracts, according to a scheduled rate of charges, for periods up to 10 years or longer, under which they will guarantee that the total amount paid for renewals during the term of the contract shall not exceed 10 per cent. per annum on the *catalogue* price of the cells specified in the contract. . . . *In all cases of renewal by* contract the old material becomes the property of the company, *and must be returned to their works free of charge for carriage or packing.*

[The italics are mine.]

Since the regular trade discount at that time was 20 per cent. off the catalogue price, and a further discount was offered which made the cost of the batteries comparable with that of an engine and dynamo, the guarantee assumed a very different aspect from that which it bore on its surface. When to this was added the cost of packing and carriage back to the factory, it ceased to be an attractive guarantee, and my calculations showed that in many cases where the storage battery might be recommended if the guarantee was what it appeared to be, it would not be economical under the guarantee as it actually was.

As before indicated, there are some situations in which either convenience or extreme steadiness of current may be controlling in deciding the question of the use or not of storage batteries. But where the question is one purely of economy, I would not myself recommend their use under any circumstances, simply because there is a still more economical method at hand. I refer to the gas engine. Even if it were necessary to use illuminating gas from the street mains it would be more economical (considering space and other factors) to take the peak of the load with a gas engine than to install a battery for this purpose. In this case there would be no standby losses, and the engine would be ready at a moment's notice to be thrown into service.

It is a fact that has been amply demonstrated by others as well as myself, that a given number of lights can be produced with half the gas burned in a gas engine that is required to produce them in ordinary burners. The mechanical efficiency of the gas engine is not quite so high as that of large compound condensing steam engines, rarely ever exceeding 83 to 85 per cent. while the latter may go to 90 per cent., but the total efficiency from fuel to the pulley of the gas-engine is about double that of the steam-engine—reaching 25 per cent. under favorable conditions, whereas with the steam engine it rarely equals 12 per cent. So that with the gas engine operating at anywhere near its full load, there would be a gain in efficiency, instead of a loss, of, say, 20 per cent. where the battery was used.

As indicating the performance of a gas engine using illuminating gas at various loads, I quote the following figures obtained from a test of a 12-H. P. (actual) gas-engine:

Actual H. P. developed.	Gas consumption (cub. ft.) each actual H. P.
12	15
11	15.3
10	15.5
9	16
8	16.5
7	17
6	18
5	19
4	21
3	26
2	30
1	48

These figures are somewhat better than would be obtained in practice, but go to show that the gas engine compares favorably at light loads with the steam engine under similar conditions.

Thus far I have spoken only of illuminating gas, but the power may be much more cheaply generated by using a fuel gas. The cost of producers or generators comes to about $11 per H. P. capacity—considerably less than the cheapest boiler—and an idea of the space required may be gained from a statement of Mr. J. Emerson Dowson, who in estimating for a plant of 400 K. W. capacity says that if the gas plant is all on one level it would occupy a ground space of 27 ft. x 54 ft., but, if necessary, all except the gas holder can be placed under or over the engine room. His estimate for such a plant is, including erection, foundations and ash-pit for generators, $5,500, or $10.38 per H. P.

These fuel-gas generators can utilize advantageously the poorest grades of fuel, and produce from the better grades of anthracite about 160,000 cubic feet of gas of a calorific value, equal to one-quarter that of 16 C. P. illuminating gas, per ton of coal.

As to the standby losses of the gas producers, this has been very carefully determined in a number of cases. As an illustration I will cite a single case—by no means the best on record. At Openshaw a generator which supplied gas for from 250 to 300 I. H. P. was shut down for 41 hours and the fuel consumption during this time was but 3.9 lbs. per hour, or about 1 per cent. When we compare this with the standby losses of the steam boiler, which are estimated by Prof. Kennedy at 10 per cent. of the total consumption in all the boilers, we see how insignificant it is. A situation usually considered peculiarly adapted to the storage battery is in subordinate or outlying stations where they are charged during the daytime from the central station and act as centers of supply during the night-time.

But gas can be much more economically distributed to these stations than can the electric current, for Mr. Denny Lane has shown that with ordinary 16 C. P. gas, 3,000 H. P. can be sent a mile for an expenditure of 1 H. P., or one-thirtieth of 1 per cent. of the power conveyed. My own calculations show that a 6-in. pipe will deliver 6,000 cub. ft. of gas per hour at a distance of 10,500 ft. under 4 in. of water pressure. If this be 16 C. P. gas, allowing 25 cub. ft. per H. P. hour, this quantity represents 240 H. P.

Cast-iron pipe, 6 in. in diameter, having a thickness of ½ in., weighs 31.9 lbs. per foot. The total weight of this 2 miles (nearly) of pipe will therefore be 334,950 lbs. This would be equivalent in conductivity to about 41,869 lbs. of copper. But 4 miles of copper weighing 41,869 lbs. would be equivalent to about four No. 000 B. & S. wires, which would have a resistance for the 4 miles of 0.325 ohms. If the charging current were transmitted at 220 volts, there would be required a current of 848 amperes; but a wire having a resistance of .325 ohms will only deliver under a pressure of 220 volts; 220 ÷ .325 = 677 amperes; there would, therefore, be required five No. 000 B. & S. wires to deliver this energy, and the weight of this would be 53,540 lbs.

If the distribution took place at 1,000 volts, the amperes required would be approximately 180. To deliver this at the same distance with a loss of 10 per cent. would require 6,264 lbs. copper, and to deliver it at 1 per cent. loss would require 62,642 lbs., which would cost far more than the pipe and still give less efficient transmission.

I think it would be very easy to prove that the gas engine with fuel gas would prove a much more economical auxiliary to the central station for taking the peak of the load and the loads amounting to fractions of a unit than the storage battery; and when we consider the efficiency of transmission of energy in the form of gas, which will permit of the location of the gas generators where land is cheap and fuel easily procured, it seems to me that the plan must commend itself to electrical engineers.

Unfortunately the gas-engine business in this country seems to be in the hands of parties totally incompetent to handle it properly, as every one knows who has ever had occasion to seek information from them.

It is probably not too much to say that every attempt thus far made in this country to adapt the gas engine to electric lighting has proved a failure. Our own manufacturers either do not know what their engines are capable of doing, or else they are afraid to make public what they will do. I believe there is not a single manufacturer who has a printed price-list, and my own experience and that of others whom I know, has been that it is impossible to get prices quoted until the manufacturer or his agent has been thoroughly satisfied of the exact purpose for which the quotations are desired. Information of any kind is almost impossible to get; and guarantees of performance, when given, are worthless. To such an extent is this true that nearly all, if not all, the recent large orders for gas engines have gone abroad, where the business is conducted on business principles.

In England, Germany and France the gas engine has come into extensive use in isolated lighting, and already has been adopted with satisfactory results in several central stations of considerable size. When the business is properly handled in this country, we may expect to see the gas-engine make its way rapidly in the lighting industry here also, for it has merits which need only be known to be appreciated.

DISCUSSION.

Mr. Edgar—I would like to answer the questions Dr. Crocker raised; but before doing that, I desire to call attention to the point he made in regard to charging accumulators in series. He probably referred to the Popp system in Paris, which I also investigated with considerable interest. If that system is used, it is impossible to charge and discharge at the same time unless the local systems of distribution are entirely separate; so that it could not by any possibility be used as we use systems of distribution in this country. All our network is connected together, and if our batteries are to be charged in series, it would be necessary to have two entire sets. This seemed to me to be the principal drawback of the system there, and it prevented its extension. It is impossible to keep the circuits entirely free from grounds, and the results would be that one system would have one voltage as compared with the ground, and the next another, and the next another, and it might go up to two or three thousand volts.

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*Abstracts of communications read at the 101st Meeting of the American Institute of Electrical Engineers, New York and Chicago, November 20, 1895.

In regard to the question he asked in respect to cost, I have not the slightest objection to giving exact figures which will show upon what I base my statement. Our first battery was put in to give out 1,650 amperes on each side of the system. A 650 horse-power generating set gives out 1,333 amperes on each side. This, as a steam plant, would have cost $65,000. Our contract was for $44,000, and there were enough incidentals probably to bring it up to $50,000. This included 45 per cent. duty. The second battery was double the size. That capacity would cost $130,000 if it had been a generating plant. Our contract was $64,000 for the battery. The former price included the switchboard, the latter did not; to that I add $25,000 to include switchboard and everything outside of the building. So that about $90,000 as compared with $130,000, and $50,000 as compared with $65,000 is the comparison I had in mind. I want to emphasize this one thing, and that is that we do not care anything about the kilowatt-hours of the battery for this particular comparison. Kilowatt hours have to do with operating. Kilowatt maximum has to do with investment, and we put it in for investment purposes. That is to say, as I have already said, we can with the same amount of capital put in more apparatus by using storage batteries than we can without. Now, if such apparatus has a capacity large enough to do that work which actually exists, we can actually save money by equipping one-third of our stations with battery and two-thirds with steam.

Now, in regard to efficiency, our guaranteed efficiency is 75 per cent. I never have understood that a high rate of charge and discharge was going to interfere with the efficiency of the battery. It is undoubtedly going to cut down the capacity. With an hour-and-a-half rate of discharge, the battery has only two-thirds of the capacity that it has at four, five and six hours discharge.

Then in regard also to the question of guarantee, I know nothing about what the American company guarantees. I have never asked the question. Our guarantee was for six per cent. of the cost of the cells. On the $44,000 contract I think the cells were put in at about $29,000. In the $64,000 contract the cells were put in at $59,000, so we are paying six per cent. on $59,000 worth of investment. There was a clause in the contract that if an American company was established this should be reduced to four per cent., because this was done in Germany.

Mr. H. Ward Leonard—There is one use for storage batteries which has not been touched upon particularly, and which to me is perhaps one of its best applications, and that is in connection with the regulation of the speed of the motor, such as would be required for the operation of, for instance, elevators or street cars, as giving an abundance of means of securing variable electromotive forces for various speeds and for reversals of direction. The point about storage batteries which is often raised to explain why the progress has been rather slow in this country has been the patent litigation, but I look upon that as merely an excuse for the slow development of an article which has not had a demand sufficient to develop it. I do not believe that any really meritorious article has been in the electrical field thus far which has been retarded in its progress by litigation, and the progress of the litigation which we have seen in the case of incandescent lamps, systems of distribution and electric street cars, while it may have cost a great deal of money for the litigants, as it unquestionably has, I do not think has tended to retard the progress of development—rather the reverse. In the case of storage batteries, the demand has not existed and their use has not given success, and that is the sole reason for the fact that they have not been used.

As regards the cost per kilowatt, which is very largely the essence of the question involving economy, it seems to me that the figures that I have seen quoted, which make a favorable showing for the storage battery, take the maximum rates of discharge for the batteries that it is deemed safe to operate them at, and have taken the horse-powers of the engine at one-quarter cut-off. Now I agree with Mr. Edgar that the question of development of power for the peak of the load is one which is largely independent of the economy of production as compared with that for a very large portion of the total load which is below the peak. But it seems to me that in making comparisons we should consider the cost of the horse-power of steam-generating machinery when operated at its maximum load, its maximum capacity, which will certainly be fifty per cent., without unduly straining any good boiler or engine above that for which it would have for the ordinary evaporations in the boiler, and a quarter cut-off in the engine; and I think that steam plants figured on that basis can unquestionably be installed for fifty dollars per kilowatt to-day, and ones which will be certainly more efficient in the production of a kilowatt than the development of a kilowatt by a storage battery, with the conversion losses and the lack of efficiency and capacity due to discharge at high rates. What I would like to find out, if we can, is: What is the cost per kilowatt when the battery is discharging at the rate for which the manufacturers guarantee the six or ten per cent. depreciation which they have guaranteed, and the figures—although we have had figures that are on their face very convincing—do not give to me an explanation of the difference between the prices which we have been familiar with in the purchase of batteries and those which have been quoted. I have bought batteries and installed them almost every year since 1885, and I have never succeeded yet in buying a battery at a price approximating $50 per kilowatt, although, of course, I have not dealt in very large units, but I have received a discount from the list which is as favorable as I think is given to customers in this country, because the instances that I had were ones in which the manufacturers were quite interested in seeing the applications made. I could not get the batteries at less than $180 per kilowatt when operated at the maximum rate at which they would make any guarantee. I think that, judging from the price lists that we have in this country, it is impossible to expect to get batteries to compare in cost with steam plants, even when run at double the rate that they call the excessive rate of discharge, that is, even allowing that the battery shall be run at double the excessive rate. The cost of batteries, even those of the largest size—if I may judge from the prices of batteries of smaller sizes—would be at least $100 per kilowatt.

I have been installing dynamos for a great many years, and I do not know one of them that I have installed that is not running perfectly successfully and economically to-day and in good condition. And, as I say, I have been installing batteries nearly every year also, and I do not know one battery that is running that I have installed. That may be because I installed it, but there may also be some influence due to the fact that it is a battery. One of the best remarks about a battery that I ever heard was made by Mr. Edison to me. He said that "the blamed thing was wet," and I think that expresses a great deal electrically.

I do not think that the storage battery is likely to be installed, when considering the question of cost, in the light in which I presented it, because of its economy over the steam plant in dollars and cents, but I do not think that that is the thing to be considered. I think that Mr. Edgar has expressed it very well, and we all of us know how it is of the utmost importance that the service from an electric central station shall be perfectly reliable and that the light shall be perfectly uniform, and the question of cost of the battery, to my mind, and its efficiency also, is quite of secondary importance—if by the use of the battery they obtain absolute reliability of service and perfect uniformity of the light, and cannot otherwise—and I think that the battery may be installed in a station with a net saving to the station, rather than to go without it, when viewed from this standpoint, while I do not believe in the actual saving in dollars and cents in our central stations in this country with the character of load diagrams that we have.

Mr. J. B. Entz—I have recently spent a year in the factory of the Tudor Company in Germany, and have had occasion to know what their practice is in that country and what their results have been. They have a great many large central stations which have been installed from ten to six years. The company sells the batteries with the capacity specified for the different rates of discharge. The customer may discharge it in one hour, two hours or ten hours as he pleases, and it does not affect the guarantee. The purchaser has the option of taking the battery without any payment for guarantee for two years. The company keeps it in perfect repair for that time. At the end of two years the purchaser can take a guarantee from the company for four per cent. a year for ten years, but very few of them care to do that. The actual expense of maintenance has been two and a quarter per cent. to the company. In that time they made considerable money out of that four per cent guarantee.

Mr. J. Appleton—There are one or two things about Mr. Perry's communication to which I would like to call your attention. He advocates the use of generators driven by gas engines for taking the peak of the load in central stations. Now in any station of a reasonable size this peak must be at least 400 horse power. In order to take this with gas engines, it must be necessary at least to have two or more engines driving generators. I would like to ask Mr. Perry if he has tried to run dynamos in parallel with gas engines of that size. If he tried it once, I do not think he would be inclined to advocate it in this way. I notice Mr. Perry begins his communication by advocating the use of gas engines for electric lighting, and then goes on to say that he does not think there is a single case in this country where they have been successful. I think this must be due to the fact that he has never tried to use them in conjunction with storage batteries. The modern gas engine, as built in this country to-day, I do not think is very far behind the European gas engine. Germany is considered the home of the gas engine, but I think we are getting nearly as good results in this country now as they are obtaining there. In fact, I know of many isolated plants which are working perfectly satisfactory with a combination of a gas engine and storage battery. Mr. Perry calls attention to the fact that in England, France and Germany a great many isolated plants and also central stations are using gas engines, but I venture to say that not five per cent. of the whole number are running without a storage battery in combination. Referring to his suggestion of transmitting power to outlying stations by means of gas through an iron pipe, even if the gas engine were available for taking the load in the outlying district during certain hours of the day, I think his calculations are wrong in one respect. He compares the price of the iron pipe to the price of copper mains. Now I take it that if he has his iron pipe he must have his copper mains as well; and having his copper mains he might just as well use them to transmit current to the outlying districts, and charge the storage battery, raising the pressure by a booster.

Mr. Chas. Blizard—We do not recognize the company Mr. Perry so mysteriously describes as "the leading storage-battery company of this country." Through an oversight, unintentional no doubt, Mr. Perry does not quote from a letter under date of June 11th, 1894, sent him by this same "leading storage battery company," in which the matter of maintenance is dealt with as follows:

"We will undertake to maintain installations of our accumulators when operated at normal rates, upon a basis that will limit the cost of perpetual maintenance to 10 per cent. per annum upon the original cost."

If Mr. Perry had brought his communication up to date, he might have quoted from the current edition of the catalogue issued by the storage battery company in question, in regard to maintenance, as follows:

"The company is prepared to undertake maintenance contracts under which they will guarantee that the total amount paid for renewals during the term of the contract shall not exceed 10 per cent. per annum on catalogue prices of the cells specified in the contract." The clause covering the return of the old material being omitted.

It is generally understood that retail prices are not maintained when wholesaling. It is not a fact that the public has been led to understand by the battery company or its representatives that the guarantee offered means anything more or less than what is distinctly stated in the catalogue, and the fact that in the letter from which Mr. Perry quotes he has referred to the catalogue for terms of guarantee is a sufficient refutation of his argument.

Mr. Perry's criticism would seem to cover the manufacturer who recommends the installation of a battery of capacity suitable to the work to be done, and who asks when giving a maintenance guarantee that the battery be worked within its normal limits and handled in accordance with the simple rules which experience has proven produce the best results as to efficiency and durability. I fail to see the injustice or hardship involved in these requirements.

Mr Perry's statement that the guarantee holds good when the battery is cared for in exact accordance with the instruction laid down by the manufacturer, conveys the impression that an infraction of the rules would necessarily nullify the guarantee. While the selling company would undoubtedly have the right to withdraw, I do not know of a case in which such a course has been taken. "The leading storage-battery company of this country" does not anticipate that its business will be materially affected by Mr. Perry's alleged discovery of the difference between its nominal and actual guarantees.

THE ELECTRIC WIRING QUESTION.*

BY FRED. BATHURST.

Having established the fact that, either from "excess of supply" or a "lack in demand," our contractors are face to face with a serious economic problem, it behoves us to look into our present methods of wiring to see in which direction economic improvement can be contemplated. Let us consider briefly the essential features of good wiring. The five cardinal points may be given as safety, durability, convenience, accessibility, and economy. Professor S. P. Thompson, in a lecture on the subject before the Society of Arts, embodied the essential features in a few words when he said, "What is wanted is a mode of running wires and fixing switches and other accessories, so that they shall not only be electric-tight, but shall also be water-tight, gas-tight, air-tight, oil-tight, fire-tight, and even rat-tight." The only "tight" he has omitted is "money-tight." It is my belief that all these requirements can be met by the use of *fire-proof insulating tubes*; but before dealing with this point I may be permitted to challenge the existing methods in the light of these requirements.

It will probably be admitted that wood casing fails in many respects. As a "mechanical" protection for the wires it is imperfect; and it is as deficient in "insulating" protection, because it is neither damp-proof nor incombustible. To again quote the words of the above-referred-to authority, it may also, like charity, "cover a multitude of sins." In concealed work it is positively an obstacle to the development of electric wiring.

Even on the surface, however, it is neither picturesque nor decorative. It is easy to install, but its nature prevents any very correct or exact estimate being formed of the labor required. If surface work is required, on the score of economy surely it would be better to adopt "open work" on porcelain insulators—a safe and scientific method of wiring, which can be carried out at a very much lower price.

"Insulation test" cannot discover an unsoldered joint or a dangerous diminution in respect to current-carrying capacity. Every practical man will agree that insulation testing will not necessarily indicate that the wires are at places in dangerous proximity to gas or water systems in event of moisture appearing. To continue, the recognized shortcomings of wood has brought into use iron and "lead compo" piping.

It may be thought that we must turn away from tube or pipe methods altogether in order to find economic wiring. Experience in other countries, however, does not show that any "rigid" system of conductors is making progress or headway. No insulated wire has yet been produced which in itself can successfully resist the deteriorating influences present in mortar or plaster. Even lead-covered insulating wires, if directly embedded in plaster, have been found wanting, and give trouble from "earths" and "short-circuits" as soon as moisture has made an appearance.

With any rigid method, if walls happen to crack and settle, or plasterers and bricklayers cause damage, a fault may develop which is very difficult to find. Usually, also, they are handicapped commercially in respect to making joints and connections, as these involve risk and trouble even with the highest quality workmen. A cardinal objection to "rigid" methods is the lack of accessibility. All good wiring should be accessible, for with this quality assured half the difficulty of "trouble" is already fought, and any imperfection or injury, whether arising from poor work, negligence or accident, can be remedied with a minimum of inconvenience.

A conduit or race-way is the practical way of rendering wires "accessible," for then the wires installed in them are always open to the inspection of owner or wireman whenever he wishes to satisfy himself as to their condition or to effect a renewal. "Accessibility" ought, therefore, to be a fire office requirement; with it an inspector can use his *eyes*, and have no need to trust to his *ears* for inspection.

From the contractor's point of view "accessibility" is desirable as limiting unfair and injurious competition; for, when an installation can be readily inspected, inferior materials cannot be used for the purpose of cutting down prices, workmanship cannot be scamped, and the "death knell" of unprincipled competition could be sounded for all time.

This brings us to the consideration of the conduit itself. From a labor-saving point of view a flexible conduit would apparently commend itself. Whilst cases do occur where this is true, every flexible conduit has the inherent drawback, as shown by experience, that the property of "flexibility" may so far assert itself that numberless bends will prevent the wires from being drawn out. Any trouble which then occurs will have to be cut out, or else the circuit must be abandoned or wired anew. Flexible conduits are always at a disadvantage either in respect to moisture-resisting properties or are wanting in mechanical strength. Bends and elbows must be *rigid*, or it is impossible to draw the wires in or out; and for the generality of work it will be found that a conduit construction permanently rigid throughout is preferable.

I have already pointed out that more than half of the wire we use is referable to "insulation," and that it is "insulation" we strive to keep. It would, therefore, appear obvious that the conduit should be an "insulating" one. An ideal insulating tube should not only be mechanically strong, but also fire-proof and water-proof. With a tube complying with these requirements all possible electrical trouble is minimized, the insulation on the conductors themselves is protected from mechanical damage, and is enveloped in a preservative rather than a destructive element. Temperature changes are reduced to a minimum, and, if the conduit resists acids, alkalies and gases, the insulating material on the wire is so shielded that its life is indefinitely prolonged. It appears to me that the insulating tube does for "wiring" what the high-resistance incandescent lamp did for the "distribution" problem. I contend, therefore, that an insulating tube method of wiring will prove the ultimate solution of the electric wiring question.

Accordingly, I have pleasure in showing a few samples of the insulating tubes manufactured by the Interior Conduit Company of New York, in the belief that they represent the highest achievement yet accomplished in the production of the ideal tube. This method of wiring originated with Mr. E. H. Johnson. This name, from its connection with the Edison companies, will be familiar to many. The system and process of manufacturing the tube and accessories have been worked out by Mr. Johnson in conjunction with Mr. Luther Steringer and Mr. E. T. Greenfield as co-patentees.

The system provides perfect immunity from fire, durability of insulation, accessibility to concealed wires, and reliable service. It has had extensive practical test in America, and more recently in Germany, where its reputation for being the safest, least expensive and most practical method of wiring is now established. Perhaps the best confirmation I can give of this statement is the fact that we already count, in various countries, some two million incandescent lamps installed in the three varieties of tube—"plain," "brass-covered," and "iron-armored"—and have yet to learn of the first electrical fire arising from its use. Risking the criticism of "advertising," perhaps the best course that I can take is to examine the system in regard to the five cardinal points before mentioned of safety, durability, convenience, accessibility and economy.

When deterioration does take place in a plain metal tube, the tube itself becomes a conductor, and invites deterioration at many points. If insulated tubes are used (with two conductors inside), the deterioration on one only brings additional stress upon the other conductor at one point. The tendency in this case is to create a "short-circuit" at the spot affected. In these particular tubes a short-circuit presents no danger, as the materials of which they are composed will resist the burning effect of the arc. Many tests have been made, and in every case it has been found that the "arc" increased in length until it broke, and severed the circuit without further danger. Any "short-circuit" trouble, then, removes itself, and its injurious effects are confined entirely within the tube. Since the presence of moisture is the principal cause of "short-circuit," the use of these tubes is likely to minimize the occurrence of trouble, because the tube material is non-conducting in respect to heat, and extraneous changes of temperature fail to produce internal condensation.

While on this question of safety, I should say that there is only one point not yet entirely settled. It is whether the two insulated conductors should be kept together or separated—whether one or two tubes should be employed. Owing to the real necessity with a wood-casing system of keeping the wires apart, some authorities urge that this construction should be applied to tube methods, and that a separate tube should be used for each wire.

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*Abstract of paper read before London Institute of Electrical Engineers.

In alternating-current circuits it is essential to keep the wires close together, to prevent a drop in voltage from inductional effects. Clearly, therefore, in this case both wires should by preference be in the same tube. Since in England two conductors are already allowed in "compo" pipes, I do not here anticipate objection being made to this construction in respect of an insulating tube which is electrically perfect and equal to "compo" mechanically. Moreover, in those positions where mechanical strength is imperative the insulating tube can be supplemented by an iron or steel covering. I maintain that theory points to the advisability of placing both wires together, and so far the results of practice favor this view.

As far as present experience has gone, it shows that the bituminized tube will, under ordinary conditions, last indefinitely. It can safely be embedded in the lime and sand plaster used in ordinary building construction. I may mention that the present tendency towards fire-proof building construction is bringing into use certain cements, caustic enough to attack nearly any material coming into contact with them. The problem thus presented has been successfully solved by the introduction of the "brass-covered" insulating tube.

The bituminous material used in these insulating tubes is inert in its nature, and exercises no deleterious influence on the insulating material of the wires themselves. It has sufficient mechanical strength to resist any damage except that inflicted by gross carelessness or design, and in the case of chance mechanical injury to the tube the "accessibility" it provides renders repair easy. In respect of permanence and durability, the advantage of placing the conducting wires in channels which predetermine their relation to any contiguous conducting bodies is, I think, beyond question.

A perfect system of wiring should not only give a suitable channel for the wires, but must provide for the convenient jointing of the tubes themselves, and also for "switch" and "lamp" outlets. It should admit of the multiplication of small circuits from convenient "centers of distribution," as this construction avoids the necessity of joints in the wire, and permits equalization of the voltage throughout the whole installation. An architect ought to be able to lay out the system and provide in his plans for the electrical installation as completely and intelligently as he now provides for steam or gas utilization. The system I advocate satisfies these requirements, for after the conduits have been erected and all danger from mechanical injury has passed, the wires can be readily drawn into their respective channels, and connected up to suitable distributing blocks. There are numbers of existing installations where over 1,000 lamps are in use, and in which any wire is "accessible" at any moment.

An insulating tube system is also economical. With trained workmen, we estimate saving from 25 to 50 per cent. in the labor of installation. Even though the tube in itself is comparatively expensive, if wires suitable to it are employed, the total cost of material will compare favorably with any other system.

The insulating properties of these tubes is such as to provide (approximately) an additional "300 megohms per mile" insulation resistance to the wire. We are beginning to appreciate the fact that, although we provide a costly "600-megohm wire," after having installed a few hundred feet our tests indicate a total insulation resistance of only a few thousand ohms. An insulating tube system can assist us to obtain a more commensurable result. If a high insulation test has to be obtained in wiring work, practical experience shows there is little doubt that an insulating tube, and its suitably insulated wire inside, is commercially ahead of a relatively heavily insulated wire.

Perhaps the limit of economy will be reached when we know how to "earth" perfectly, and can use a bare copper conductor within a metal-covered insulating tube.

THE CROMPTON POTENTIOMETER.

W. C. Fisher has concluded in a recent number of *The Electrician*, London, a series of articles describing the Crompton form of potentiometer and the uses to which it may be adapted by central-station engineers and others.

Describing the instrument as briefly as possible, it might be said to consist in its present form of 15 sections of wire connected in series, 14 of which are in form of coils concealed in the instrument, the 15th being stretched along a scale suitably divided; all are accurately adjusted with each other, so that with a fixed E. M. F. of 15 volts over the whole each section has a fall of $\frac{1}{10}$th of a volt, the scale beneath the slide wire being divided into 1,000 parts, each part corresponding to $\frac{1}{10000}$th of a volt (see Fig. 1).

The unknown quantity x to be measured is placed in series with a galvanometer G and attached to the movable contacts A and B, the intermediate reading between the contacts or main sections of A being obtained by the movement of B along the slide or scale wire, x being so connected up that its E. M. F. opposes that of the main circuit. No deflection of the galvanometer takes place when the point of balance between the opposing E. M. F.'S is obtained; such position, supposing it to exist in the diagram given, would be represented by the contacts 4 and 500 divisions of the scale wire, which, taking into account that each section is equal to $\frac{1}{10}$th of a volt, is equal to 0.450 volt. This represents the ordinary working conditions of the main instrument when used in measuring E. M. F. or current. Under certain circumstances, more especially when measuring resistances, it is advisable to alter the main E. M. F., in which case the values of the sections are correspondingly altered; such conditions will be described as they arise in the study of the capabilities of the instrument.

Although the above represents roughly the diagram of the main instrument, there are fitted in it certain switches and a rheostat for adding resistance in the main current, so reducing the E. M. F. of the secondary cell ordinarily used to the proper value, and for connecting any series of x into circuit in due rotation, so that measurement may rapidly be taken in sequence, there being also a short-circuit key for the galvanometer and a due array of necessary terminals, the true diagram of the instrument therefore being that shown in Fig. 2.

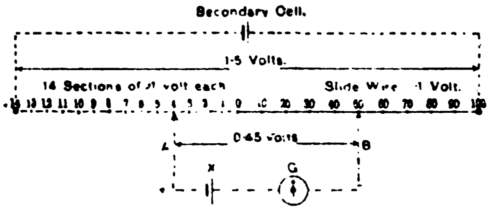


FIG. 1.

In using the instrument for the measurement of power, the first operation necessary is its due calibration—i. e., the adjustment of 1.5 volts at the terminals of the whole of the sections; for as shown in the diagram, a secondary is used as the source of main E. M. F., and having, roughly speaking, an E. M. F. of 2 volts, resistance has to be inserted in circuit to bring it down to the 1.5 volts required. This value is ascertained by substituting for x a known value or standard—i. e., a Clark's standard cell; its temperature is noted, and the two points A and B are placed upon the figures corresponding to the value of the cell at that temperature. Resistance is added in the main circuit until there is no deflection of the galvanometer, due to the fact of the two E. M. F.'S—that in the main and galvanometer circuits—equalling one another; the instrument is thus standardized from what afterwards becomes the x circuit, and is then ready for working and obtaining the value of unknown E. M. F'S. The act of switching in the unknown puts the standard cell out of circuit, so that no possible accident can happen to it, and it need only be brought into circuit again for occasional check purposes.

It will be noticed that the maximum observed E. M. F. on the potentiometer is 1.5 volts; all values therefore to be measured must fall within that range. To meet this requirement multiples and submultiples of the ohm are used, and are so proportioned that their maximum carrying capacity is some definite value proportional to that of the instrument and it is entirely upon them that the range of the set of apparatus depends, the maximum standards made up to the present being for the measurement of 10,000 amperes on the one hand, and 3,000 volts upon the other, but this does not in any way suggest the limit, which might almost be described, in the case of current, as illimitable, whilst with voltage the question of insulation alone steps in.

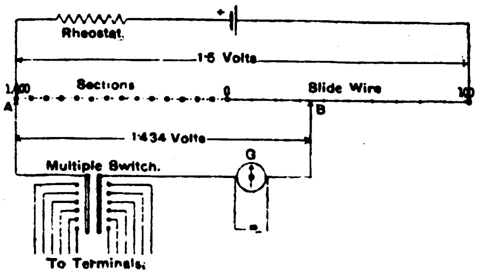


FIG. 2.

Taking, first, the question of the measurement of current, this is done by passing the current to be measured through a standard low resistance of such value that the fall in volts with maximum current over the whole does not exceed that measurable on the potentiometer. The usual units adopted by the majority of the English central stations allow of standards for maximum currents of 1,500, 750, 150, 15 and 1.5—the last three for meter and lamp testing, the preceding two for machine and instrument tests. To be effectively used with the instrument described they should be so proportioned as to be direct reading—that is to say, the first, with a load of 1,500 amperes, should allow of a fall of 1.5 volts. Each section of the instrument having $\frac{1}{10}$th of a volt, will therefore correspond to 100 amperes, each division on the scale to 0.1 of an ampere; the second standard should be similarly proportioned, 750 amperes reading at 0.750 volt; the third standard, for 150 amperes, should have 10 amperes per second and 0.01 per division of scale; the fourth, for 15 amperes, having 1 ampere per section and 0.001 per division; the fifth, for 1.5 amperes, having 0.1 per section and 0.0001 per division. If, therefore, any of these standards are placed in the circuit, current through which is to be measured, the fall of E. M. F. over same is balanced on the potentiometer, and value in current read off accordingly direct.

The maximum E. M. F. ordinarily measurable on the potentiometer is 1.5 volts, but for secondary cell tests, etc., it may be made 3 volts by adding another secondary, and balancing with the Clark cell at half value, but in that and other cases in which it may be done it is necessary to multiply the reading by 2 to obtain the true result. When, however, some very much higher E. M. F. has to be measured, it is necessary to place it across a very high resistance, the fall over some portion of which only is measured. For instance, taking a box of 100,000 ohms, across which is placed 1,000 volts, the fall over 100 ohms corresponding to $\frac{1}{1000}$th of the total, and represented by 1 volt only, is carried to the potentiometer; in the same manner, if it were 100 volts, the fall over 1,000 ohms, or $\frac{1}{100}$th of the whole = 1 volt, is connected; or again, if 10 volts, that over 10,000 ohms, or $\frac{1}{10}$th of the total, still 1 volt only is taken to the instrument. The instrument is, therefore, direct reading, unless, as in the case of current measurement, half values are taken and the reading doubled—a practice equally bad in this case, and for the same reasons, therefore, to be avoided.

In the standards supplied for current and E. M. F. measurement we have accurate submultiples of the ohm—i. e., $\frac{1}{1000}$th, $\frac{1}{100}$th, $\frac{1}{10}$th of the ohm, and also multiples of 100, 1,000, 10,000 and 100,000 ohms, the missing 10 ohms to complete the series being easily obtainable with these. It is therefore possible to measure from the infinitesimal part of an ohm to many megohms, in the following manner:

The unknown is placed in series with the standard with which it is to be compared; a current suitably adjusted is passed through both, the E. M. F. at the terminals of the standard being duly connected with x and balanced at any point most suitable on the instrument; the E. M. F. at the ends of the unknown is then brought into instrument circuit at x, and its value compared with that of the standard.

In conductivity tests the procedure is, of course, the same as that pursued in measurement of resistances. The sample strip, wire, cable, or sheet is placed in series with the standard considered most suitable, and its resistance ascertained as accurately as possible; this is duly compared with that calculated in the usual way, from its known length, section, weight, etc., and the percentage conductivity at given temperature ascertained. This, however, is not necessary, if comparison is made with a known copper standard, duly protected from atmospheric influences and injury, in which case the conductivity may be read off direct, which is very much more simple and occupies less time.

To the measurement of temperatures by means of the platinum thermometer the potentiometer lends itself well by reason of its flexibility and range, and the total disregard of resistance of leads and consequent compensation. Whether it be ordinary atmospheric changes of temperature, or those produced by friction or intense heat, from the melting point of ice to that of the platinum wire itself, all comes easily within the range of the instrument; therefore, by its means temperatures of liquids, flue gases, hot bearings and journals or of the atmosphere may easily be measured in the following manner: The platinum spiral is placed in series with a battery and standard resistance (which may be simple, compound, or compensating) having a temperature coefficient known or practically negligible. This standard is equal in resistance to the pyrometer when at the temperature of melting ice; when, therefore, placed in circuit, as described, and balanced at any point of the potentiometer, any change in the resistance of the platinum spiral is at once detected by comparison, assuming it to be caused by temperature. Such temperature may be measured by means of the constant supplied with the thermometer, and which may be practically taken as 0.38 per cent. per degree Centigrade, which, divided into the difference between the balance of standard and spiral, gives the actual temperature in degrees Centigrade.

SOME NOTABLE ISOLATED ELECTRIC LIGHTING PLANTS.

Private installations of electrical generating apparatus for purposes of lighting and power have become so general that any addition to the already large number of isolated plants must have the merit of novelty to attract any particular attention from persons interested in the art.

The installations described and illustrated in these pages quite properly come under the classification just made. Aside from the interest attaching to a description of any particular department or feature of the most palatial hostelry or one of the greatest churches of a great city, the data which follows will invite attention from all those who have given any thought or study to the problem of safely, efficiently and economically lighting large buildings.

The Hoffman House has long been one of the chief objects of interest in New York City for both the traveller and the native. The magnificence of its equipment and furnishings, even in its earlier days, brought to it the well-merited distinction of "the finest in the city." In 1894 the hotel was reconstructed on a scale of magnificence surpassing all previous efforts in the history of hotel equipment in this country, and during the past year an extension fronting on 25th street and Broadway has been added, the completed structure now forming the New Hoffman House.

THE NEW HOFFMAN HOUSE.

The electrical equipment of the hotel consists of two generating plants. The first of these supplies current for use in the main part of the hotel, the second for the addition, although the arrangement is such that the plants can be used interchangeably, or one can be used for lighting the entire building. The earlier plant installed consists of two 50 K. W. and one 75 K. W. 110 volt General Electric generators direct connected respectively to 75 and 125 H. P. Ball & Wood engines. Steam is supplied by four horizontal tubular boilers of 125 H. P. capacity each. Exhaust steam is used in the heating service of the building.

During the past year there has been added a second plant, located on the Broadway side of the basement. The equipment consists of one 1,500 light "Wood" type alternator, built by the Fort Wayne Electric Corporation. The generator is compound wound, separately excited by an exciter driven by belt from the main armature shaft, and delivers current to the switchboard at 100 volts potential without the intermediary of transformers. The switchboard is of marbleized slate and is equipped with Wood measuring instruments and huge double-throw double-pole switches. By means of these switches either generating plant can be thrown into service or the load divided between the two if run simultaneously.

The prime mover in this plant is a High Speed Buckeye engine built by the Buckeye Engine Company, Salem, Ohio. The cylinder is 16¼ inches in diameter and 18 inches stroke. The engine is speeded at 225 revolutions per minute; this under 90 pounds steam pressure gives a rating of 200 H. P. The generator is belted to the band wheel of the engine by a perforated leather belt.

The building of the extension to the hotel has necessitated a reconstruction of the main system of current distribution installed when the first plant was built. In addition to the multiple connection of the switchboards of the two generating plants the mains are taken to a common distributing center. A distributing board of slate, constructed and erected like a switchboard and equipped with necessary switches, controls the supply of current from either generating plant and its distribution to the several circuits. Arrangements are also made to connect the system with the street mains should an emergency arise.

Throughout the completed building 2,800 16 C. P. lamps have been wired. The generating capacity, as will be observed, is sufficient to operate 3,800 lamps. Excepting the distributing mains leading from the switchboards to the distributing board and which are suspended from the ceiling by porcelain insulators, the wiring is incased in iron-armored conduit made by the Interior Conduit & Insulation Company. On the circuits used for decorative illuminations brass-armored conduit has been used. Bishop and "Safety" wires have been used.

Alfred Zucker of New York was the architect and Hatzel & Buehler, 114 Fifth avenue, New York, the electrical contractors for the extension now being completed. The earlier electrical equipment was installed by the New York Electrical Equipment Company. John J. Hackett is electrician in charge of the entire electrical equipment of the hotel.

The lighting and power plant of Grace Chapel and Mission Buildings is another installation possessing several features of novelty. The group of buildings which are to be set aside for the missionary care of the poor of the East Side are located on East 14th street, occupying a rectangular lot 200 x 125 feet. The buildings comprise a main auditorium, morning chapel, hospital, clergy house and parish house. The auditorium has a seating capacity of 800. The small chapel will be used for early morning services and will be kept open all day. The hospital will be devoted to the care of the aged poor and homeless children. The resident clergy will be housed in the clergy house while in the parish house provision is made for a boys' school, a cooking school, sewing-schools, a boys' club, etc.

The electrical generating plant of these buildings is located in the basement of the clergy house, fronting on 13th street. The space set aside as a dynamo room is somewhat cramped, the aim having been to reserve as much space as possible for gymnasium and swimming bath, both of which are located on the basement floor. Scant as the floor space may be, the design shows how compactly a plant of this size can be arranged. The electrical equipment consists of three generators, one 50 K. W. and one 25 K. W., 125 volt, for the lighting service, and one 50 K. W., 250 volt, for power service. The generators are of the Mather type, multipolar, compound wound and connected direct to Armington & Sims engines. The engines driving the 50 K. W. generators have cylinders 13″ x 12″ and run at a speed of 275 revolutions per minute. The engine for the 25 K. W. generator has cylinders 9½″ x 12″ and runs at a speed of 300 revolutions per minute.

The dynamo leads are carried to an Italian marble switchboard, at one side of the engine room, upon which are mounted the generator field rheostats, Weston illuminated dial measuring and indicating instruments and the knife-switches for the control of the main and feeder light and power circuits.

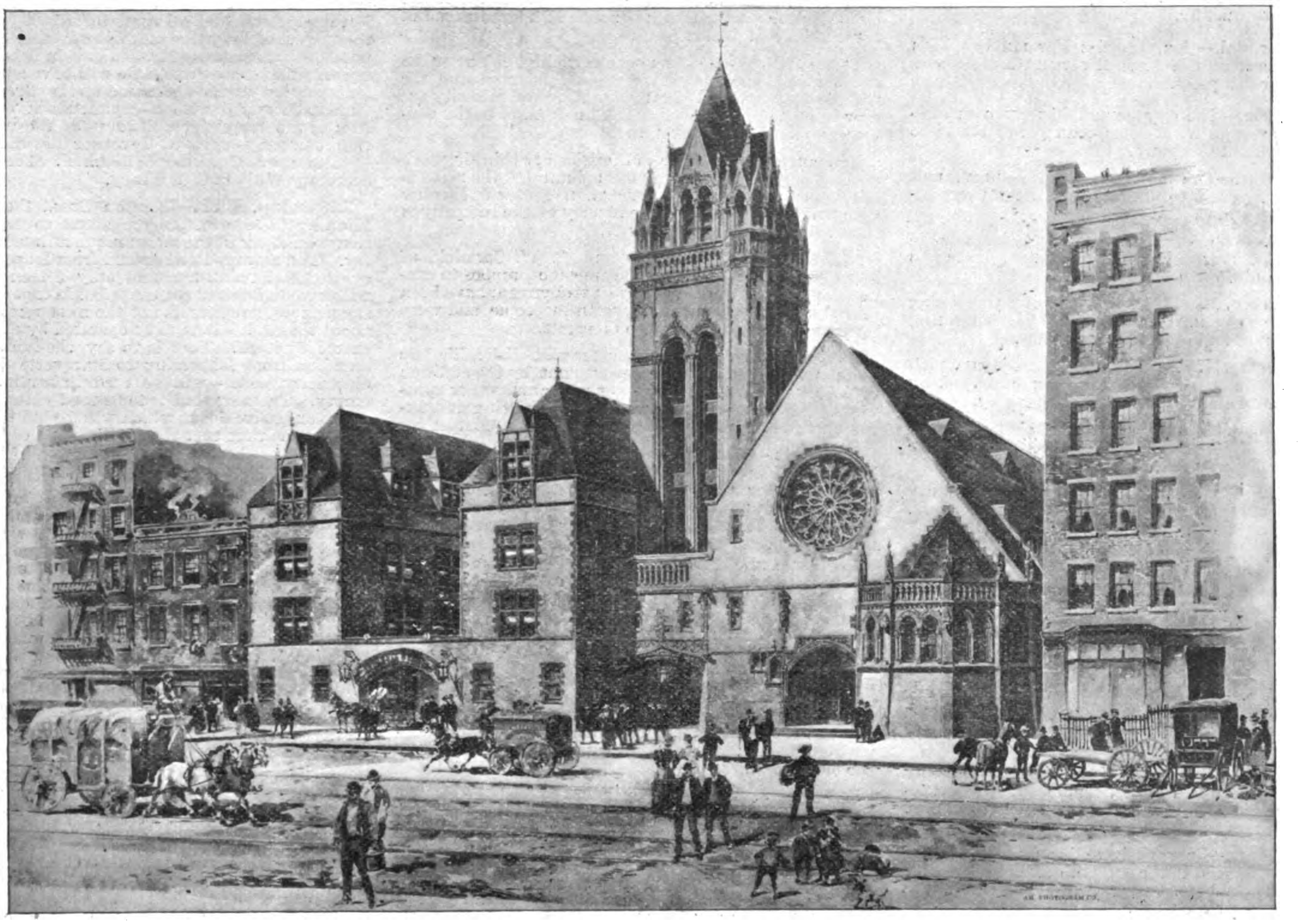
The wiring of the buildings is installed on the conduit system throughout, brass and iron armored interior conduit being used. Feeders are run to the distribution centers, connections to supply conductors being made through cutouts of the panel-board type, of a special design, mounted on slate panels and enclosed in slate boxes. These boards are all located at convenient and accessible points. Bishop rubber cored wire is used throughout the buildings, which are wired for approximately 12,000 16 C. P. lamps. The power service is separate from the lighting service. When the equipment is fully completed, two elevators, two Sturtevant ventilating blowers, the organ and the chimes will be operated by electric motors. For the elevator, two 20 H. P. motors will be required; for the ventilating fans, one 10 H. P. and one 5 H. P., and for operating the organ bellows one 1 H. P.

In the location and distribution of lamps in the auditoriums of the main chapel and the morning chapel the aim has been to secure a uniform degree of illumination and subdued effects. Wherever possible the lamps have been concealed. In the main chapel the chancel is lighted by vertical rows of lamps placed behind the supporting columns. From the auditorium the lamps themselves are not visible, but the reflected light given by them is very pleasing in its effects. The arch over the chancel in the morning chapel is treated in the same manner. Around the cornice of the cruciform auditorium of the main chapel, twenty-eight feet above the floor, is placed a row of lamps one foot apart. Alternate lamps are attached to separate circuits controlled by automatic switches located in the sexton's office, by means of which half or all of the lamps may be lighted extinguished as may be desired. Elsewhere in the building lamps are attached to brackets, or pendant from the ceiling, all electrically controlled by flush double-pole switches.

Every detail of the installation has been carefully worked out, making of the whole a complete plant of the most modern type, which has been installed in the best possible manner.

J. Stewart Barney and Henry Otis Chapman were architects of the buildings. Pattison Brothers, 136 Liberty street, New York, were the consulting engineers who designed and supervised the complete electrical equipment.

Hatzel & Buehler, 114 Fifth avenue, were the electrical contractors who installed the electrical plant and all its accessories.



GRACE CHURCH CHAPEL AND MISSION BUILDING.

Attractive Carbon Advertising.

Carbon products, such as motor brushes, battery carbons, electric light carbons, etc., have never been regarded as altogether proper subjects for artistic treatment. The advertisement of the Phœnix Carbon Manufacturing Company, St. Louis, Mo., published elsewhere in this issue shows that the possibilities in this line have not been overlooked by this progressive and enterprising western firm. This company has recently increased its capital stock to $250,000 which will be applied to increasing manufacturing facilities, so as to better accomodate the rapidly growing trade.

ARTISTIC ADVERTISING.

The trade-paper publisher often hears the complaint from manufacturers and merchants that advertising in trade papers does not pay. No one disputes the general proposition that advertising does pay, but each one makes his own defence for his position as to trade-paper advertising, and the usual story is: "My business, you know, is different; we can't offer bargains; nothing but personal solicitation will sell my goods."

There is some truth in this, also some error. In these days of sharp competition, personal solicitation and plenty of it is required to sell goods. But what salesman ever went on the road and made a successful trip for an unknown house or an unknown article of merchandise?

Personal solicitation is all right, and so is advertising when properly done.

If any concern in this or any other trade has found trade-paper advertising unprofitable, the fault nine times out of ten lies with the man who has charge of placing and preparing the advertising. A slovenly prepared advertisement may easily fail to do any good—even more, it is likely to do actual harm. But when a concern's advertising department receives proper attention—the same as is bestowed on other departments—advertising is a sure advantage, and a surely profitable investment. There is no line of merchandise which cannot, in some way, be profitably advertised. And in this trade, as in every other, those who devote thought and care to their advertisements grow in prestige and wax wealthy.

These remarks are called forth by the appearance of new advertising matter from one of the largest supply houses in the country—also one of the youngest. Starting in a conservative way only two or three years ago, this concern has worked steadily upward and has secured a business of mammoth proportions. Artistic advertising has not done all this, but it has been a potent factor. Followed up by persevering salesmen, it has done the business.

Does advertising pay? What man turning the pages of ELECTRICITY, feasting his eyes on the artistic production put forth to call attention to their new catalogue, will ever forget the Metropolitan Electric Company of Chicago?

GENERAL NEWS.

What is Going On in the Electrical World.

Kingston, N. Y.—The council has granted a franchise to the Rondout & Eddyville Electric Railway Company.

Beeville, Tex.—George W. Greathouse has organized a company here to erect an electric light plant.

Philadelphia.—The common council has declared in favor of establishing a municipal lighting plant.

Tarrytown, N. Y.—A. J. Mackay has applied to the trustees for the right to build and operate a trolley railway in this village.

Alexandria, La.—The electric light plant of the city is to be doubled. Additional dynamos, boilers, engines, etc., will be put in.

San Jose, Cal.—The board of trade has passed a resolution in favor of establishing a municipal electric lighting plant in this city.

Gainesville, Fla.—J. M. Graham, H. E. Taylor and F. W. Cole have petitioned the city council for an electric light plant franchise.

Los Angeles, Cal.—Gen. Charles Forman has been elected president of the Kern River and Los Angeles Electric Power Company.

Lake City, Fla.—The city council has given an electric light charter to W. R. Bush, manager of the Lake City Water & Light Company.

Ridgway, Ont.—The Crystal Beach Improvement Company has decided to build an electric railway between Ridgway and Crystal Beach.

Tully, N. Y.—An electric light plant is to be added to the waterworks, now nearly completed. A vote was taken on the addition on the 21st inst.

Benton Harbor, Mich.—Preliminary steps are being taken by the city council to secure an electric lighting plant to be owned and operated by the city.

Chatham Centre, N. Y.—The electric light plant which supplied this village with light has been destroyed by fire. The plant belonged to Henry C. Spangler.

Elyria, O.—Cars began to run on schedule time on the Cleveland and Elyria electric line on the 15th inst. The running time between the two places is 1½ hours.

Lincoln, Ill.—The organization of the Logan County Electric Light Company is announced. Capt. D. H. Harts is the president and the capital stock is $10,000.

Raleigh, N. C.—J. M. Tufts, of Boston, is building an electric railway to his new winter settlement, "Pinehurst," and will, it is said, extend it to Jackson Springs.

Unionville, Mo.—Bids for the erection of an electric light plant to cost not more than $18,000 will be opened January 10. G. H. Gardner, city clerk, can be addressed.

Newark, N. J.—An ordinance to prevent the carrying for toll of any freight, merchandise or express matter by trolley roads in this city has been introduced in the board of works.

Waycross, Ga.—The Satilla Manufacturing Company of Waycross wants a 1000-light incandescent dynamo, 50-light arc dynamo, 150 H. P. engine, and two 60 to 80 H. P. boilers, new or second hand.

Holyoke, Mass.—Surveys have been made for the proposed electric road to the summit of MountTom, and those interested in the scheme are awaiting a report as to the estimates for the work.

Moodus, Conn.—The people of this place are talking of plans to raise sufficient capital to build the Moodus, Marlborough and Glastonbury electric road, which was chartered as far back as 1893.

Ellsworth, Me.—Hon. George E. Macomber, of Augusta, has made a proposition to build an electric railway between this city and Ellsworth Falls, and will probably be granted a franchise.

Ennis, Tex.—It is reported that President E. H. R. Green of the Texas Midland Railway has an expert figuring on the practicability and probable cost of running trains on his road by electricity.

Wheeling, W. Va.—The Wheeling & Moundsville street railway was opened for traffic a few days ago. The road extends from Wheeling twelve miles south, to Moundsville, and was built at a cost of $200,000.

Chicago.—A representative of the Electric Storage Battery Company of Philadelphia has, it is said, completed arrangements with a South Side street railway company to run storage battery cars on its lines.

Montreal, Can.—The shareholders of the Montmorenci Light & Power Company have decided to accept the offer of the Electric Street Railway Company for the purchase of the stock and franchise of the former company.

New Albany, Ind.—It is reported that a syndicate of Eastern capitalists are negotiating for the purchase of the New Albany and Paoli turnpike with a view of building an electric railway between this city and Paoli.

Warren, N. Y.—The people of this town are anxious to have an electric road from Sugar Grove to Warren and are willing to subscribe liberally toward the undertaking. It is hoped to interest outside capitalists in the project.

Waltham, Mass.—The special committee on municipal lighting has reported to the board of aldermen in favor of the city purchasing the gas and electric light plant, which they valued at $253,000. The report was accepted.

Staunton, Va.—The street railway system in this city is to be changed at once from mule power to electricity. President D. D. Parmely of the railway company says the line is to be extended so as to make it a belt line around the city.

Columbia, Tenn.—Under a court decree the electric light plant and other properties of the Columbia Water Company and Columbia Improvement Company will be sold at public outcry at the court house here on the 15th of February next.

Redlands, Cal.—The Redlands Electric Light & Power Company has sold to Henry Fisher of Pittsburg, Pa., about $45,000 worth of bonds, which closes out all of the unsold bonds, and gives the company sufficient cash to pay off its floating debt.

Winona, Minn.—Right of way is now being secured for the projected electric railway from La Crosse to Neillsville. A slight change has been made in the route. by which the road will run through Mindora instead of three miles east of that place.

Tomahawk, Wis.—The new electric light plant at the dam on Tomahawk river has been completed and the wheels set in motion. Many buildings in this city are now lighted from this source. The distance to the generating plant is over two miles.

Buchanan, Mich.—The authorities are thinking seriously of buying the electric light plant and the right to 500 horse power of the Buchanan Power & Electric Company for $30,000. The property of the company is to be sold at auction January 17.

Suffolk, Va.—L. D. Smith and A. W. Cormick, of Norfolk, representing a syndicate who propose to connect Suffolk and Smithfield by a trolley road, have been over the ground, consulting with the people, and were favorably impressed with the prospects.

Newburgh, N. Y.—The Buttermilk Falls Electric Company intends to increase its plant by the addition of a 75 K. W. Westinghouse generator and other apparatus. All necessary wiring, pulleys, shafting and fixtures will be supplied by the Hyer-Sheehan Company.

St. Louis.—Work is progressing rapidly on the St, Louis and Kirkwood Electric Railway, known as the Houseman Air Line. The tracks are laid from the eastern terminus of the road, at the southwest corner of Forest Park, to Meramec Highlands, the western terminus.

Washington, D. C.—In the Senate a bill has been introduced to amend the charter of the Eckington & Soldiers' Home Railway Company, and providing for a new route. The bill provides that overhead wires shall not be used if electricity is the motive power and prohibits the use of horses.

Buffalo, N. Y.—The mayor has signed the ordinance giving the Niagara Falls Power Company a franchise to supply electricity for light and power in this city.—The new street railway company is encountering strong opposition to its proposed lines from those interested in the old companies.

Albany, N. Y.—The mayor has vetoed the electric light ordinance recently passed by the common council, one of his principal objections being that it was apparently framed to prevent competition by specifying a system to be used which is not up to the latest improvements in lighting.

Middletown, N. Y.—Bids will be received for additional lighting at the Middletown State Homeopathic Hospital, Middletown, N. Y., up to noon January 4, 1896. Specifications may be seen at the office of the hospital, and at the office of the State Commission in Lunacy, Albany, N. Y.

Rochester, N. Y.—Several new trolley lines are projected for next summer, to make the pleasure resorts in this section more easily accessible to our citizens. One of the most important of the proposed lines is the Irondequoit & Lake Shore road which will connect Summerville and Forest Lawn.

Baltimore.—The sale of the Baxter Electric Motor Company's property to Benjamin Deford and Jesse Hilles has been judicially ratified. It is understood that the company will not be reorganized, but the property will either be sold to an outside corporation or the plant and real estate disposed of separately.

Lorain, O.—An effort is being made to secure the location of a big electric motor works in this city, which will employ 325 men. Johnstown is also trying to secure the enterprise, but the chances are largely in Lorain's favor. Tom L. Johnson and his brother, Albert Johnson, are said to be interested in the motor works.

Macon, Ga.—Three hundred electric lights will be put in the Brown House at Macon. Every room in the hotel will be lighted by electricity. It is said that the Central Railroad, Brown House and one or two other neighboring parties contemplate jointly establishing their own dynamos to furnish electric light and power.

Niagara Falls.—The Niagara Light & Power Company will shortly begin the work of laying the wires for electrical transmission of power to Buffalo. The great transforming station will be at Tonawanda, to which point the current will be carried in large units, and from there distributed throughout Tonawanda and to Buffalo.

Crawfordsville, Ind.—Master in Chancery W. P. Fishback has sold at public auction the plant of the Crawfordsville Water and Light Company. William Hord and Newman Erb, representing the first mortgage bondholders, bid the plant in for $50,000. The plant is said to be worth $250,000, and has an indebtedness of $350,000.

Oswego, N. Y.—F. E. Pritchard, superintendent of the Oswego Street Railway, has succeeded in perfecting an automatic regulator for controlling the current which supplies arc lamps, preventing irregularity in the brilliancy of the lights. Mr. Pritchard is the inventor of a similar device for regulating the current on street car circuits.

Culpeper, Va.—There is some talk here of building an electric passenger and freight railway from this town to Front Royal. This would make a line through the richest part of Rappahannock County, and would be very helpful to the people of the county, as they have no railroad at all, and all freight must be hauled from ten to twenty-five miles to a depot.

Brooklyn, N. Y.—The rights, franchises and properties of the Long Island Traction Company, sold at auction recently to John G. Jenkins, president of the First National Bank of Brooklyn, for $5,000,000, were long the subject of litigation in this and other States. The purchase was made by Mr. Jenkins in behalf of the reorganization committee, who will have a new company incorporated under the name of the Brooklyn Rapid Transit Company with a capital stock of $20,000,000. Among the largest stockholders of the wrecked Traction Company were ex-Governor Roswell P. Flower, ex-Lieutenant-Governor William F. Sheehan and ex-Secretary William C. Whitney.

Ishpeming, Mich.—Winston Bros., the well-known Minneapolis contractors, are about to begin the construction of one of the most unique railroads in the country. The new road will extend from Ishpeming to Marquette, Mich., a distance of only fifteen miles, but it will have to descend some 800 feet in that distance. The steep grade, however, is not the most remarkable thing about the road. It is to be operated by electricity generated by itself. That is to say, the loaded trains descending from Ishpeming to Marquette will generate electricity, which will be used in hauling them back empty. The new road is to be used chiefly for hauling ore to extensive docks which will be built at Marquette at the same time that the road is being constructed.

Pittsburg, Pa.—A party of New York, New Haven and Hartford Railroad officials, headed by President Charles P. Clarke, visited the East Pittsburg works of the Westinghouse Electric & Manufacturing Company on Tuesday of last week. There they were shown the new polyphase long distance current system in operation. They also made a minute examination of the mechanism of the large motor engines which the Westinghouse Company and Baldwin Locomotive Works, of Philadelphia, are jointly experimenting upon, and which is designed for longer distance and heavier hauling than the motor engines now in use. None of the gentlemen would say whether there is any immediate probability of changing the motive power of their road. They said they are anxiously waiting the progress of the experiments with a view of taking the earliest advantage of successful results.

TELEPHONE AND TELEGRAPH.

Good Work in the Southwest.

F. H. Brown, of Emporia, Kan., has been active in extending independent telephone service in Kansas and Missouri. In a recent interview he said: "Girard, Pittsburg, Galena, Independence, Neodesha, Coffeyville and other Kansas towns have telephone plants, and I am now busy on plants in Parsons and Oswego. The cities are to be connected. In Missouri, there are Joplin, Carthage, Webb City, Carterville and Lamar. The cost to subscribers varies from $12 to $30. My charges at Parsons are $24 and $12; at Girard $24 and $30. In Joplin aad Carthage subscribers pay $30 and $18."

Another Pacific Cable.

The Pacific Cable Company has been incorporated at Trenton, N. J., with a total capital stock of $1,000,000, divided into 10,000 shares. The names of the incorporators are: Abram S. Hewitt, D. O. Mills, G. M. Dodge, Fred D. Grant and Wager Swayne, of New York; James J. Hill, of St. Paul, Minn., Z. S. Spaulding, of San Francisco; John H. Browning, of Tenafly, N. J., and Mason W. Tyler, Plainfield, N. J.

The object of the corporation is stated in the papers filed to be the construction and operation of electric submarine cables in the Pacific Ocean with telegraph lines and connections for the transmission of messages. Connection, it is understood, will be made with the Hawaiian Islands. Offices are to be maintained in Jersey City and San Francisco, and business will be commenced on January 1 next. The company has been organized through the efforts of Col. Spaulding, of Hawaii, who has obtained a concession for a cable to the United States, with an annual subsidy of $40,000 from the Hawaiian Government.

Called a Liar by Wire.

Rev. I. C. Monson, of Stevens Point, Wis., has brought suit against H. A. Lathrop and the Western Union Telegraph Company for $5,000 damages for an alleged libelous telegram sent over the Western Union lines by Lathrop in which Mr. Monson was declared to be "an unscrupulous liar."

W. F. Churchman, the receiver of the Phœnix National Telephone and Construction Company of Indianapolis, Ind., has filed his final report, showing that a syndicate was ready to purchase the property of the defendant, and that all creditors had been satisfied. The report has been approved and the receiver discharged.

The council of East St. Louis, Ill., has passed an ordinance providing for the construction of a night watch and messenger system. The Missouri District Telegraph and Night Signal Service Company has accepted the ordinance and will proceed with the construction of the system.

The Wausau and Merrill Telephone Company has let a contract to Peter Berard, of Merrill, to build a toll line between Wausau and Merrill, Wis. The contract calls for the completion of the line within thirty days, and the line will be owned jointly by Wausau and Merrill companies.

At the recent meeting of the stockholders of the Lansing Telephone Exchange, Lansing, Mich., the following directors were elected: J. Stahl, John Herrmann, W. A. Fraser, D. A. Reynolds, F. B. Johnson, Dr. Ranney, H. C. Hedges, L. C. Blood, H. K. Vedder and A. A. Nichols. The exchange now numbers 367 subscribers.

A sub-committee of the Electrical Committee of the Philadelphia city council is considering the application of the Standard Telephone Company for a franchise in that city.

The Fort Valley and Perry Telephone Company of Fort Valley, Ga., has declared a dividend of 24 per cent. on the capital stock. The company has been doing business but little over three months.

The ordinance adopted by the common council of West Bay City, Mich., for the Harrison Telephone Company has not been accepted by the company, and the $200 check that was deposited becomes the property of the city through limitation.

The Telephone Users' Association of Milwaukee, Wis., has secured new schedules of rates from the Wisconsin Telephone Company, granting material concessions, to take effect January 1.

Mayor Lebknecher, of Newark, N. J., is withholding his signature from the ordinance granting rights to the Home Telephone Company of that city. The company announces its readiness to go ahead as soon as the ordinance is signed.

A new copper wire is to be strung by the Western Union Telegraph Company between Albany and Pittsfield for the exclusive use of the Boston & Albany Railroad.

The Department of Public Works of Philadelphia, recently advertised for bids for telephones to be used in the police department. The only bid received was from the Bell Company. The bid was $10 for full sets and $5 for single sets.

The Corry Telephone Exchange is the name of a company recently organized at Corry, Pa., to construct an independent telephone exchange.

The bids of the Standard Signal Company and the Gamewell Fire Alarm Telegraph Company for a signal system at Medina, N. Y., have been rejected.

The Clarke Automatic Switch Company of Sioux City, Iowa, has secured a franchise and is at work putting in a telephone system at Rock Rapids, Ia.

The telephone exchange built at Petoskey, Mich., by John W. Chase, of Grand Rapids, and Frank Vincent, of Petoskey, has been opened with 60 subscribers. Bell rates have been cut to $20 and $14.

The Central Union Telephone Company is negotiating for right of way to connect Nashville, Ill., with Mascoutah.

Contract has been let to C. W. Gallagher, of Meridian, Miss., for the construction of a telephone line from Shubuta, Miss., to Cocoa, Ala.

The Automatic Telephone Company has applied for a franchise at Niagara Falls, N. Y.

The New Castle Telephone Company of New Castle, Ind. Capital stock, $4,500. Directors: E. B. Phillips, C. S. Hernly, E. N. Bundy.

The Southern Bell Telephone Company has declared war on the Home Telephone Company of Mobile, Ala., by a reduction of rates to $12 and $20.

New Companies Incorporated.

The Wayne Telephone and Telegraph Company—to connect Auburn, Geneva, Palmyra, Lyons, Clyde, Seneca Falls, Waterloo and numerous smaller places in New York State by telephone. Capital $5,000. Directors: S. E. Bishop, A. B. Bishop, George E. Brisbin, Derick Douglas. John H. Childs and Albert C. Lux, of Clyde, and E. W. Brown, of Palmyra.

The Blue Earth Valley Telephone and Exchange Company of Winnebago City, Minn., has amended its articles of incorporation increasing the debt limit to $10,000.

The Southern States Telephone Company, with a capital stock of $100,000, has been organized at Baltimore, Md., to construct telephone systems, etc.; Charles E. Fink, president; A. G. Davis, vice-president, and R. B. Hazlett, secretary-treasurer.

The McEwen Engine and Thompson-Ryan Dynamo.

The accompanying illustrations show, somewhat in detail, the workshops and the products of the J. H. McEwen Manufacturing Company.

Figure 1 shows an interior view of the machine shop, a steel structure built by the Shiffler Bridge Company, of Pittsburg, Pa. The central part, 60 feet wide, is spanned by a twenty ton electric traveling crane. Within this area all the heavy machines are located. On either side is a wing 30x260 feet the second floors or galleries of which are equipped with light tools. Railroad sidings extend through the center of the main building.

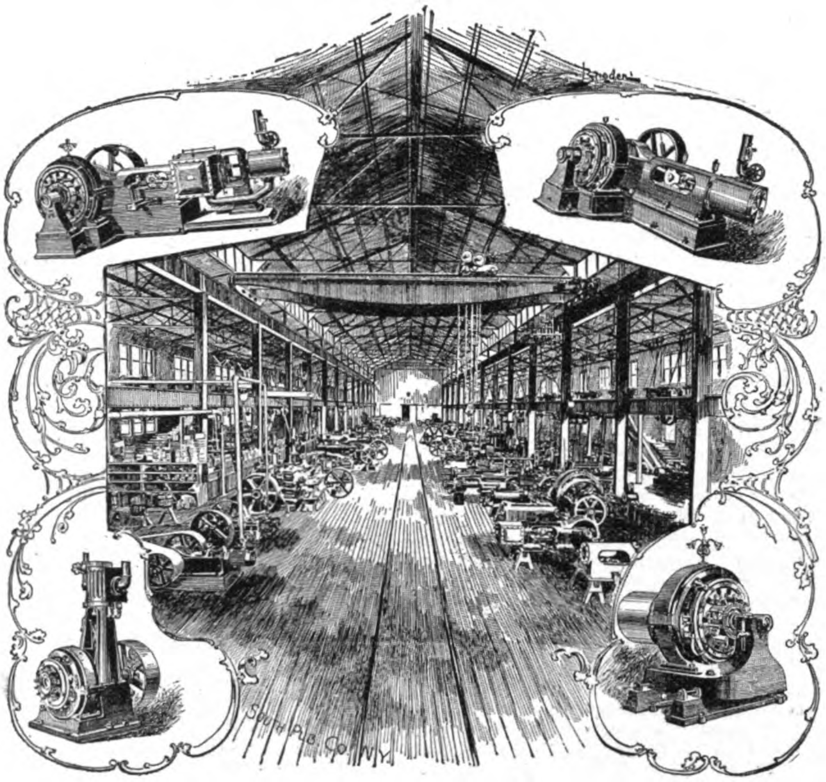
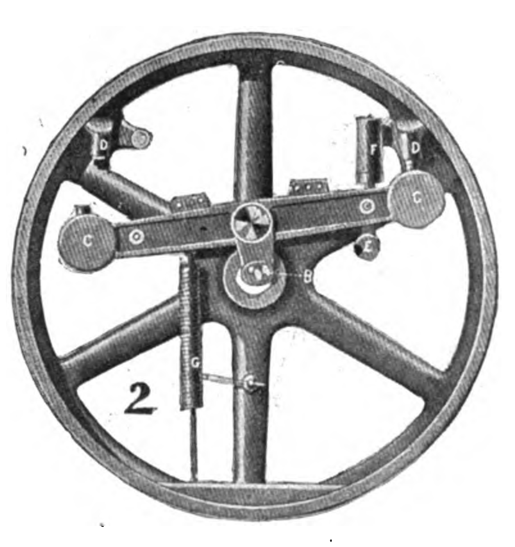
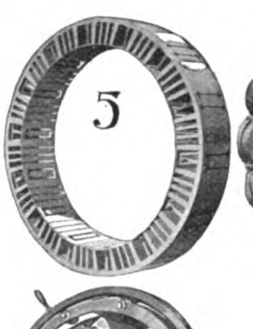

South Pub. Co. N.Y.

Fig. 1.

The McEwen High Speed Engine, one of the products of this company, has been on the market for about four years and has made a very creditable record during that time. Recently a number of improvements have been made in the details of the engine. Fig. 2 is the improved governor, shown by the cut to be extremely simple, having but one bearing and that a roller-pin bearing which requires no lubrication, so that the want of lubrication will not affect its regulation, and as the spring is the only part that is adjustable, there can not be any trouble from misadjustment.



The Thompson-Ryan Dynamo differs in nearly every detail of construction from the ordinary type of generator. The most important feature is a set of series windings surrounding the armature and termed balancing coils. This feature, which is the invention of Prof. Harris J. Ryan of Cornell University, was introduced for the purpose of balancing armature reaction, and carefully conducted scientific tests show that it accomplishes the desired end perfectly. Having no armature reaction to contend with, the designers have been able to introduce into the dynamo many important features never before possible.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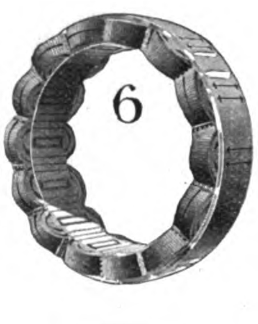
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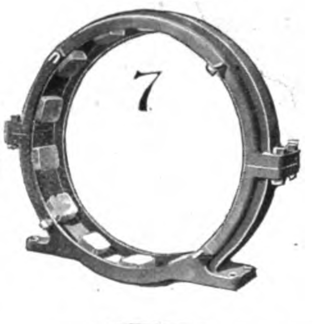
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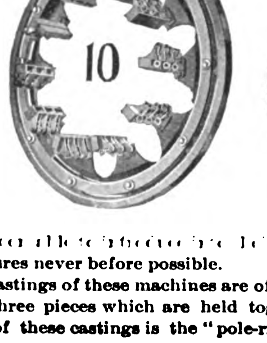
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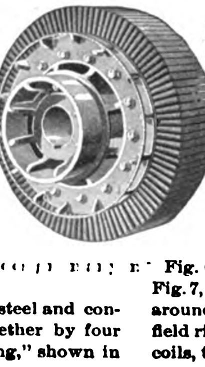
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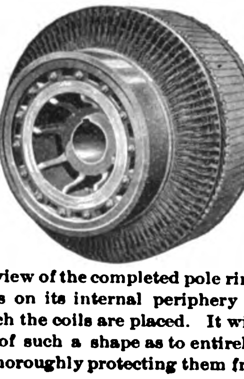

9

The field castings of these machines are of steel and consist of but three pieces which are held together by four bolts. One of these castings is the "pole-ring," shown in Fig. 5, through which the balancing coils are wound, and the other two constitute the field ring proper, Fig. 7.

The balancing coils are wound in such a way that the current passes through them across the pole face in the opposite direction from the currents in the armature conductors, and thus the magnetic effects of the armature currents are neutralized.

Fig. 6 is a view of the completed pole ring. The field ring Fig. 7, shows on its internal periphery the "pole necks" around which the coils are placed. It will be seen that the field ring is of such a shape as to entirely enclose the field coils, thus thoroughly protecting them from mechanical injury. On account of the very small amount of field energy required the rise in temperature of the field coils is very slight, notwithstanding the fact that these coils are so nearly surrounded on all sides. No compound winding is used, since the balancing coils afford a compounding vastly more effective than the compound coils of the ordinary dynamo.

All of the armature cores are built of thin plates of a peculiar special steel, the distinctive feature of which is its unusually low hysteresis loss. The plates are stamped out in the form of rings, and a series of long slots are punched near the edges.

The large number of poles used enable the builders to greatly shorten the armature conductors and to use what may be described as the cylindro-hexagonal style of drum winding. In this winding all parts of every conductor of any particular layer lie in the same cylindrical surface, the windings do not bend down over the end of the armature core at any point, and the conductors being placed through the core and below the surface no binding wire is necessary. The commutators are built of tempered copper with pure mica insulation throughout.

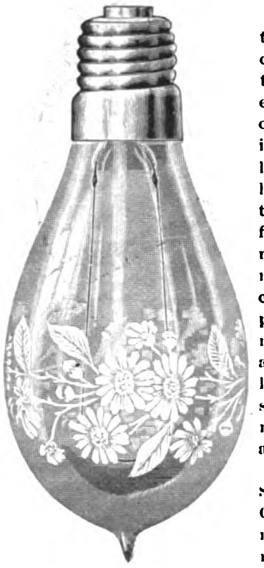
But little heat is developed in the core of the armatures since the quantity of iron is comparatively small and the magnetic density low, and the armature being short and the ends of the windings being thoroughly cooled, it will be readily seen that there is small danger of overheating one of these armatures even with excessive loads.

Fig. 10 is a view of complete brush-holder. The brush-holders are very simple, and hold the brushes in such a way that they require no adjustment, but have only to be slipped into the holder. Working with brush-holders absolutely fixed, there is entire freedom from sparking under any and all conditions of load. The design of the machine peculiarly fits it for running in parallel. Two or more of these machines will work perfectly in parallel, and divide the lightest load evenly or maintain perfect unison with the entire load thrown off.

The Thompson-Ryan Dynamos are built in sizes from 12½ K. W. to 1500 K. W. capacity, both belted and direct connected. Fig. 1 shows the belted dynamo as well as the dynamo direct connected to the different types of the McEwen engine.

The sales office of the company has been established at 26 Cortlandt street, New York City.

Sunbeam Engraved Lamps.



Decorative lamps for interior lighting effects have come to be regarded as essential to the stock equipment of every well-regulated electrical supply store. The rapidly increasing use of this form of lamp has called into being a large variety of designs, so that the most fastidious may find styles suited to their needs, however elaborate they may be. Novel shapes and colorings have long been employed to secure effects with miniature lamps. Satisfactory as the employment of these lamps have been, they are unsuited to certain purposes, notably for richly designed and finished fixtures.

For supplying this want the Sunbeam Incandescent Lamp Company, Chicago, recently made a new departure in furnishing engraved lamps, and they have issued a catalogue showing a number of handsome standard designs as well as samples of special designs that have been made to order. The lamps used in a handsome residence should be in keeping with the shades and fixtures, and it is not improbable that within a few years nothing but ornamental lamps will be used in such lighting.

COMMERCIAL PARAGRAPHS.

Mr. E. E. Cary has assumed the general managership of the Packard Electric Company, Limited, St. Catharines, Ont. This company, with unlimited water power, manufactures the Packard lamps and transformers for Canadian trade.

Among the handsome new calendars for 1896 received by ELECTRICITY are those of Wm. Jessop & Sons, Ltd., 91 John street, New York, makers of the well-known Jessop tool steel; Knowles Steam Pump Works, 93 Liberty street, New York, and Robert Poole & Son Company, founders and machinists, Baltimore, Md.

The Lafayette Engineering and Electric Works, Lafayette, Ind., which recently purchased the patents, plant and appurtenances of the Muncie Electric Works, Muncie, Ind., have become owners of the buildings formerly occupied by the Lafayette Car Works. These buildings have been fitted up with machinery for the manufacture of a complete line of electrical generating apparatus.

A circular which is now finding its way to the desks of central station men thus explains how the high grade of American Incandescent Lamps is maintained: "It has always been our aim to manufacture only high grade lamps, and to this end we use nothing but the best in material and workmanship. The utmost care is exercised in every part of our works. Every material is carefully examined; every chemical is subjected to scientific tests for purity and fitness; every filament is accurately measured and tested; every lamp is tested for vacuum, contact, correct candle-power and voltage, and, before being shipped is subjected to careful scrutiny, and is burned on circuit for a sufficient length of time to develop latent defects.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

DECEMBER, 1895.

DATE	LIGHT.	DATE.	EXTING.
1	4.10 A. M.	1	6.00 A. M.
2	No light.	2	No light.
3	"	3	"
4	5.00 P. M.	4	8.00 P. M.
5	5.00 "	5	9.00 "
6	5.00 "	6	10.10 "
7	5.00 "	7	11.30 "
8	5,00 "	9	12.40 A. M.
9	5.00 "	10	1.00 "
10	5.00 "	11	1.50 "
11	5.00 "	12	3.00 "
12	5.00 "	13	4.20 "
13	5.00 "	14	5.30 "
14	5.00 "	15	6.20 "
15	5.00 "	16	6.20 "
16	5.00 "	17	6.20 "
17	5.00 "	18	6.20 "
18	5.00 "	19	6.20 "
19	5.00 "	20	6.20 "
20	8.00 "	21	6.20 "
21	9.10 "	22	6.20 "
22	10.10 "	23	6.20 "
23	11.00 "	24	6.20 "
24	11.00 "	25	6.20 "
25	...... "	..	....
26	12.10 A. M.	26	6.20 "
27	1.10 "	27	6.20 "
28	2.10 "	28	6.20 "
29	3.20 "	29	6.20 "
30	4.20 "	30	6.20 "
31	No light.	31	No light.

INCORPORATIONS.

The Connecticut Engineering Company, Norwich, Conn.—to establish, construct and operate electrical lighting and power plants, etc. Capital stock, $5,000. Promoters: Geo. W. Phillips, A. E. Rich, Geo. W. Hunt, Geo. E. Raymond, Norwich.

La Capital Company, Portland, Maine—to manufacture and deal in electricity for purposes of light, heat and power. Capital stock, $1,500,000. Promoters: Theo. N. Vail, Lyndon, Vt.; Francis A. Houston, Boston, Mass.; Edw. K. Milliken, Deering, Me.

The Martha's Vineyard Electric Light and Power Company, Cottage City, Mass.—to manufacture, generate and sell electricity for light, heat and power. Capital stock, $15,000. Promoters: Jno. A. Duggan, Josiah Quincy, Jno. R. Graham.

The Cherryfield & Milbridge Street Railway Company, Cherryfield, Me.—to build and operate an electric railway from Cherryfield to Milbridge. Capital stock, $30,000. Directors: Samuel D. Leavitt, of Eastport; George A. Curran and George A. Murche, of Calais; William N. Nash and G. R. Campbell, of Cherryfield, and James Mitchell, of Portland.

The Schance & Fair Electric Company, Chrisman, Ill.—to operate telephone, telegraph and electric plants. Capital stock, $6,000. Incorporators: George W. Fair, John G. Schance, Byron Ash and James Hoult.

The Page Ticker Company, New York City. Capital stock, $25,000. Directors: David W. Johns and Willis B. Hale of Cleveland, Ohio; Robert H. Campe, Horace P. Hussey, John E. Wright, Edward T. Hickey and C. M. Artz of New York City.

A bill has been introduced in the House of Representatives at Richmond, Va., to incorporate the Norfolk Electric Light & Power Company, with Paul K. Boyd, B. N. Sperry, George Russell and Walter H. Taylor, all of Norfolk, and J. C. Sperry, of Syracuse, N. Y., as incorporators. The measure authorizes the company to supply natural or artificial lights and electric power for public and private uses, and to transact the general business of an electric company. The capital stock shall not be less than $15,000 and may be increased to $500,000.

The Pittsburg, Braddock & McKeesport Street Railroad Company, Pittsburg, Pa—to build an electric street railway in the City of Pittsburg. Capital stock, $66,000. Promoters: Chas. H. Johnston, Wm. Robison, Pittsburg; Walter Farmariss, Philadelphia, Pa.

The Amarillo Realty and Live Stock Company, Kansas City, Mo.—to do a general real estate business; supply gas, water and electricity, etc. Capital stock, $25,000. Promoters: H. B. Sanborn, Wm. A. Craddock, C. P. Harney, Kansas City.

The stockholders of the electric railroad at Fulton, N. Y., have decided to increase the capital stock of the company from $15,000 to $100,000. A consolidation of the Fulton and Oswego systems is now being arranged.

The Union Traction Company, Reading, Pa. Capital stock, $400,000. Shareholders: Robert N. Carson, I. F. Carson, Nelson Buckley, Philadelphia: Richmond L. Jones, Samuel E. Rigg, Oliver S. Geiger, Frank P. Lauer, James A. O'Reilly, William R. McIlvain, Henry C. England, and George F. Baer, Reading.

The Walker Company of Cleveland, O., has filed articles of incorporation with the Secretary of State at Trenton, N. J. The company is capitalized at $2,000,000, and will manufacture electrical machinery. The incorporators are John Ludwig of Brooklyn and Charles N. King and Martin W. Dixon of Jersey City.

The Sprague Electric Railway Company, Jersey City, N. J.—to manufacture, construct and equip electric and other railways, electric light and power plants and works, etc. Capital stock, $1,000,000. Promoters: Frank J. Sprague, Chas. M. Sprague, Chas. A. Benton, New York City; Edw. C. Platt, Brooklyn, N. Y.; Howard F. Gurney, Jersey City, N. J.

The Standard Building Company, Chicago, Ill.—to contract for and do a general improving, constructing, repairing, building and supply business, including electrical work and public and private improvements of all kinds. Capital stock, $50,000. Promoters: Jos. Fish, Richard Sullivan, H. A. Senf.

The Logan County Electric Light Company, Lincoln, Ill.—to operate electric lights, electric power, and to heat buildings by steam. Capital stock, $10,000. Promoters: John A. Lutz, R. H. Gaines, John St. Gerny, Chas. C. Reed, T. A. Reynolds, Adam Denger, D. H. Harts.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DECEMBER 17, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

551,534. Closed-Conduit Electric-Railway System. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed April 12, 1895.

551,535. Closed-Conduit, Railway System, Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed April 12, 1895.

551,536. Closed-Conduit Electric-Railway System. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed April 26, 1895.

551,537. Closed-Conduit System for Electric Railways. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed Sept. 11, 1895.

551,587. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to The Electric Car Company of America, same place. Filed Feb. 23, 1887.

551,664. Electric-Railway-Motor Shield. Isaac F. Baker and William R. McLain, Lynn, Mass., assignors to the Thomson-Houston Electric Company of Connecticut. Filed Nov. 25, 1889.

551,734. Transmission of Electricity to Moving Cars. Thomas Nesom, Indianapolis, Ind., assignor by direct and mesne assignments, of one-half to William D. Eckenrode and Edward S. De Tamble, same place. Filed Sept. 21, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

551,357. Incandescent Electric Lamp. Charles A. Beal, Abington, Mass. Filed Feb. 28, 1895.

551,364. Magnetic Electric-Lamp Holder. Martin H. Collom, Denver, Colo. Filed June 12, 1895.

551,394. Electric Light. David Misell, New York, N. Y. Filed April 5, 1895.

551,451. Electric Lighter. Herbert E. Rider and John Hencken, New York, N. Y., assignors to Robert W. Inman, same place. Filed Nov. 10, 1894.

DYNAMO ELECTRIC MACHINERY, ETC.

551,371. Means for Operating and Regulating Speed of Electric Motors. Rudolf Eickemeyer, Yonkers, N. Y.; Rudolf Eickemeyer, Jr., executor of said Rudolf Eickemeyer, deceased. Filed Dec. 31, 1892.

551,470. Controlling Electric Motors. David Mason, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed April 22, 1892.

551,567. Electric Motor. Merle J. Wightman and Oscar C. G. Urban, Cleveland, Ohio. Filed May 16, 1893. Renewed May 15, 1895.

551,633. Electric Motor. Frank E. Herdman, Winnetka, Ill. Filed Aug. 6, 1894.

551,634. Mechanism for Admission and Regulation of Currents to Motors. Frank E. Herdman, Winnetka, Ill. Filed March 29, 1895.

551,635. Mechanism for Admission of Currents to Motors and Regulation of Current in Same. Frank E. Herdman, Winnetka, Ill. Filed June 28, 1895.

551,712. Dynamo-Electric Machine. Alexander B. Blackburn and William Buchanan, Wolverhampton, England. Filed Oct. 1, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

551,391. Automatic Telephone-Exchange System. William F. Lounsbury, Oswego, N. Y. Filed April 23, 1895.

551,551. Holder for Telephone-Receivers. Fergus W. Martland, Fall River, Mass., assignor of one-half to George W. Hoar, same place. Filed June 10, 1895.

551,674. Telephone-Transmitter. Theodore Grissinger, Mechanicsburg, Pa. Filed Oct. 18, 1894.

MISCELLANEOUS.

551,361. Apparatus for Manufacturing White Lead by Electrolysis. Arthur B. Browne, Cambridge, and Edwin D. Chaplin, Natick, Mass., assignors to the American Lead Company, Kittery, Me. Filed July 2, 1894. Renewed May 18, 1895.

551,372. Electric Program-Clock. Frederick Frick, Waynesborough, Pa. Filed April 29, 1895.

551,388. Strong-Current Protector. Adrian L. Joynes, Paducah, Ky. Filed Jan. 9, 1895.

551,436. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Filed July 11, 1895.

551,565. Process of Renovating Storage Batteries. John Trowbridge, Cambridge, Mass. Filed Oct. 1, 1895.

551,648. Electrolytic Process of Obtaining Precious Metals. Louis Pelatan, Paris, France, and Fabrizio Clerici, Milan, Italy. Filed June 25, 1895.

551,682. Electric Lock. Philip Meyer and Julius A. Meyer, Newark, N. J., assignors of one-third to Emil Blumenhein, same place. Filed Feb. 23, 1895.

551,743. System for Regulating Effective Tension of Electrical Circuits. Hermann O. W. J. Breul, Berlin, Germany. Filed Nov. 17, 1893.

ELECTRICITY.

Vol. IX. NEW YORK, JANUARY 1, 1896. No. 25

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EDITORIAL NOTES.

The Wizard of War. It is naturally to be expected that the newspaper war which has been raging with the fury of a woman scorned in the editorial offices of New York and London, would prove an incentive to the inventive genius of the world, and under the impetus of a state of belligerency there would be brought forth a variety and kind of life and commerce destroying devices that would astound the world should an opportunity arise to make a demonstration of the possibilities of these besoms of destruction. To conceive and to construct these engines of war, by means of which a handful of men can annihilate an army in the twinkling of an eye, would, it seems, require inventive and mechanical genius of a high order.

Sober-minded people having some knowledge of mechanics, and who have been accustomed to look to the hare-brained, visionary inventor for the most wonderful conceptions, will be not a little surprised to know that Thomas A. Edison is the latest to plot destruction for America's foes. In a page interview, embellished with illustrations, he has told a reporter of the New York *Journal* all about his "aerial torpedoes that will bring swift destruction to the strongest fleets"; he has described his "snake-like chains" that deal death in multiple arc, so to speak. In event of war the Wizard says he will "abandon all else and give my whole energy to the service of my country." He will perfect the sub-marine boat and dynamite gun, and by the magic of his name alone will transform the waters of our coasts into an agency more devastating than bullets. He will surround our great cities with cables that will deal death to all who attempt to cross them, and will charge all the circumambient atmosphere near the enemy's fleet with electricity and consume ships and men alike. Should these devices fail to repel an invading foe, it will still be impossible for a hostile fleet to enter New York harbor.

The present plan of torpedo protection finds little favor with the Wizard of War, and to improve upon it he proposes to erect a number of structures on which a wheel can be placed. "These sunk to the bottom of the sea with a cable around them, would give you an endless cable that could be kept in motion just like the cables that run the street railroads. Torpedoes could be attached to these cables and run out as far from or near the shore as desirable. Its location at any time of its travel could be traced just as readily as if it were stationary. The torpedo could be cut loose, and allowed to shoot toward the surface by some magnetic arrangement and would discharge itself when the pressure of the water on the top was lightened. A few of these cables run out in various directions would make the harbor a mine of death. Nothing afloat could live in it. There is nothing to prevent this being done to-morrow. So you see how quickly defences can be found."

* * *

Acetylene is Profitable. The recent incorporation of a $7,000,000 company at Albany to introduce acetylene gas in New York and neighboring cities calls attention again to the general question of the utility of this gas and to the operations of the promoters who are making fortunes out of the sale of territorial rights.

In the latter part of 1894 the Willson Aluminium Company claimed to have accidentally discovered a very cheap process of making calcium carbide, and a promoting company—the Electro Gas Company—was at once formed for the sale of rights.

A dividend of 60 per cent. on the stock of this company has already been paid, and one of 50 per cent. is promised in the near future. A Chicago sub-company has already paid to the parent company $300,000 as one instalment for the rights in that city. This dividend has been paid, in fact, solely from the sale of rights. Not a single ton of calcium carbide has yet been made in this country, and acetylene gas is not yet a commercial product.

In Electricity for December 26, 1894, there was printed a paper on this subject, by Prof. Francis Wyatt, Ph. D., which attracted wide attention. Among other things, Prof. Wyatt said:

> When Maquenne and Travers were working on these lines, Mr. Thomas L. Willson, of the Willson Aluminium Company, was carrying on experiments in the manufacture of aluminium and calcium alloys at Spray, N. C. In the progress of these experiments, and while attempting to produce metallic calcium in his patent electric furnace, he succeeded in making, from a simple mixture of lime and carbon, and with a current of 4,000 to 5,000 amperes, a fused, black, homogeneous mass, which became solid and brittle when cooled. This substance was shown by analysis to be very pure carbide of calcium, of the formula CaC_2, and the gas which it evolved from the decomposition of water was pure acetylene, formed according to the reaction
>
> $$CaC_2 + 2H_2O = C_2\,H_2 + CCa\,(HO)_2.$$
>
> This contribution to organic chemistry of a plentiful and cheap source of acetylene, by so easy and simple a method of making calcium carbide, must be regarded as one of the most important of the valuable resources added to the chemical industry by electrical engineers, and the Willson Aluminium Company has shown its appreciation of it by continuing to manufacture the carbide on the small scale. A new corporation has also been formed, which is known as the Electro Gas Company, and which proposes to erect a large new plant for its wholesale production. . . . As the actual result of its recent practice, the Willson Aluminium Company has found that it can produce one short ton of calcium carbide from a mixture of 1,200 lbs. of fine coal dust and 2,000 lbs. of burnt lime, and at an expenditure of about 180 electrical H. P. per hour for 12 hours. These figures are not very far from those required by theory, and

> they agree very closely with those given by H. Moissan, who has also produced the carbide in an electrical furnace of his own invention. It would, therefore, seem safe to formulate the approximate cost of production somewhat as follows for both the carbide and the acetylene:
>
> | | |
> |---|---|
> | 1,200 lbs. coal dust, say | $2.50 |
> | 2,000 lbs. powered burnt lime | 4.00 |
> | 180 E. H. P. from water at, say, 50c. per hour for 12 hours | 6.00 |
> | Labor, etc. | 2.50 |
> | Cost per 2,000 lbs. CaC_2 say | $15.00 |
> | Cost per 2,000 lbs. C_2H_2, say | $87.00 |
>
> These figures would hold good, not only for the present works in North Carolina, but at any other place where cheap water power and equally cheap coal, lime and labor are procurable and accessible. . . . The experiments that have been made by the Electro Gas Company have satisfactorily demonstrated that one short ton of calcium carbide will produce, by merely mixing it with water, about 10,500 cubic feet of acetylene, which, when mixed with the required amount of air produces a gas equal in illuminating value to 100,000 cubic feet of city gas of 22 to 25 candle power per 5 feet standard burner. If to the estimated cost already given for the calcium carbide there be added, say $15 per ton for freight, incidentals and profit, the material for producing such a gas could be obtained at nearly all points for 30 cents per 1,000 cubic feet ready for burning, and the convenience with which the calcium carbide can be packed and freighted, combined with the easy preparation of the gas itself in great or small quantities, at any time, should enable it, if not to be adopted for the common supply of large cities, to supply the requirements of country hotels and dwelling houses and of railway cars.

Prof. Wyatt's paper was really the prospectus upon which the Electro Gas Company went into business, and that the business has been profitable up to date is proved by the payment of a 60 per cent. dividend.

Now that a full year has passed, it is proper to inquire how far the promises have been realized.

Is acetylene gas being used commercially? No. Has the Electro Gas Company built a plant for the manufacture of calcium carbide? No. Is any one making calcium carbide in quantities? No. What have investors bought?

The *Engineering and Mining Journal* prints a communication which gives considerable information on this point:

> Acetylene gas is a combination of hydrogen and carbon and is the product of the decomposition of calcic carbide and water. Calcic carbide is the combination of calcium and carbon and is a product resulting from the action of the heat of the electric arc on lime and coke. A short ton of calcic carbide, 95 per cent pure, may be counted upon to produce 10,000 cu. ft. of illuminating gas, which gas is over ten times brighter than the present average illuminating gas. If calcic carbide could be produced for $30 per ton, including conversion of the same into gas, the resulting gas would cost $3 per thousand: hence, as this gas is ten times brighter than ordinary illuminating gas, the proportionate amount of illumination could be had for 30c. per thousand. The production of water gas in the United States is now costing from 30c. to 40c., or more, per thousand, varying according to the care in the management of the work. This figure does not take into consideration the handling of the gas further than putting it in the holder. Calcic carbide is now being produced and has been for about two years past. at Neuhausen-on-the-Rhine, with water power, and in one of the most complete electrical and industrial plants in the world, at a cost of 3½c. per lb. or $70 a short ton.
>
> It is explained by the promoters of the scheme to those who are able to get near the point of the business, that "Here we have an electric furnace, in the bottom of which is a cathode, in the top of which we have an anode (the first a carbon plate, the second one or more large sticks of carbon); here is our dynamo, here is our water-wheel, here is our old millrace, and where is the cost of power? Here is a one-armed man feeding ground lime and coke into the furnace, and here is a negro-boy working the anode up and down so as to maintain the arc. There is the pay roll; here is the bill for the lime and coke. Where is this great expense account we hear about?"
>
> This situation apparently presents very simple ground for investigation. As a matter of fact it is a little too complex for the ordinary technical investigator, and is far beyond the public. It combines several important elements which require investigation by men who are fitted to investigate in three important fields: (1) Mechanical engineering, (2) Chemistry and (3) Electricity. It has not been passed upon, publicly, by men of the character mentioned. It is safe to assume that the promoters in question have not discovered any new principle in electricity. Unless they have done so, it is equally safe to assume that with their primitive methods they cannot produce calcic carbide as cheaply as it is being made at Neuhausen with the most perfect facilities which capital can employ. It is held by a few students of this subject that the same ignorance which prevented the promoters of this operation, knowing that they had made calcic carbide originally, is responsible, together with the enthusiasm of the moment, for their further failure to discover the leak in their estimates. It is possible that that leak may be found in the fact that they fail to charge themselves with sufficient expense for power. It is said that the Electro Gas Company has arranged to put up calcic carbide works on the line of the Niagara Falls Power Company and has contracted with that company for power at the rate of $25 per horse power per annum. It will be found that paying for their power at this rate, if they run every hour and every week day of the year, and use every atom of their electric current in the production of calcic carbide, that their power will cost them about $11 per ton of carbide produced. At Neuhausen, only about 20 per cent. of the total efficiency of the heat of the arc is utilized in forming the calcic carbide. $11 × 5 = $55. The Pittsburg Reduction Company has had a wide experience with electric power and heat. No one to date, it seems, has succeeded in patenting calcic carbide. Patents have been secured on several ways of utilizing the same. The Pittsburg Reduction Company, apparently being aware of these facts, made a line of experiments which are said to have been much more exhaustive than any work yet done, or possible, by the Willson Alluminium Company, and stopped the work because of the fact that the production of the calcic carbide cost them, instead of $70 per short ton, as at Neuhausen, at the rate of about $150 per ton. At this price they saw little use chemically for the product; and, as their acetylene gas product would cost them $15 per thousand, or $1.50 per thousand for illumination proportioned to ordinary gas, they left the field
>
> It is supposed that the reason for the failure to secure the total effectiveness of the heat of the arc in the production of carbide is found in the impossibility to feed the ground lime and coke into the furnace so that the arc may be continuously maintained. When the crushed lime and coke are placed on the cathode, and when the top of the pile reaches a proper distance from the anode or the carbon sticks, quite the full effect of the arc is had, and calcic carbide is formed. Should the top of the pile be too far beneath the anode, as long as this continues the power is being wasted, the anode being burned away. Should the top of the pile of coke and lime be too high and touch the anode, the current is short-circuited, and the waste goes on as long as this state remains unchanged. Various methods are being tried for correcting this state of affairs, which will be best understood by pointing to the clockwork now used for a similar reason in the arc lights in daily use, which are all imperfect in the respect in question to date. Industries depending upon electric arc are proceeding without much hope of correcting this serious drawback. Their hope of economy lies in cheap generating power. With very cheap power, say $2 per horse power per year, or the discovery of means for the utilization of the full theoretical power of the heat of the electric arc, the problem of the production of calcic carbide at $30 per ton and acetylene gas at $3 per thousand will be solved. So far as the Willson Company, or any other carbide producer, is concerned, these accomplishments are as far away as the discovery of a method to get in general use more than 20 per cent. of the full energy of coal.

The incorporators of the New York Carbide and Acetylene Company are Elias C. Benedict, Anthony N. Brady, Walton Ferguson, Frederic P. Olcott, John Sloane, and Samuel Thorne. They are likely to pay a high price for their education as to the commercial possibilities of acetylene gas.

The patents of the Willson Company are worthless. The manufacture of calcium carbide is free to the world. The only reason why it is not now being manufactured in dozens of places is that it costs more than it is worth. The Willson people first claimed to have reduced the cost of manufacture to $5 @ $7 per ton. This estimate has been growing until now $40 is the cost claimed. Even at this price there would be little incentive to introduce acetylene as a competitor of water gas, for the reason that, although it were cheaper there are many obstacles in the way of introducing acetylene even as an enricher of ordinary gas. The first is that it burns ordinarily with a very smoky flame. Means must be devised to overcome this before it can be used successfully as an illuminant. In the second place, the gas unites directly with copper, forming a highly explosive compound, and therefore copper or brass must be eliminated from the fixtures in which it is to be used. The latter objection is a serious one, and impossible to overcome except by selling the gas so cheap that consumers can afford to put in new fixtures.

The spectacle of conservative capitalists investing their money in such rights as the Electro Gas Company and the Standard Telephone Company offer is a curious one, and provides a subject for the careful study of psychologists. What are these men thinking of? As far as the original promoters are concerned, it is easy to see what they are thinking of. Stock in the parent Electro Gas Company, par value $100, has been sold as high as $1,000 a share.

Electricity as an illuminant has nothing to fear from the competition of acetylene gas at present. But we recommend Mr. Thomas L. Willson, Mr. George F. Seward and the rest to go slow unless they value money dishonestly made more than their reputation as business men.

* * *

Questions Soon Answered.

Commenting last week upon the serious problems which confront railway companies in the large cities, where the demand for rapid transit is increasing and where hostility to the overhead trolley grows more formidable every year, the conclusion was reached that in many localities neither the cable nor an open-conduit system could be looked to for relief, and we asked the question "What is there left?" We were unaware at the time that there would so soon be an answer to our question by a thorough and practical demonstration in this city.

In the same issue appeared some comments of the *American Engineer and Railroad Journal* on the "Bugbears of Electric Traction." These were, according to our esteemed contemporary, the acknowledged difficulty of getting two motors to work in unison on one car, the necessary difficulties of the gearing problem, pounding of the rails and consequent flattening of the wheels.

The demonstration above referred to will also have an important bearing on the question of whether these "bugbears" can be eliminated in electric railway practice and is worthy of careful consideration.

The Johnson-Lundell Company have arranged with the Metropolitan Traction Company to put in a working system in Thirty-fourth street from Tenth avenue to the North River to prove during the coming winter the utility of this closed conduit in connection with a single-motor car equipment.

This system was thoroughly described in ELECTRICITY for March 16, 1894, since which time, however, several important improvements have been made, notably in insuring protection against the rail remaining charged after the car had passed any contact switch.

The street chosen is admirably adapted for a conclusive test, and its choice shows the confidence of the promoters. It has a steep grade, takes in some of the most poorly drained territory in the city, and for heavy traffic is one of the busiest of our streets. Every obstacle which would be encountered in the entire Belt Line system will be met with here. The cars will be in operation by January 10 or 15, and every opportunity will be afforded to railway men and the public generally for complete and exhaustive tests. If the General Electric Company adopt the same policy with regard to the open conduit system in Lenox avenue, a good many disputed points as between the closed and open conduit systems will be settled forever.

Every detail of the equipment is designed to represent the highest development of economical practice, the generator being driven by a Westinghouse gas engine.

The single motor idea is not a new one, but has not before proved successful. One of the obstacles *in* previous experiments has been in the control of the motor. This has been obviated entirely by Mr. Lundell by giving the armature two sets of windings. By handling the sets of coils separately the motor is susceptible of series multiple control. The method of suspension on the frame of the truck dispels at once all the "bugbears" referred to by our steam railway critic.

Under the Searchlight.

Views and Opinions on Timely Topics.

New Unit for Hous-Kennooley.

(From the Sioux Falls Argus-Leader.)

J. E. Tomlinson received on Monday a new four ton dynamo for his electric light plant.

* * *

Tadpoles as Pole Finders.

A French physician has found that if an electric current be passed through water in which a tadpole is swimming the animal will immediately turn so that its head is toward the anode, or, in other words, so that the current passes into its mouth and out from its tail; its head will therefore always point towards the positive pole. The effect on a lot of tadpoles in the same vessel is quite amusing.

* * *

THE doctors of Buffalo, N. Y., don't want the peace and quiet of Franklin street in that city disturbed by the clang of Tom Johnson's trolley gong. At a meeting held a few days ago to protest against the granting of a franchise to the Buffalo Traction Company, Dr. Delancy Rochester, acting as spokesman for the allopathic, homœopathic and eclectic kickers, gave utterance to the following:

"The noise of a trolley car passing would injure a physician's business. It would be impossible for us to hear a heart-beat with the trolley's clanging, banging and zipping all the time. It would be impossible for us to properly diagnose a disease."

* * *

"Electricity" and Americanism.

(From the St. Louis Republic.)

ELECTRICITY is augmenting the spirit of true home life and intensifying our love of country. It will, from the very nature of its essential progress, vastly strengthen the American spirit in the rising generation.

* * *

A Chance for H. M. Byllesby.

(From the Leola [S. D.] Herald.)

The Electric Light Company of Watertown is about to throw up the sponge. The company intends to close the plant unless someone will take it, and that right away. The company has been running behind ever since the city quit paying for lights. The company offers the plant to the city for 1896 at $1 rental, the city to take all the receipts. The company has a bonded debt of $9,600.

* * *

The Latest Niagara Wheel.

Of the making of water wheels to utilize the Falls of Niagara the same may be said as was said of the making of books. The latest device of this kind is the invention of L. W. Hotchkiss, described by the Niagara Falls *Cataract* as "the well-known quarryman at Lewiston, who was brought up along the banks of the Gorge, and who has carefully studied the currents and other conditions." This gentleman has "a current motor scheme in mind before which all other current motors sink into insignificance."

Inventor Hotchkiss contemplates the building of a steel arch across the Gorge below the falls, which "is to be used to sustain an undershot wheel extending from shore to shore, the power to be equally divided between the two countries, and transmitted where it is wanted. The paddles of the motor are all to be attached to the main shaft and immersed to such a depth as to furnish the most power. The main shaft would extend across the river, with a power-house at each end. The location selected for the bridge and motor is at the outlet of the whirlpool where the river is narrowest, and the bridge is to be used for traffic. It is estimated that such a wheel would develop 50,000 horse power, and ice and other debris floating down against the paddles would only add to the power exerted."

* * *

Christmas by Gas Light.

(Interview with a prominent citizen of Brooklyn.)

Since the Brooklyn Union Gas Company has got all the Brooklyn companies into its grasp, the light has been getting gradually worse, until to-night our Christmas is spoiled because we have no light, and as the stores are closed we could not buy candles or oil.

* * *

JUDGE SEAMAN has issued an order that the property of the historic Appleton (Wis.) Edison Company be sold in foreclosure on January 3.

* * *

SERVICE in a corporation which has no body to be kicked, no soul to be damned, appears to have a deadening effect on the finer sensibilities of most men so employed. A recent incident at the new Manhattan Athletic Club illustrates this. Mr. A. G. Mills, vice-president of the Otis Elevator Company, happened to be a member of a committee for the purchase of some new elevators. He graciously informed his associates that he knew all about electric elevators, while they knew nothing. Therefore the matter should be left to him. He would see to it that his firm put them in at cost. To satisfy themselves on this point, the committee were urged to call on Stokes & Parrish, the Whittier Machine Company and the Otis Company for bids.

How many members of the committee knew that the relations between these concerns, all in the Elevator Trust, are such that the bids of all three of them can be made up in the office of the Otis Elevator Company whenever it seems best to do so?

* * *

THE anti-English sentiment in Caracas, Veneuzela, is very bitter. A movement is now on foot to displace all English telephones with those of American manufacture.

Johnson--Sprague--Weston.

A few weeks ago ELECTRICITY printed a notice of the incorporation of the Johnson Lundell Railway Company coupled with the news that Mr. Edward H. Johnson would soon again be an active factor in electric railway work.

Last week it was recorded that Mr. Frank J. Sprague is in the field with the Sprague Electric Railway Company, with assurances of startling developments in the line of equipment for elevated and suburban roads.

This week the Weston General Company is announced, with Messrs. Edward Weston, F. C. Matthiessen and Henry E. Niese as incorporators, to develop electrical inventions and devices and manufacture and sell electrical machinery and appliances connected therewith.

Which all looks as though the pioneer inventors and hustlers think there is money yet to be made in the electrical business, and many improvements yet to be introduced before the development reaches the ultimate.

OBITUARY.

Mr. Merritt Clarke, who died on Christmas Eve at his home in Derby, Conn., was buried on the 27th. Mr. Clarke was eighty years old on Dec. 4 last and had spent the greater part of his life in the community where he died. He leaves six children, the youngest of whom is Mr. W. J. Clarke of the General Electric Company.

Brooklyn Institute.

Prof. M. I. Pupin, of Columbia College, will deliver an illustrated lecture before the Brooklyn Institute of Arts and Sciences on the evening of the 3d inst. on "Electrical Resonance and Alternating Current."

The Hunnings Transmitter.

(*From the original MS., now in possession of* ELECTRICITY.)

IN RE TELEPHONE—Statement by the Reverend Henry Hunnings, M. A. Oxon., of Portland House, Ryde, Isle of Wight.

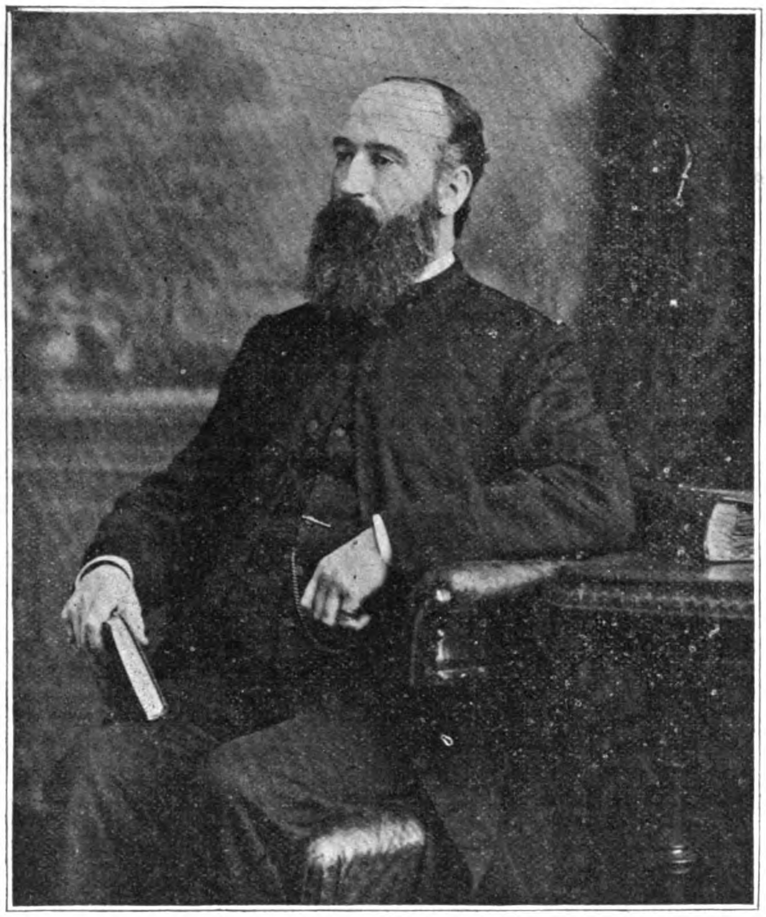
Having from childhood been brought up in an "electrical atmosphere," it was only natural that when Bell's telephone was introduced into England I should immediately turn my attention to it; and more especially as it actually carried out a proposition which my eldest brother made to me some years before. His idea was that a vibrating diaphragm might be arranged to control a voltaic current at one end of a line wire and that those vibrations should be reproduced at the other end by means of an electromagnet acting upon a similar vibrating diaphragm, so that he might be asked a question and give an answer without the trouble of leaving his office. I did not see at that time how it was possible to accomplish such a thing and in fact spoke as no scientific man should speak, and said it was *impossible*. It may well be imagined that when Bell's telephone was brought before the notice of the British Association, in 1877, I should of course take the matter into consideration, the Bell telephone carrying into practical effect my brother's desire of some years before. On experimenting with it, I was greatly disappointed with the results, viz., the *feebleness* with which the voice was reproduced, and I came to the conclusion that what was wanted was a transmitter which would control a direct voltaic current, and to that I turned my attention.

In November, 1877, I made a transmitter with a vibrating diaphragm of paper, and also one with a smaller iron diaphragm. I tried from one to many points, but the adjustment was so delicate and so easily disarranged that I reluctantly gave up my theory of *fixed points*. I need not detail the various experiments I made, and over which I lost a great deal of time, but go on at once to say that I was ignorant of what was being done or had been done in America. I was working entirely upon my own lines and upon my own theories.

My next step was to arrange a row of cinders (about 18 inches long) upon a tightly stretched piece of paper. This gave articulate speech, but very feebly. At last about April, 1878, I thought I would try the following experiment: I turned a wooden ring about two inches in diameter and about $\frac{3}{8}$ deep, a paper diaphragm covered with tinfoil was affixed to either side and the intervening space filled in with crushed cinders. This gave very fair and encouraging results, and in the end I took out "letters patent" in the following September. This step I should have taken earlier had it not been for the great discouragement I received from the Post Office authorities. In my simplicity I thought the Government of the country was the fountain-head to go to with such an invention. I accordingly sought an interview with the Postal authorities in the summer of 1878, and was introduced by a nephew of the late Sir Rowland Hill. Mr. Preece was unfortunately away, and the gentleman I saw poured so much cold water upon me and telephones in general that I returned to the country much disheartened. After the genial warmth of the summer months, spent in a pleasant part of Yorkshire, I sufficiently recovered animation to venture upon a "Provisional Protection" so that I might allow the instrument to be experimented upon. This "protection" was granted on the 16th September, but the instrument had undergone no vital change since the previous June, and in fact was the first transmitter invented, or as far as I can learn, the only one in existence in England at that date.

And now may come some remarks with regard to my claim and Mr. Edison's. It has been alleged that my patent is an infringement of Mr. Edison's, but if we compare the action of the two transmitters it will, I think, be clear to every unbiassed person that they act upon two different principles. In January, 1883, I wrote to Mr. Preece upon the subject and he replied upon the 26th: "I am perfectly satisfied that the contact theory is the right one and the pressure theory is—in plain Saxon 'all rot.' I do not think you have anything to fear from Edison's patent."

Points of contact had been my aim from the very first, and why I say in my specification "preferably oven-made engine coke" is because of its specific gravity compared with its bulk. I have obtained much louder results from fine brass turnings; but success with these is so very variable, owing to the heavy specific gravity compared bulk for bulk with oven-made engine coke, that for practical purposes brass or any other metal turnings are unsuitable and altogether unmanageable. At the same time I reserve to myself the right to use any conducting substance in a granular form and in a loose state. Th innumerable *points of contact* and the mobility of the same are my claims to originality.



I believe the above to be a correct and concise history of my invention.

H. Hunnings, M. A. Oxon.

Ryde, I. of W.
Jan. 3rd 1882.

Now let us turn to Mr. Edison's own account of his transmitter experiments and we find him stating that "a small disk made of lampblack taken from a smoking petroleum lamp gave splendid results. It was soon found upon investigation that the resistance of the disk could be varied from 300 ohms to the fractional part of a single ohm by *pressure* alone." We can now compare the two instruments. Mr. Edison's transmitter is the "pressure" system—mine, points of contact and the mobility of the same.

Towards the end of December, 1878, my instruments were publicly used on Messrs. Bright's wire between Manchester and Rochdale. On the 3d of January, 1879, the Earl of Derby inspected them "and was astonished to find that the transmissions were so distinct." In a private letter to me his Lordship said he never heard the telephone so loud and perfectly before.

At the British Association meeting at Sheffield my transmitters were exhibited and came under the notice of Mr. Edison's agent.

On the 22d and 23d January, 1880, I had the pleasure of making several tests in company with Mr. Preece. On the latter day, Mr. Edison's agent, Mr. Adams, was present and was very much astonished to find that my transmitter was so much superior to, and could get through so much more "induction" than Edison's.

On the 2d February, 1880, the Bell Telephone Company entered into negotiations with me for the purchase of my patent, but on the amalgamation of the two companies the negotiations came to an end.

I believe the above to be a correct and concise history of my invention.

H. Hunnings, M. A. Oxon.

Ryde, I. of W., January 3d, 1882.

Chicago Electrical Association.

"What Next in Electrical Railway Work?" was the theme of discussion at the meeting of the Chicago Electrical Association held Dec. 20. The paper of the evening was by Mr. J. R. Cravath of the *Street Railway Review*. He discussed at considerable length the underground conduit and other systems, and said that while the conduit system might be operated successfully in clean, well-drained residence streets, to attempt to employ it under the conditions which obtained in the down-town streets of Chicago would be to invite probable failure.

COMPARATIVE TESTS OF STEAM BOILERS WITH DIFFERENT KINDS OF COAL.*

BY DR. CHARLES E. EMERY.

Experimentally, hydrogen burned in oxygen has over four times the calorific value of carbon. It seems evident, therefore, that the value of the fuel should be greater the larger the proportion of hydrogen it contains, but such is not the case. The evidence to the contrary was at an early date overwhelming, and it was claimed by many that the commercial value of coal of all kinds was practically proportioned to the carbon element alone. From the weight of evidence, it appears to the writer that this simple rule is, in a general sense, as nearly accurate as any other that has been suggested for a number of varieties of coal burned with ordinary apparatus and management.

It has also been suggested that the practical evaporation bears a definite relation to the proportion of "fixed combustible," or that remaining after the volatile matter in the coal has been distilled off; but from the weight of evidence it appears to the writer that this proposed rule is not generally applicable, though it should be borne in mind that the proportions of fixed and volatile combustible matter are used universally as a means of identifying and classifying different kinds of fuel. A well-established result of this classification is that the evaporative efficiencies of anthracite and semi-bituminous coals containing less than 20 per cent. of volatile combustible are, in a general sense, nearly equal, independent of chemical composition; though, as a rule, the theoretical calorific value increases considerably, and the practical evaporation slightly, with the increase of volatile matter within these limits. On the contrary, as the proportion of volatile matter increases above such limits, the percentage of the total calorific value of the fuel utilized is, as a rule, reduced materially, with ordinary apparatus and management. It is true that the calorific value of many coals reduces as the percentage of volatile matter is increased; but this is not always the case, particularly with the coals of this country. The percentage of efficiency is, however, in general decreased with the increase of volatile matter above the limits mentioned.

Most of the coals used on the seaboard and in the eastern part of the United States have less than 20 per cent. volatile matter in their composition, and, in a general sense, with conditions favorable to each, give substantially like evaporative results. Each, however, has peculiarities of its own, so that, with ordinary apparatus and management, the results vary somewhat, and the mechanical structure of the coal seems to have more influence on the result than the chemical composition. The practical results for the softer coals of the same class, substantially alike in appearance and composition, also vary in much the same way; but in general all show a falling off in evaporative efficiency when the volatile matter is greater than 20 per cent.

The above will serve to give a general impression of the information available on the subject. The explanations that have been made of various observed phenomena are more or less conflicting because based on experiments limited in number, or carried out in a manner which did not develop all the conditions. One difficult question to explain has been the variations in practical result shown by coals of substantially the same chemical composition. These differences have frequently been referred to a less percentage of refuse, and to differences in the refuse as respects the formation of clinkers, etc., whereby less labor was required to handle the fires, the fire-doors were opened less, and there was less heat carried away in the refuse itself. All these practical questions are of importance; but it is probable that the more important variations in result are due to the different way in which the components are united chemically, and, as stated, to a difference in mechanical structure of the coal. It is known that a difference even in the allotroptic form of the element affects the calorific value, Berthelot finding nearly 5 per cent. difference in calorific value due to the combustion of carbon in the form of a diamond, and of amorphous wood charcoal. It is known that comparing coals of very similar composition, some will smut the hands and others will not; some have little cohesion, like rotten wood, others are like stone. The suggestion that the calorific value may vary with the mechanical structure is, therefore, very probable. It has occurred to the writer that these differences may be very much akin to those resulting from the mixtures and combinations of carbon and iron, resulting in cast iron, malleable iron, soft and hardened steel, etc.

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* Abstract of paper read at the New York meeting of the American Society of Mechanical Engineers, December, 1895.

In burning coal with a large proportion of volatile matter, there results a combined combustion and wasteful distillation of the volatile products, which latter are not consumed in ordinary furnaces but escape to the chimney. The experiments show, as stated, that the loss of heat increases with the proportion of volatile products, and Rankine gives the carbon value of losses on the several assumptions: first, that hydrogen only is wasted; second, that the carbon is combined with hydrogen in the same proportion as in "marsh gas" and the product wasted; and third, that the combination is in the same proportion as in "olefiant gas" and the product wasted. This would seem to imply that, at the temperature of the furnace, carbon and hydrogen unite to form hydro-carbons, but this is probably not the case. Any hydro-carbons that appear are doubtless condensed and combined as a part of the coal itself, released as gases by the heat of the furnace, and in the main carried away, wasting the heat due to their chemical composition, which it is interesting to note is less than the sum of the calorific values of the elements. The imperfect combustion resulting from driving off the volatile matter can, in part at least, be explained by the great volumes of gases disengaged, which prevent a proper admixture with the air supplied, and which, moreover, absorb a portion of the heat of the combustible consumed.

[The tests made by Prof. Walter R. Johnson, of Philadelphia, in 1841, under authority of Congress, the tests made under the directions of Chief Engineer B. F. Isherwood, U. S. N., 1858–1862, and the discussion of the reports of these tests by various authorities, both American and foreign, are here reviewed at some length by Dr. Emery.]

The general conclusion to be derived from the study of the numerous experiments with coals varying considerably in the percentage of volatile matter seems to be that, while the average results of evaporative tests with a number of coals from a given region may indicate an approximate general law, the individual experiments vary so much among themselves, or even from the average, that they cannot be accurately compared with each other either directly or by any fixed law of progression, and this will be particularly the case when a highly bituminous coal is used in one case and an anthracite or semi-bituminous in the other. These limitations are particularly emphasized by the fact that the results of the tests presented can only be compared with those made with customary apparatus and customary management. Mr. Kent points out that much better results have been obtained in practice with Western coals than those given by Johnson, though he found that the foreign and American tests corresponded well with each other. In order to test the relative efficiencies of different boilers in different locations, using different coals under different conditions, it would be necessary to ascertain the value of the improved furnace and of the improved care exercised in making a particular test, in addition to such information as was available about the theoretical and practical calorific value of the coals employed. Even then no accurate comparison could be made unless the practical evaporative efficiency under standard conditions of the coal used had been previously determined; and in determining the relative value of the coals still another difficulty is encountered, to wit, the variations in the efficiencies of the boilers themselves. The efficiency of the boiler is usually the very question to be settled in a boiler test; but to ascertain the comparative calorific value of different fuels, in order to use them in standard tests, allowance must be made for the difference in efficiency if different boilers are used or if the rate of combustion is varied.

The writer, in the preparation of the General Report of Group XX., Centennial Exhibition, presented curves and tables based on experiments made in the United States Navy which very satisfactorily show the variations in the evaporative efficiency of a boiler due to different rates of combustion; and the results there stated may be applied with confidence to tests of boilers that have been designed for economy by insuring a thorough distribution of the products of combustion over all the heating surfaces. Such a boiler cannot be forced much above its capacity without the use of artificial draught and is therefore only adapted for positions where the load is comparatively steady. When the demands vary at short intervals it is necessary that the boiler be constructed so that it will burn coal freely when required. With such construction it is possible to obtain considerable difference in capacity, and this fact makes such a boiler of no better or even lower efficiency at comparatively small powers, thus reversing the rule compared with boilers proportioned for economy.

The falling off in evaporative efficiency of bituminous coals, and indeed the low results with other coals, has been attributed by various writers, on the one hand, to a deficiency in the air supply, and, in connection with experiments with chimney gases, to a surplus of air admitted. Professor Unwin states as his opinion that the "chief loss of efficiency in the operation of the boilers is the heat carried into the chimney," and "this depends on simple conditions of air supply." Rankine makes a somewhat similar statement, but, from information now available, it appears safe to say that such conclusion is not warranted, though, doubtless, improvements in the result can be obtained in that way. If such a simple proposition were true, we would sometimes obtain very high evaporative results from ordinary boilers with rich bituminous coals; but the best efforts seem only to bring such results up, or nearly up, to those obtained with anthracite. Mr. Kent hints that hot gas and air, or the conditions obtaining with a regenerative furnace, are necessary.

With the expectation that mere regulation of the air supply would secure great economy of fuel, there has been invented abroad an instrument called the "dasymeter" to indicate the percentage of carbonic acid in the products of combustion compared with pure air. The indication depends on the weight of a vessel through which gases are being continually drawn from the chimney of a steam boiler. It is stated that with practice the stoker "learns what alterations of the damper or fire-door or thickness of fuel on the grate are necessary, or whether a permanent alteration of grate area is desirable." Comparative experiments of ten hours' duration were made with a boiler having sixteen square feet of grate surface and 1,076 square feet of heating surface, with the following results:

Coal per 1,000 pounds of steam.	Percentage CO_2 by dasymeter.	Chimney loss.
152.6	6.8	33
125	13.1	13

At first blush these results seem to show the great value of the dasymeter, and indeed a distinguished gentleman abroad has allowed himself to speak in enthusiastic terms of a device which will enable the percentage of carbonic acid to be continually read off "as readily as the steam pressure on a gauge," but it is the office of the engineer to look at the facts presented in a critical way. It seems suspicious to have the evaporation stated in terms of coal per 1,000 pounds of water, and by taking the reciprocal, so that the results appear in the customary way, we find that the boiler only evaporated 6.55 pounds of water per pound of coal without the dasymeter, and 8 pounds with it. The first result is altogether too low for any conditions, those actually obtaining not being mentioned, whereas the second result is about what should be expected under ordinary conditions; thus raising the suspicion that the trials were made in the interests of the inventor of the particular dasymeter, but once published reached the eye of one always on the lookout for improvements, who kindly attributed to others the same honesty of purpose as himself without thinking of conditions which unavoidably enter into commercial transactions.

From what has been said, however, in the preceding pages it will be seen that the greatest losses occur from the fact that only the carbon in the coal is fairly well consumed, and the hydrogen, though of a higher calorific value, has little or no influence on the result. It is believed that this is a condition of things which needs further investigation with the view of improvement.

It is a maxim in making tests of all kinds to arrange all the conditions alike except the particular one to be examined. In applying this principle to the matter in hand it becomes evident, in view of the varying results obtained with coals of similar composition, that if the comparative evaporative efficiencies of different boilers are to be tested with superlative accuracy it should be with the same variety of coal burned in furnaces of like construction under standard conditions. The value of improvements in furnaces should not only be tried with the same coal, but with the same or exactly similar boilers. Tests of the efficiency of different coals offer more difficulty, as furnaces of a particular form and boilers of particular proportions are not strictly adapted for obtaining the best results from all varieties. It would seem, therefore, necessary in comparing different coals to make changes of detail suited to each, but the same rate of evaporation per square foot of heating surface should be maintained. If other than ordinary details or boilers of unusual proportions are used, the experiments made with the same would not be strictly comparable with tests made of the same coal with different details or in boilers of different proportions, and this of itself is sufficient to prevent in general any accurate comparison of boiler tests made with different kinds of coal in different parts of the country.

The difficulties in comparing the results of tests with steam boilers are very much reduced if such tests are made with the better grades of anthracite or semi-bituminous coals ordinarily sold in the market, as the difference in results between the same is, as shown by the elaborate Isherwood experiments, very small. As clearly pointed out, the practical evaporations are not accurately proportioned to the calorific values shown by calorimeter or chemical composition, but they can be compared with a fair degree of accuracy by stating the results in units of evaporation per pound of combustible. It does not appear, everything considered, that for tests of different boilers with different coals of the same general character any other plan will give results any more accurate. There will be some variations in particular samples of the different coals, even of the better grades, which will affect the results for comparison with other boilers tested with different samples; but these minor differences can only be eliminated by the adoption of the suggestion that in all standard tests of boilers, where great accuracy is required, a particular kind of fuel be employed, which, from the experience of engineers in general, is quite uniform in quality, as regularly delivered in the market. A modification of this would be to compare the boilers in a given location by their relative performances with a fair sample of a particular fuel available in that particular locality, when a careful comparison of the standard fuel adopted in one section with that employed in another would enable the performances of all boilers in different sections to be compared.

DUST DESTRUCTORS AS STEAM PRODUCERS FOR ELECTRICITY SUPPLY STATIONS.*

BY E. MANVILLE.

I do not propose to describe all the various methods and systems on which dust destructors have been constructed, and I will therefore confine myself to a description of those two installations at present being erected for the Vestry of Shoreditch and the Corporation of Swansea.

In the year 1892 the Vestry of St. Leonard, Shoreditch, in London, had in view the erection of a central electric supply station and at the same time of a dust destructor. I being appointed to advise the authorities in relation to electric lighting, strongly recommended them to combine the two schemes. A great deal of careful investigation was carried out on their behalf to ascertain what power might reasonably be expected as obtainable from the burning of their ashbin refuse, and as a result of this investigation I felt enabled to assure them that all the steam required for the estimated electrical output likely in the first instance to be demanded from their electric light station might be obtained from a properly designed dust destructor, without the use of other fuel.

When the unsorted refuse was burnt directly in a boiler, it evaporated as much as 3 lb. of water from and at 212° Fahrenheit, and my opinion that the steam required could be obtained from the burning of this refuse in a properly designed arrangement of destructor cells and boilers was founded on the supposition that only about one-third of the calorific value of the refuse would be utilized in the boilers, after due allowance had been made for the complete and perfect combustion of the ashbin refuse and its gases.

The plant consists essentially of a destructor house, in which is arranged a range of destructor furnaces, twelve in number, in two banks of six each, placed back to back, with the working floors in between. The destructor cells themselves are arranged a pair on each side of a Babcock & Wilcox boiler. Each of these boilers has a heating surface of above 1,400 square feet, and a pair of cells on each side of it are arranged to discharge their products of combustion under the boiler tubes immediately above the level of the fire-bars, these fire-bars being left in the boiler together with the fire-doors in exactly the same manner as if the boilers were being erected without the accompaniment of dust destructor cells. Each cell is arranged with double flues, one leading to the boiler, as aforesaid, and the other direct to the main flues.

Each destructor has a grate area of twenty-seven square feet. The main flues are arranged above the floor level and underneath the working floor, and are in duplicate, each boiler and cell being able to discharge its gases into either or both of the main flues. This arrangement of duplicate flues is essential in the combination of a dust destructor with an electric lighting station, as the dust carried over with the products of combustion from the cells into the main flue must be removed at moderately frequent intervals' whilst the working of the main flue can never be discontinued owing to the necessity of continuous steaming of the boilers, and this duplicate arrangement of the flues enables one flue at a time to be cleaned out, the products of combustion of all the boilers and all the cells being taken into the remaining flue during that time. At the end of the main flues is placed a chamber, which for the present will serve the purpose of a dust-depositing chamber, but may in the future be divided up to contain an economizer with its requisite by-pass flue. This chamber leads into the main chimney shaft, which is 150 feet in height from the floor level, and is provided with a circular gallery around its base, into which this chamber leads, and between which gallery and the main shaft are a number of small openings, the whole being so arranged that the products of combustion have to swirl round the gallery to enter the shaft—a provision to ensure the final depositing of any fine dust carried by the gases through the depositing chamber. The chimney shaft is lined right to the top with fire-brick, and a ventilated air-space left between the fire-brick lining and the main structure of the shaft, to avoid the outer walls being appreciably heated.

Each boiler has its proper complement of fire-grate, fire-doors, etc., which are provided for the express purpose of enabling the boilers to be fired by coal alternately or simultaneously with the absorption of heat from the waste gases of the destructor cells passing through the boilers. This arrangement fulfils a two-fold object. First, the provision of the secondary fire before referred to, which is in the most desirable position for further heating the destructor gases immediately they enter under the boiler, should that operation be requisite, and having the further advantage that the heat so produced is ultimately completely absorbed by the boiler and thus turned into profitable use ; secondly, to add to the steam raising power of the boilers when the heat of the destructor gases is not sufficient to produce all the steam required, or when the destructor cells attached to a particular boiler are out of order, to enable the boiler to be entirely fired by coal or coke.

Each of the destructor cells and the boiler furnaces is fitted with two systems of forced draught, one being an air blast, the other an induced blast produced by steam jets. The air blast is produced by three sets of fans coupled to and driven by electric motors, two out of the three fans being sufficient to supply 16,000 cubic ft. of air per minute, the maximum quantity that could possibly be required and to produce it at a pressure up to three-inch water-gauge. The steam blast is derived direct from the boilers, and is arranged as a continuous system, so that cells adjoining a boiler not in use can still obtain their steam blast from the other boilers in use.

Ten out of the twelve dust destructor cells are capable of burning with ease the 20,000 tons of ashbin refuse which have to be dealt with by the Vestry annually. The charging of the cells with refuse is to be effected in a manner which, though not novel, will perhaps be more effective than heretofore. The refuse is tipped from the carts into a tipping wagon, sinking below ground level and raised by the lifts afterwards to a floor considerably above the level of the tops of the dust destructor furnaces. These tipping wagons are then hauled by mechanical means into any desired position along the range of furnaces, and the refuse tipped from them into storage bins reaching from this floor to the level of the tops of the destructor furnaces. From these storage bins the refuse is discharged as required into charging trucks, divided into compartments so arranged that the charging truck being brought over a horizontal door in the top of and at the back of the destructor cells, doors in the bottom of the truck may be opened simultaneously with the door at the top of the cell, and the exact charge of refuse dropped through in the cell. There it falls upon an inclined hearth at the back of the fire-grate, whence it is raked down through the clinkering doors in front on to the fire-grates themselves.

As mentioned previously, the principal object of the whole of this arrangement of boilers and cells is to get the maximum output of steam. I have calculated that the electric light station will require steam at 120 lb. pressure at the rate of 12,000 lb. per hour for four hours a day, 6,000 lb. per hour for three hours a day, and 2,000 lb. per hour for the balance of the twenty-four hours, or in all 100,000 lb. weight of steam for twenty-four hours.

The contractors who tendered for the carrying out of the works were invited to state what proportion of this weight of steam they would guarantee should be raised by the consumption of ashbin refuse only. Many of them undertook that no coal should be required to raise the requisite amount of steam daily. It must be borne in mind that the chief difficulty to be met in the combination of a dust destructor with an electric lighting station, from a steam-raising point of view, is that while the refuse is being burned at an approximately even rate during the whole day the steam for the electric light station unfortunately is required in very varying quantities, varying from a very small quantity during the greater portion of the day to a maximum, at least six or seven times the minimum, during the four hours of heavy load ; and whilst the furnaces might be quite capable of raising the total quantity of steam required at an even rate, they might be incapable of raising the quantity required during the four hours of heavy load. To meet this difficulty, it is proposed to install in conjunction with the boilers the Halpin thermal storage system. Seven reservoirs, each 35 feet in length and 8 feet in diameter, are provided and connected up to the boilers, thereby accumulating the energy. The temperature in the reservoirs is never allowed to drop below the equivalent of 120 lb. steam pressure to the square inch, but, during the accumulation of the energy developed by the boilers, the temperature is raised in both the boilers and these reservoirs until a temperature equal to a pressure of 200 lb. per square inch is attained. When in each day the time of heavy load is attained at the central station both the boilers and these reservoirs feed into the steam mains supplying the engines, and as the energy taken by the engines considerably exceeds that which the boilers are capable of generating, the pressure in both boilers and reservoirs gradually falls until a minimum of 120 lb. is again reached, and the energy represented by this difference in temperature is that which has been taken up from the boilers during the daytime by the thermal storage reservoirs. Thus is the energy, that would otherwise be wasted, accumulated and carried on to the time when it can be utilized by the electric light engines. An additional and not unimportant advantage accrues from the use of these thermal storage reservoirs, inasmuch as the feed water is pumped into the reservoirs and not into the boilers, and hot water at the actual boiler pressure is allowed to gravitate from the reservoirs into the boilers to make up for the evaporation in the boilers.

It has been stated that higher pressures than 70 lb. or 80 lb. cannot be attained in boilers fired with destructor gases. Statements of this kind do not require much comment from me. It will be obvious to all of you that with destructor gases varying from 1,200° to 2,000° Fahrenheit, such a pressure as this, or, indeed, if it were desired, a much higher pressure of steam, can be obtained. Perhaps those who have made such statements will be reassured when they find a firm of standing guaranteeing, under the heavy penalties, the successful issue of a dust destructor thermal storage scheme in which a pressure of 200 lb. to the square inch has to be attained without the use of coal.

A somewhat similar system is about to be erected now under my superintendence for the Corporation of Swansea, the chief differences in this scheme being that only eight in place of twelve destructor cells are being put up, with four boilers each, however, in this case with a total heating surface of 2,896 square feet. No thermal storage cylinders are for the present being connected to this installation, though provision is being made for their addition at a future date when the load on the station makes it desirable. In this case, also the electric lifts are not being used, as the general configuration of the site allows of an easy inclined roadway being constructed for the up load. In all other respects the installations are almost identical.

About a year ago I informed you that a project was on foot by which the Swansea Corporation hoped to be enabled to supply all the tramways within their own town with electricity generated at their own electric lighting station. This has now become a definite scheme. The Tramway Company will ultimately have about twenty-five cars simultaneously in operation, and these cars will between them run annually an estimated car-mileage of 1,000,000. An electric tramcar takes in an average town a B. O. T. unit for each car mile run, and therefore the output of supply to the Tramway Company will be one million units annually. On the basis of the arrangement proposed between the Corporation and the company, it is estimated that the latter will be supplied with current about 1½d. per B. O. T. unit conditionally upon the supply being made only during 20 hours of the day instead of 24, the other 4 hours being those of the heavy lighting load, and to carry the Tramway Company over this period a stationary battery of accumulators will be installed of sufficient capacity. The revenue from these million B. O. T. units represents a sum exceeding £6,000 annually, and it is remarkable that it will be earned with one plant running during the day and late at nighttime with an output of about 200 kilo-watts. In other words, it will be earned by the same machinery that would in any case be running during the hours of daylight to keep the mains charged, and earning practically no revenue. It follows also that the cost of producing this extra million B. O. T. units will be only some additional oil used on the engine owing to its running at full load in place of at an extremely light load, no further charges for attendance, and possibly but a small extra amount annually for repairs, though this is doubtful.

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* Abstract of paper read before the Northern Society of Electrical Engineers, England.

Since, therefore, the whole of this large output is produced at an extremely low additional cost, the station and destructor can be run, paying all its maintenance charges, as well as interest and sinking fund for the production, not only for the million units per day load, but of 350,000 units for public and private lighting, and the cost of attending to the public arc lamps at no extra cost, leaving the revenue derivable from these sources as net profit. It will therefore be feasible for the first time in this country to sell electricity for private lighting purposes at two pence per B. O. T. unit and to make no charge for the current used for public lighting purposes. I need hardly point out to you that with gas at 3s. 6d. per thousand cubic feet, electric lighting will under these conditions be much cheaper than gas. Had the Corporation to pay for the fuel, their cost of production, with the stoker's wages, would be raised by nearly one penny per unit. This would then raise the price of the supply of current to the Tramway Company to a point at which it would be more profitable for the latter to erect their own generating station. The successful combination of dust destructors with electric lighting is in this way likely to produce a complete revolution in the prospects of electric lighting in this country.

EUROPEAN INCANDESCENT LAMPS.

Supplementing the tables founded upon the tests of European incandescent lamps made by Mr. D. Paisley, London *Industries and Iron*, has published considerable data which serves to illustrate the cost per candle power of the chief English and foreign lamps. In ELECTRICITY for December 18 the table showing cost of 16 C. P. lamps was reproduced. The following shows the cost for 8 C. P. lamps :

Name of Maker.	Av'e C. P.	Watts per C. P.	Price.	Cost per C. P. for 600 hours in Pence.
			s. d.	
Gabriel & Angenault, Paris.	8.7	3.68	1 0	14.61
Stearn	8.7	3.83	0 11½	14.68
Constantia	7.66	3.83	0 7½	14.74
Gebruder Pintsch	8.98	3.91	1 0	15.40
Allgemeine Company	6.9	4.12	1 0	16.56
Daylight	7.66	4.34	0 7½	16.57
Brush Company, Vienna	8.00	3.94	1 0	16.66
Pope & Goosens	7.83	4.31	0 9½	16.77
Siemens & Halske	8.23	4.41	1 0	17.41
Robertson	7.96	4.81	1 4	17.52
Hard	7.1	4.43	0 10	18.16
Phaeton	5.33	6.15	0 9	22.71
Sunbeam Company	7.86	5.14	1 3½	20.45
Ediswan (Old)	8.16	5.17	1 9	20.90
Ediswan (New)	7.26	5.24	1 9	21.45

The Storage Battery.*

A DISCUSSION OF ITS APPLICATIONS BY THE MEMBERS OF THE A. I. E. E.

THE STORAGE BATTERY OR THE GAS ENGINE AS AN AUXILIARY.

BY NELSON W. PERRY, E. M.

DISCUSSION (*Concluded*).

Mr. Perry—Mr. Appleton speaks of the peak of the load requiring in the neighborhood of 400 horse-power. The largest gas engine so far constructed, so far as I know—single cylinder gas engine—is of 375 horse-power, with fuel gas ; with illuminating gas it will go something over 400, perhaps 450 horse-power, and it has been repeatedly stated by English manufacturers that they were ready to make gas engines in 1,000 horse-power units whenever wanted. But it is customary, I understand, when the large units are employed, to use two-cylinder gas engines, so that we may have, for instance, an engine of two cylinders, each of which would separately give 200 horse-power, and the explosions are so timed as to give an explosion once every revolution. Then in regard to the transmission of power by means of gas to an outlying station, Mr. Appleton suggested that we have the copper mains also. My idea was to supplant the copper mains with the gas mains, and while I suggested a six-inch pipe, that was assuming that we required that power continuously. With the storage battery the claim is that we may use a smaller conductor, and by charging for a long time we can store up a large amount of energy to use when the demand is excessive. The same would apply to gas storage. In regard to Mr. Blizard's remarks—in reading a paper before the National Electric Light Association at Cleveland I was jumped on by a member of "the leading storage battery company of this country" for some of my remarks in regard to the storage battery at that time. He distinctly stated at that time, if I recollect his remarks, that the cost of maintenance, guaranteed charges, was 10 per cent. on the *price* of the battery, and this letter that I referred to and the catalogue—the catalogue was the one in force at that time—contradict that statement flatly. This is the first opportunity I have had of replying to it. I have seen a later catalogue since that, and this also bases the guarantee on the catalogue prices. I also have in my possession the letter to which Mr. Blizard referred, but which I have not copied here. That letter, as I recall it now, is less specific than this one —this one being very specific, as it states here : "We send you by to-day's mail our illustrated catalogue, and would especially call your attention to the question of maintenance as contained on page 11." That seemed to be very specific as to what their guarantee means. Their guarantee was on the catalogue price and not on the cost price ; and at that time and in that place it is stated that : "In all cases of renewal by contract, the old material becomes the property of the company and must be returned to their works free of charge for carriage or packing." Now the omission of that statement from the new catalogue does not convince me that they do not expect that. I know from the experience of some others—not my own experience—that when you ask for a battery for some particular purpose where the discharge is pretty rapid, or for some very unusual use, the guarantee which they offer you, or that they print in their books, or that they talk about, no longer holds. They want a very much larger price for their battery, or their guarantee will be very much less favorable. And I admit that it is perfectly proper that they shall protect themselves ; that that battery shall be used under certain conditions and in certain ways. They cannot guarantee a battery, or a steam engine, or anything else that is improperly used. But what I maintain is that it is not economical under most conditions of central station practice, or at least where the demand is somewhat excessive in the way of discharge, to use the storage battery; that their prices are put up so high in order to give them a safe guarantee.

Mr. E. T. Birdsall—In regard to Mr. Perry's figures on the transmission of gas, he omits several important factors in the transmission of gas for that distance. In New York the subways are ventilated by pumping air through pipes, and they find that the loss of pressure per mile of 8-inch pipe, when delivering 12,000 cubic feet per hour, is 11 ounces per square inch. That is, starting with 16 ounces pressure, at the end of one mile the pressure is reduced to two ounces. That means considerable power is used to pump that gas along, and that should be counted in the cost of transmission. Another factor is that the friction in the flow of gas in pipes depends greatly on the number of bends in the pipe ; if it had a large number of bends or elbows, it would make a vast difference. A third factor is the leakage factor. Every gas company in New York, except possibly the latest one, which has new mains, figured that the loss of leakage at the joints is about 10 per cent., and in that the loss of pressure in the electrical conductors is balanced at once.

In regard to the reason why batteries are not used more universally, it has always been my opinion, as the result of considerable experience, that all the first plants were too small for the work they had to do. But this has been the great difficulty : a man would put in a battery, and as a rule it would be about one-tenth of the size necessary to the work, and the battery would fail in six months; and all batteries were the same in his eyes after that. In regard to guarantees, it is my present practice not to call on the companies for guarantees where I am reasonably certain of having a chance to look after the plant once in a while. The only experience I had with guarantees was not successful—the company failed before we had a chance to call on them.

Mr. A. E. Childs—Mr. Edgar in his remarks spoke of the value of his battery in cases of rapid changes of weather. I was in Boston one day in September, and I happened to be in an office taking light both from his company and from the alternating current company in that city. At three o'clock a very black cloud passed over the city, and inside of five minutes possibly every light in Boston that was ordinarily in use was turned on, and there is no doubt that inside of five minutes Mr. Edgar's station had on its maximum load. His lights were absolutely perfect ; there was no diminution in voltage. The lights were steady, without a single flicker. The lights in the adjoining office were low ; they were like red-hot hair pins, and were flickering.

Referring to Mr. Hering's communication, we find that he states that "a purchaser will believe you if you admit that the life of the perishable parts will be comparatively short, but he will not believe you if you say it will be long, even if you are telling the truth. Later on he states that you may as well recognize that the life of a positive plate is short, and therefore you may as well build a battery that has a positive plate with a short life. It seems to me that Mr. Hering is working to satisfy the popular demand. He wants to produce a battery which has a short life, so that when he goes to a man and tells him he has a battery with a short life he will be believed. He does not want to produce a battery with a long life, for he is afraid people will not believe him when he brings it forward.

I would like to ask Mr. Hering what he means by one trip. It may be one mile, or it may be 20 miles, or it may be 50 miles.

Mr. Perry states that he would not recommend storage batteries under any circumstances, but that he has a still more economical method, and he proposes to use the gas engine for a purpose for which none of us, I may venture to say, have ever seen it used before, and he states in the most positive language that it is a more economical method. I would ask him to refer to even one central station using gas engines to take the peak of their load.

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* Abstracts of communications read at the 101st Meeting of the American Institute of Electrical Engineers, New York and Chicago, November 20, 1895.

Referring to his remarks on the guarantee which he describes here, of June, 1894, Mr. President, the world has progressed a great deal in the last eighteen months, and if Mr. Perry, knowing that his communication was to be read to-night, had taken the trouble to inquire what guarantees he could obtain to-day and not last June twelvemonth, he would be able to find that the companies supplying batteries could guarantee to him a specific percentage depreciation on the cost of the elements, and not on the complete plant installed. He would be able to find that the rate at which the depreciation goes on was guaranteed to be very small. It is astonishing, sir, to me at least, that a man will bring forward such statements as those 16 or 18 months behind time.

In conclusion, I would state that the storage battery seems to call forth from engineers more prejudice than any other class of apparatus. It is my experience that certain engineers will tell you inside of 15 seconds, if you broach the subject to them, that they know all about storage batteries; that they do not want them at all, at any price; that they wouldn't have them if you gave them to them. If you put up a guarantee with Government bonds at the back of it, they would not look at it. We ought to expect from them a better spirit with regard to storage batteries, and that when they are approached on the subject of applying storage batteries to their central stations they ought to take the matter in a spirit of investigation; and I am not wrong in saying that at present a large majority of them will not even consider the storage battery. They think they know all about it, and they think they know it would be of no use to them.

Mr. Carl Hering—Mr. Childs asks what is meant by one trip. One trip is the distance a car travels from one power house to another or back to the first.

Mr. Childs—May I be allowed to ask Mr. Hering what the length of his trip is?

Mr. Hering—The length of a trip, of course, may vary very greatly. What I wished to emphasize in the paper was that the best possible arrangement of a plant would be to use a battery which will discharge in one trip whatever the length of that trip may be; whether the trip is one of a few miles or of a hundred miles, the battery should be adapted to it. As a rule, the trips of a car in an ordinary city are comparatively short, much shorter in time than what would correspond to the "excessive" rate (four hours) of discharge of a certain well-known accumulator; there are very few cars in use the length of whose trips, in time, is four hours or more.

The Electrical Exposition of 1896.

Mr. Clarence E. Stump, who is so well known in the electrical field, has been appointed General Manager of the Electrical Exposition which is to be held in New York City beginning May 4 and continuing until the 1st of June.

Numerous inquiries for information regarding space and other details are daily being received by the management, and a large number of prominent manufacturers have already closed contracts, while many additional firms have signified their intention to make extensive exhibits. The success of the enterprise is assured, and all indications point to the largest and most interesting display of electrical apparatus and supplies ever made in this country.

Storage Batteries for Traction Work.

The mention of battery cars has a tendency to make an electrical engineer's mouth water, but hitherto they have done little else than make his eyes weep. The long-looked-for and hardly-striven-for has not yet come, at any rate in this country, and, what is even more depressing, does not give any very notable promise of coming. Electrical industry has yet to produce a battery commercially adapted to the conditions of traffic on common roads and tramways. The non-existence of such an appliance is, we do not hesitate to affirm, one of the most serious hindrances to electrical progress, possibly the most serious of all; and, conversely, its advent will open up an immense field of electrical applications which cannot now be attempted. Yet, though a really commercial traction battery cannot be said to exist, and though the direction from which it may come is not very clearly defined, we should not care to assert that the outlook is quite hopeless. The storage battery of today is less imperfectly adapted to this class of work than the battery of a few years, or even of only one year ago. Structural difficulties and mechanical imperfections are being overcome gradually by the practical manufacturers, while we hope the researches of many electro-chemists who are engaged in this problem will help things forward on the more scientific side.—*The Electrician* (London).

London Notes.

(From our London Correspondent.)

VERTICAL EARTH-AIR ELECTRIC CURRENTS.

Before the Physical Society (London) on December 13 a contribution by Prof. A. W. Rucher was read on the subject of "Vertical Earth-Air Electric Currents in the United Kingdom." Before the British Association meeting at Oxford, a year or so ago, Dr. Schmidt stated that he had expanded the components of the earth's magnetic force in series, and had deduced expressions two of which give the magnetic potential on the surface of the earth in so far as it depends on (1) internal and (2) external forces. The third series represents that part of the magnetic forces which cannot be expressed in terms of a potential, but must be due to electric currents traversing the earth's surface. Dr. Schmidt concluded that such currents amount on the average to about 0.1 ampere per square kilometer. Prof. Rucher has tested this conclusion, drawn from the state of the earth as a whole, by means of an examination of the line integral of the magnetic force taken round a re-entrant circuit in the United Kingdom. The results arrived at by the author upon stated selected circuits, calculated upon data obtained from 1886 and 1891 surveys, lead him to the conclusion that there is not, in the United Kingdom at any rate, a vertical current amounting on the average to 0.1 ampere per square kilometer.

ELECTRIC SIDE LIGHTS.

The question of screening ships' side lights has been under consideration at the Board of Trade. The deliberations of the officials have ended in instructions being sent out to the Board's surveyors to the effect that in the case of electric lights the forward edge of the screen, or chock on it, should be in a line parallel to the keel with the inside edge of the filament. The breadth of the filament is not to be more than two inches, nor less than one inch, measured at right angles to the fore-and-aft line of the ship.

HORSELESS ROAD CARRIAGES.

During the past few months there has been spreading a very necessary agitation on the part of the press and the general public to have amended the legislation which at present so absurdly prevents the use of horseless carriages upon our streets. The present Parliament will most likely revive the bill introduced by the late Government. The Board of Trade is being memorialized to take the matter in hand. A large public meeting has been held in London and an Association formed to see that there is no unnecessary delay in getting matters righted, and Sir David Salomons, an amateur electrician of some note, has accepted the presidency of it. Test cases are being tried in various parts of the country, but in every case so far the magistrates have decided that the steam, petroleum and similar carriages are locomotives within the interpretation of the Locomotive acts. In certain quarters it is thought that these horseless carriages will develop into an immense industry once reasonable legislation is passed. Unfortunately, electricity in this application has been occupying a back seat during the agitation. Mr. W. Worby Beaumont took the subject of "Mechanical Road Carriages" for a series of Cantor lectures just concluded before the Society of Arts, but electricity had little place, for the subject was treated more from the standpoint of the general engineer than from any other. Another paper delivered before the Society of Arts was by Mr. H. H. Cunynghame, on "Locomotive Carriages for Common Roads," but in the course of the discussion which followed the complaint was made that "electricity had been eliminated" from the paper.

Legal Notes.

A petition has been filed in the United States Court at Milwaukee, Wis., praying for the appointment of a receiver for the Central Wisconsin Electric Street Railway Company. The company is located at Oshkosh, where it owns valuable franchises, but has not yet begun operations beyond the laying of two miles of track. The plaintiffs in the suit are C. E. Loss and Philip J. Partenheim of Chicago, who allege that the company is indebted to them in the sum of about $16,000, and among the defendants named is J. K. Tillotson. The bill of complaint goes quite extensively into the history of the attempts to secure the franchise and the consequent workings of the company. The bill alleges that a large quantity of steel rails was purchased from the petitioners to be used in the construction of the road, and which have accordingly been laid on streets in the city of Oshkosh. The amount due has not been paid and the rails have been attached. Judgment is asked, together with the appointment of a receiver and the sequestration of the property.

The suit of Mrs. Clark, of Middletown, N. Y., against a traction company running a line from that city to Goshen is an important one, as the matter affects many trolley companies in the State of New York. The plaintiff wants damages for running trolley lines over her property without first obtaining her consent to do so. The property in question is at Wickham avenue and North street., Middletown. The defendants set up the claim that in using the land they were sustained by the statutes. Judge Brown, at Newburg, on the 26th ult., declined to hear any argument on the law in the case, directing the counsel to put in their briefs as soon as possible. The Court said that if the tracks of the company had been laid in the middle of the street there would have been no cause of action. This would have had a tendency to discourage the bringing of similar suits. As it was, however, the Court said, the plaintiff was entitled to recover damages, the amount of which is to be determined later.

Chancellor McGill, of New Jersey, has appointed Mr. J. D. Bennett of Brooklyn receiver of the Rockaway Electric Light Company, a corporation which lights Rockaway Beach. The liabilities are about $100,000 and the assets are $15,000.

Original Electrical Investigations at Columbia College.

In the laboratory of the department of Electrical Engineering at Columbia College, New York, a number of investigations of an advanced and purely scientific character are now in progress. This work is in charge of Prof. M. I. Pupin who has recently completed some interesting investigations of the transmission of long electrical waves, the results of which will soon be published. Several candidates for the degree of Ph. B. are conducting special investigations. M. R. Rittenhouse, a graduate of Stevens Institute of Technology and the Electrical Department of Columbia, and at present holder of the fellowship in electricity, is investigating the magnetic behavior of iron when subjected to rapidly alternating currents. At the next annual exhibition of apparatus to be given by the New York Academy of Sciences, next March, when the original work done by the members of the society during the preceding year will be illustrated, Prof. Pupin expects that his department will have an important exhibit.

GENERAL NEWS.

What is Going On in the Electrical World.

Windom, Minn.—The water works and electric light system which is being put in here is nearing completion.

Somerville, Tenn.—A. J. Rooks, of this place, wants to correspond with dealers in reference to storage batteries.

Beatrice, Neb.—A special election will be held here to get the public vote on an issue of $15,000 bonds for an electric light plant.

Union, S. C.—The city council is considering the question of a bond issue of $40,000 for waterworks and an electric light plant.

Dublin, Ga.—An election will be held on the 11th inst. to vote on the proposed issue of $25,000 in bonds for water-works and electric lights.

Amherstburg, Can.—George M. Winn has been granted a franchise to establish an incandescent electric lighting system in Amherstburg.

Rockford, Ill.—The aldermen have passed an ordinance appropriating $70,000 to build, equip and maintain for one year an electric lighting plant.

Greenville, S. C.—The Greenville Electric Light Company, S. C. Hamilton, Jr., manager, needs an electric-light plant of 35 arc and 400 incandescent lights.

Appleton, Wis.—The Citizens' Electric Light & Power Company has filed an amendment to its articles of incorporation increasing its capital stock to $30,000.

Chattanooga, Tenn.—The sale of the Chattanooga Electric Railway, on petition of the second mortgage bondholders, has been postponed to the 24th of February next.

San Leandro, Cal.—At the recent election there was a large majority vote in favor of the proposition to issue $10,000 of bonds for the purpose of establishing a municipal lighting plant.

Hillsboro, N. C.—Webb & Co., of Hillsboro, will next month begin the erection of a cotton mill at that place and will equip it with an electric light plant as soon as the buildings are completed.

New York.—The Eighth Avenue Railway has been leased to the Metropolitan Traction Company, and there is a probability that within a year the road will be changed to a conduit-electric line.

Elgin, Ill.—The Elgin Electric Illuminating Company has made an assignment, naming J. B. Dick as assignee. Mr. Dick estimates the assets and liabilities, in round numbers, at $20,000 each.

Youngstown, O.—Daniel Moynahan, who purchased the Niles and Mineral Ridge electric railway, has decided to extend the line to Youngstown and work will be commenced upon the extension in a short time.

St. Paul, Minn.—It is thought that the outcome of the meeting held here recently by a number of physicians to discuss the organization of a school of medical electricity will be the establishment of such a school.

Woburn, Mass.—It is understood here that the North Woburn Street Railway has been sold to a syndicate of which State Treasurer Shaw is the head. The road will be converted by its new owners into an electric system.

Alliance, O.—The Pennsylvania Railroad Company intends to erect an electric lighting plant to furnish the lights needed in its yards and buildings here, which have been heretofore lighted by the Mutual Electric Light Company.

Brainerd, Minn.—At the election held recently to determine the question of selling the city electric light plant to C. N. Parker, of Brainerd, and E. C. and P. A. Gibson, of New York, the proposition was carried by a vote of 723 to 143.

Columbia S. C.—Dr. W. C. Black, of Greenville, and associates, are organizing a stock company for the purpose of building a cotton mill on Broad River, S. C., which will include in its equipment an electric light plant of several hundred lights.

Staten Island, N. Y.—The New Brighton Light, Heat & Power Company, lately organized, will apply to the trustees of New Brighton for permission to string wires in that town for the purpose of supplying light and power for public and private use.

Portland, Conn.—A representative of the Connecticut Engineering Company of Norwich has been in Portland inspecting the plant of the insolvent Portland Electric Light Company, and it is said the Engineering Company is negotiating to purchase the property.

Kenosha, Wis.—G. R. McDonald, S. C. Newman and W. W. Strong, acting for Chicago parties, have filed articles incorporating a new electric light and power company for this town. They bought the plant from the old company. The new company will petition for a new franchise.

Amherst, Mass.—Meetings have been held lately at North Amherst and Sunderland in the interest of the proposed electric road to Sunderland and financial support was promised in both places; the desire to have the road is general along the proposed route and there is no doubt that it will be built.

Plainfield, Conn.—At a meeting of citizens held here last week a committee composed of Ira F. Lewis, Dr. G. H. Jennings and Charles H. Ray was appointed to assist the warden and burgesses to see about lighting our streets by electricity and report at a future meeting.

Chester, Pa.—The Citizens' Electric Light Company, which furnishes light to the borough of Clifton, Lansdowne and Sharon Hill, will have a competitor in the Llanerch Electric Light Company. An ordinance has been passed by the Lansdowne council giving the Llanerch company the right to erect poles and string wires.

Norfolk, Va.—The contractors for the building of the new Portsmouth electric street railway will begin work immediately. Messrs. Troft and Burns, representing the contractors, Belden & Seeley, are making preparations to start. The poles are expected to arrive at any time, and the building of the road now seems an assured fact.

Sheffield, Ala.—The Consolidated Water & Electric Light & Power Company has been organized here with a capital stock of $250,000. The following are the directors: E. F. Enslen, C. B. Ashe, L. A. May, F. V. Evans and W. R. Brown. E. F. Enslen of Birmingham was elected president and C. B. Ashe of Sheffield secretary and treasurer.

Reading, Pa.—The Union Traction Company, which was granted a charter at Harrisburg a few days ago, will control the Reading Traction Company, the East Reading Railway Company and the Reading and Womelsdorf Electric Railway Company, which together occupy nearly sixty miles of electric road. James A. O'Reilly is president and Wm. R. McIlvaine secretary.

Pittsburg, Pa.—At a meeting held in this city on the 23d ult. a combination of the leading street railroads was effected, to be known as the Consolidated Traction Company. The new organization will be controlled by the Widener-Elkins syndicate that brought about the combination of the Philadelphia roads. The capital stock of the consolidation aggregates $10,400,000.

Mt. Clemens, Mich.—Three electric railroad corporations have applied for franchises for a line to Detroit by way of Harrison and Erin and are seeking to gain right of way around Grosse Point. The probability that a railway will be built through the section has boomed real estate at Lakeside and Hamtramck, where Detroit and Mt. Clemens parties intend to erect a number of summer homes.

Watertown, N. Y.—It is proposed to utilize the water power of the Black River in generating electricity for power and lighting purposes in this city. A plant will be established at the old Lance woolen mill site, where there is available water power. Wires will be run across the river from the power station to the different manufacturing plants, which will be equipped with suitable electric motors.

Seattle, Wash.—A deal has been consummated here involving the purchase of the Seattle Gas and Electric Light Works by a party of Minnesota capitalists, headed by Samuel Hill, of Minneapolis, president of the Eastern Minnesota Railroad Company. The new board of trustees will consist of Samuel Hill, W. J. Murphy, W. H. Dunwoody, Horace Henry, all of Minneapolis, and W. H. Cannon, of the Chase National Bank, New York.

Fort Wayne, Ind.—The entire street car system of this city is to be improved by the Cleveland syndicate who have obtained control of the properties. The capitalization of the new company is $1,500,000, and a mortgage of $1,500,000 has been filed to cover the bonds of the company. John J. Shipherd, of Cleveland, is the leading spirit in the new organization, which will be known as the Consolidated Electric Railroad Company.

Hagerstown, Md.—The Harrisburg Construction Company, which has the contract to build the road for the Hagerstown and Potomac Electric Railway, has closed the deal with the Martinsburg Street Railway Company and purchased for $10,000 the plant of the latter company, consisting of three miles of track, with the rails, motor cars, trailers and other equipments, which will be used in the construction of the Funkstown and Leitersburg extension.

Blairstown, N. J.—The dynamos of the new electric light plant, just finished, are run by water power from the flouring mill at Paulina, two miles away. The entire expense of the work, amounting to nearly $50,000, has been assumed by John I. Blair, the multi-millionaire, of this place. He will give a deed for the plant, together with the valuable mill property, to the Blair Presbyterial Academy, which he has already endowed to the extent of $600,000.

Albany, N. Y.—The State Railroad Commissioners have granted permission to the Syracuse and Oneida Lake Electric Railroad Company to build an eleven-mile railroad from the boundary line of Syracuse to Oneida Lake. They have also granted the petition of the Fulton and Oswego Falls Street Railway Company to increase its capital from $15,000 to $100,000, and the petition of the Corning and Painted Post Railroad Company to change its motive power to electricity.

Providence, R. I.—The Providence & Taunton Street Railway Company has been organized with a capital stock of $30,000. The proposed railway is to connect Providence and Taunton and indirectly Fall River and Providence. Its length will be about 11 miles. The present directors are: Earl H. Potter of Seekonk, Reuben Bowen of Rehoboth, N. A. Walker of North Dighton, J. A. King of Seekonk, F. E. Perkins and W. B. M. Miller of Providence, and Peter H. Corr of Taunton.

Raleigh, N. C.—A small cotton mill will be built early in the coming year at a point five miles north of Raleigh, by John C. Drewry and associates. When completed it will probably be equipped with an electric light plant. —The Capital Club, a politico-social organization of business and professional men of Raleigh, will soon begin the erection of a new club house, which will be equipped with all the latest electrical devices used in such an establishment, such as call-bells, electric lights, etc., etc.

Buffalo, N. Y.—The Buffalo Traction Company after a prolonged contest has finally been granted a franchise by the board of aldermen. The franchise gives the company the right to use a number of the city's streets for the operation of a new electric car line. Herbert P. Bissell and Tom Johnson, of Cleveland, O., are among the prominent men connected with the company. The Traction Company a few days ago purchased the Buffalo, Kenmore and Tonawanda Electric Railway in order to get a connection to Tonawanda.

Washington, D. C.—Mr. Benedict, the Government printer, in his report says: "The utilization of electricity as a motive power is an important step in connection with the work of the office [Government Printing Office]. Electricity applied to machinery has been found to be not only very economical, but a great advantage and convenience. Its easy adaptation to the varying speeds required by printing machinery, its safety and the ease with which it may be produced and controlled are all points in its favor."

St. Joseph, Mo.—Every railroad car loaded with live stock on arriving here has to be weighed at the railroad yards and then rushed over to the stock yards and unloaded and the empty car switched back and reweighed before the farmer can know what his freight charges will be. In order to facilitate this operation all of the railroads are quietly putting in electric scales at their yards. These scales will catch and register the weight of a car almost as quickly as the cumbersome weights could be picked up under the old system.

Cripple Creek, Col.—Arrangements have been completed for building an electric road from Cripple Creek to Canon City, over a route about 26 miles long, and work will begin the middle of January. J. H. Peabody, who represents the people behind the project, says: "The completion of this road and the building of the Denver and Cripple Creek short line, will bring Canon City from forty to sixty miles nearer Denver, and will give Denver that much shorter line to the great grain fields and coal mines of the Canon City district. At present Canon City comes to Denver around by Pueblo and Colorado Springs, 161 miles. By the new route this would be cut to 100 or 115 miles."

Milwaukee, Wis.—Judge Jenkins has appointed Frank M. Hoyt special master to take charge of the sale of the Milwaukee Street Railway. The sale will take place some time in February. No bid will be accepted, under the orders of the court, for a sum less than $5,000,000, and it is inferred that only one party wil be in position to buy it—the reorganized Milwaukee Street Railway Company—which will offer the old bonds and stock of the company as purchase money, or even a cheek secured by those bonds and stock. The officers of the reorganized company are: President, William Nelson Cromwell; secretary, C. A. Spofford; treasurer, A. Marcus; purchasing agent, C. L. Jones, all of New York.

Stockton, Cal.—Much of the power used at the various mines in this section to operate the machinery is water power, and some of the mines have had to stop work lately owing to the lack of sufficient water. Under this condition of affairs the mine-owners have come to the conclusion that where the water cannot be brought to them by flumes and ditches they must go where the water is, and by generating electricity utilize the power at points to which the water itself cannot be taken. The App mine, at Jamestown, is arranging for an electric plant; the Rawhide mine will use the same power plant. The Utica mine, at Angels, which has suffered greatly from scarcity of water at different seasons, will soon commence work on the largest mine electric system to be found in California. Electricity has superseded candles in most of the mines.

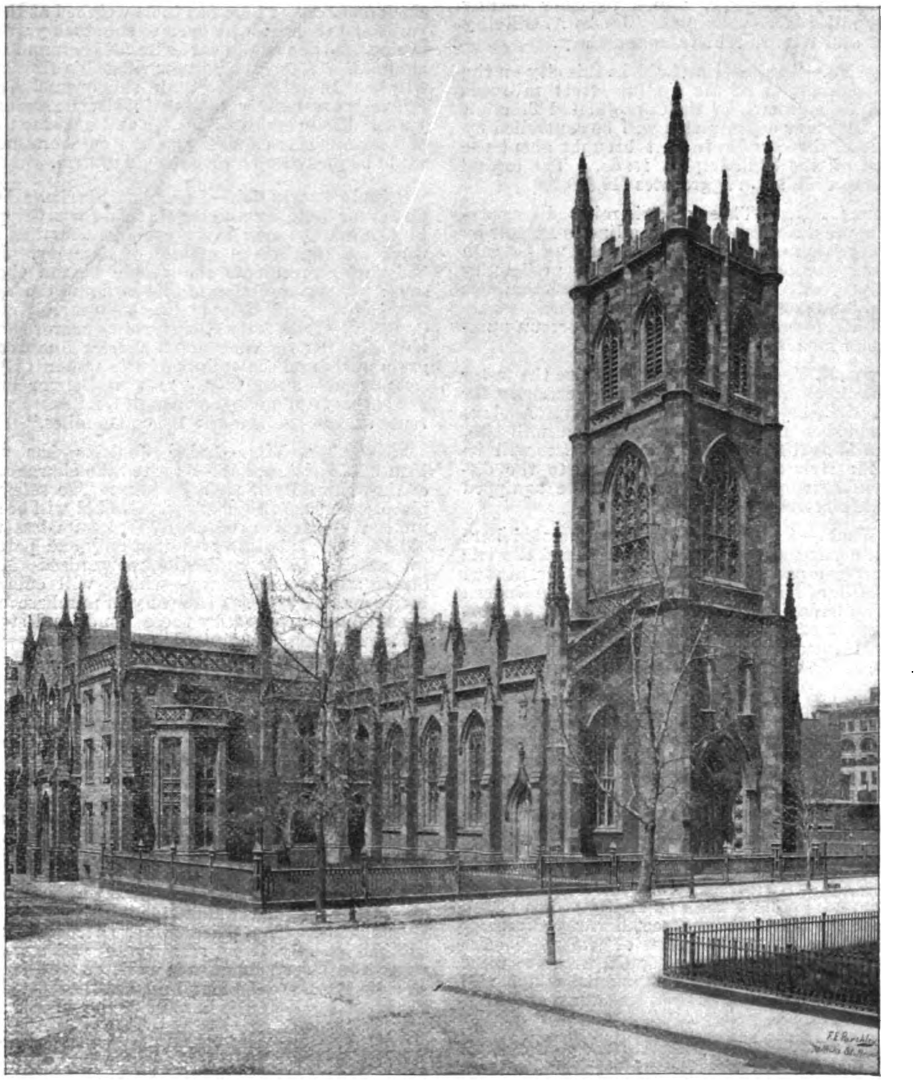
Fayetteville, N. C.—James H. Holt & Sons, last week began the erection of a $300,000 cotton mill in this city. The senior member of the firm tells a representative of ELECTRICITY that it is their intention to equip the factory with one of the best electric light plants that can be secured, of about 1,000 light capacity. The same firm own six cotton mills at Burlington, N. C., which is their headquarters, one of which has no electric lighting facilities, and it is the intention to put in a small electric light plant at this mill also in the near future. —Ex-Governor Thomas M. Holt, of Haw River, N. C., Benj. N. Duke, of Durham, N. C., and associates, will, during the approaching spring, begin the erection of a large cotton bleachery, to cost $1,000,000, at Fayetteville. A feature of the establishment will be its electric light plant and other electrical apparatus. No contracts for anything connected with the establishment have yet been given out.

Philadelphia.—The amount named in the ordinance for electric lighting is $751,000, or $75,000 less than the companies offer to light the city for during the next year. As a consequence, the department of public safety appropriation ordinance for 1896 remains unpassed by select council, and unless the electric light companies reduce their bids for lighting the city so as to bring their estimates within the amount named in the ordinance, the electric light item is likely to be stricken out and the bill passed without it.—Municipal ownership of street railways was unanimously recommended at a meeting of the Citizens' Committee of Twenty-one, authorized at the great mass meeting at the Academy of Music on December 5. The committee also urged the importance of securing the nomination of councilmanic candidates who will favor the purchase of street railways by the city, and an executive committee was empowered to draw up a form of declaration to which candidates for council will be asked to subscribe.

Baltimore, Md.—The Maryland Electric Company and the International Telegraph District and Construction Company have been consolidated and now form the Edison Electric Illuminating Company. It is the intention of the new company to enlarge the plant of the absorbed Maryland Electric Company and build another plant of equal capacity. The officers of the new company are: Alfred A. Glasier, president; E. S. Webster, vice-president; Nicholas P. Bond, secretary; J. W. Ellard, treasurer, and J. Frank Morrison, manager. Directors: Alfred A. Glasier, Nicholas P. Bond, Ronald T. McDonald, William Endicott, third, of Boston, Mass., Edwin S. Webster, J. Frank Morrison, J. P. Smith, J. Warren Ellard and Edward Duffy.

TWO INTERIOR CONDUIT INSTALLATIONS.

In the accompanying illustrations are shown two electric lighting installations, differing widely in character it is true, but neither is without interest to those who wish to keep in touch with latter-day improvements in the art.



OLD FIRST PRESBYTERIAN CHURCH, NEW YORK.

The Hotel Ford, Phœnix, Arizona, is a modernly designed and equipped hostelry, and enjoys the distinction of being the first building west of the Rocky Mountains to be equipped with interior conduit. For the lighting service, which consists of 200 lamps, iron armored conduit was used. For the annunciator service, brass armored conduit was used.

W. R. Norton, of Phœnix, was architect of the structure. The electrical equipment was installed by the Electrical Supply Company of Phœnix.

The Old First Presbyterian Church, at 5th avenue and 11th street, New York City, has recently been equipped with an electric lighting system possessing no particularly striking or novel features, but is an example of first-class work throughout. In the church proper and its accessory buildings 400 16-C. P. lamps have been wired on the interior conduit system, the brass-armored grade being employed. Current is supplied from the mains of the Edison Electric Illuminating Company.

Hatzel & Buehler, New York, were the electrical contractors.

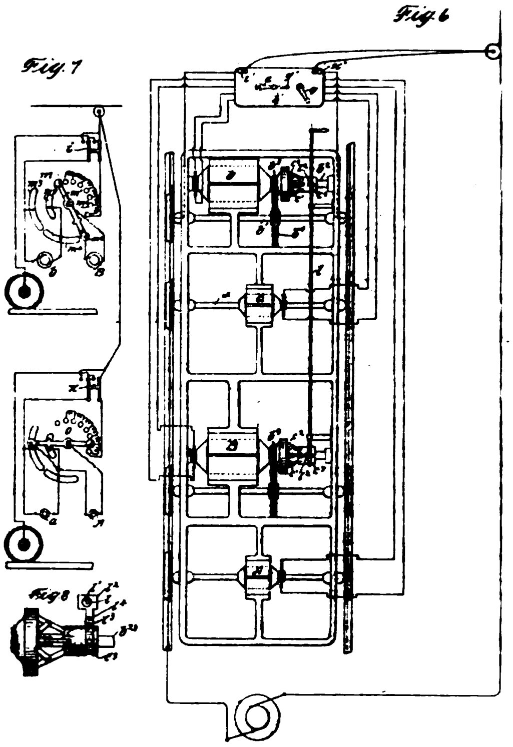
The Badt Electric Locomotive.

Under date of November 12, 1895, letters patent No. 549,485 was issued to Francis B. Badt, of Chicago, assignor to the Siemens & Halske Electric Company of America, for an electric locomotive which possesses many features of novelty. Having in mind the well-known fact that considerably more power is required to start a car or train from rest than is required when running at normal speed, the inventor has sought to overcome this objection by a method other than the employment of two motors adapted to be run in series at starting and then to be thrown into parallel for higher speeds. To accomplish this the inventor provides, in connection with each car or unit, two motors, one large motor, which he terms the "starting motor," having sufficient capacity to start the car in motion, and a small motor, which he terms the "speed motor," the capacity of which is sufficient to propel the car at normal speed. The two motors are mounted upon the axles of a single truck, the smaller motor being preferably mounted directly upon the axle without intermediate gearing, while the larger motor is connected to the other axle by means of intermediate gearing through a mechanical clutch by means of which it may be thrown into and out of gear.

When it is desired to start the car, the starting motor is thrown into gear to start the car in motion, after which the speed motor may be thrown into circuit to propel the car, the starting motor being thrown out of gear and disconnected from circuit. The speed motor may or may not be used to assist the starting motor, as may be desired. In order to avoid mistakes and render the operation certain, two operating levers are provided—one for the starting motor and the other for the speed motor—a lock being provided which prevents the movement of the operating lever of the speed motor beyond a certain point until after the operating lever of the starting motor has been moved to a position to cut the same out of circuit and disconnect it mechanically.

In connection with each car or unit, two starting-motor and two speed-motor switching devices are provided whereby the two starting motors may be connected first in series and then connected in multiple, after which the speed motors may be thrown into circuit, first in series and subsequently in multiple.

The inventor claims that by the employment of his invention high efficiency is obtained between stations, the two classes of work—starting and running at high speed—being done by different motors, each designed and geared for the highest economy and efficiency for the particular class of work. The capacity of the two motors combined is no greater than the capacity of the single motor as heretofore employed for doing the same work, and taking into consideration the simplified method of starting and operating, the first cost of the apparatus for an equal amount of work is not increased; the efficiency is greatly increased and the cost of operating decreased, while the fluctuations of the amperage at the power station are much smaller than in the systems at present employed.

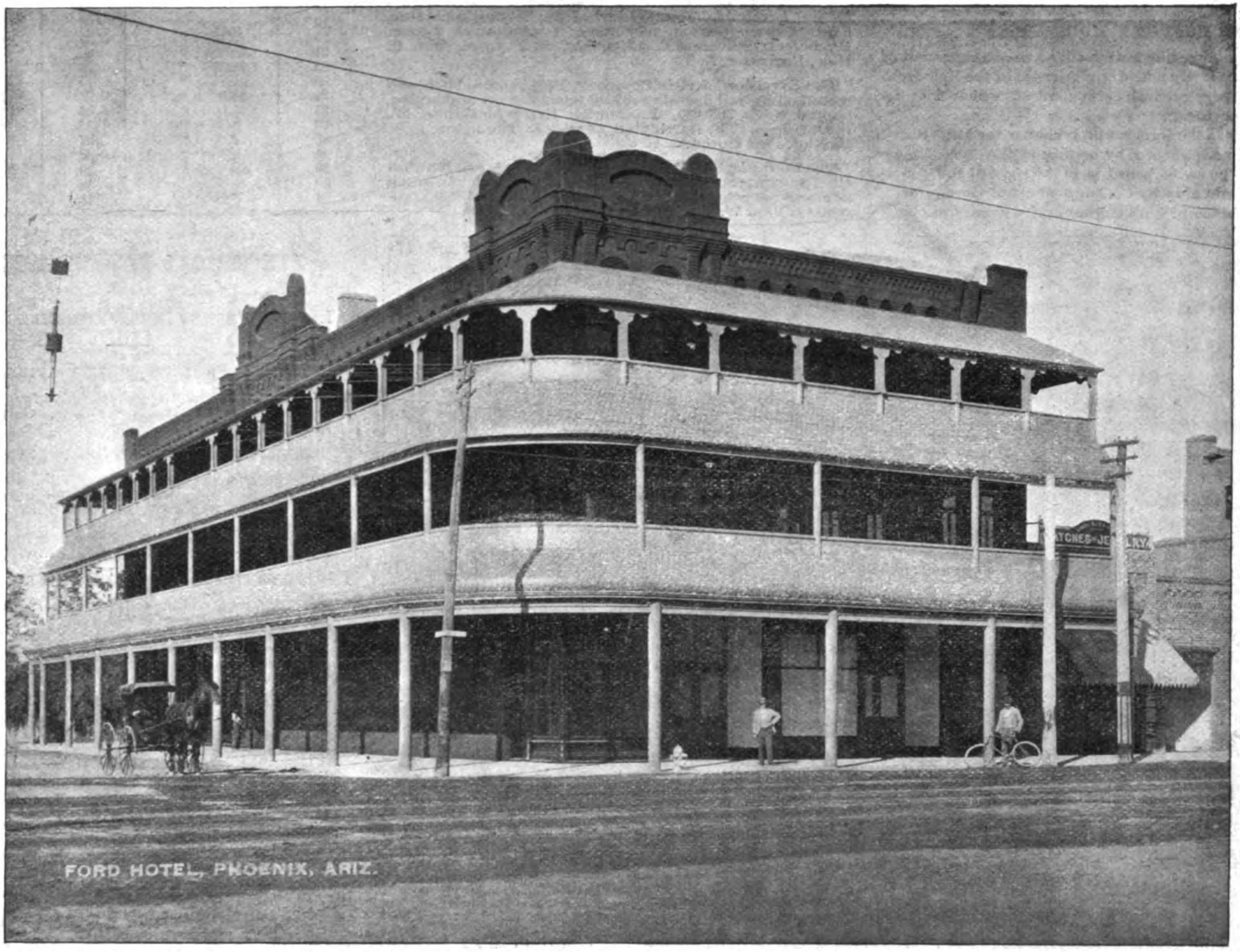


THE BADT ELECTRIC LOCOMOTIVE.

This form of locomotive is particularly adapted to heavy trains run at high speeds—as, for instance, where it is proposed to convert an existing steam road into an electric road. In applying this invention to such trains, it is preferred that a number of motor-cars in a train be attached to a single locomotive, say one motor-car to each three trailers, so that if a train should consist of twelve coaches three of them would be motor-cars and the other nine trailers. By distributing the weight necessary for the traction over a number of motor-cars, instead of having a single locomotive, a large saving is effected in repairs of the track, while in an elevated structure a large amount of money may be saved in the construction, as a lighter structure may be employed. By employing a system of electrical and mechanical connections between the first motor-car and the other motor-cars of a train, the motorman on the first motor-car may govern all of the motors on the train. The first motor-car alone may be provided with a trolley device, or each of the motor-cars may have its independent trolley.

Describing the invention in detail, reference is had to the accompanying illustration, in which Fig. 6 is a plan view of a car or unit provided with two starting and two speed motors, the circuit connections being illustrated in diagram. Fig. 7 is a diagram showing the circuit connections and switches for controlling the circuits through the several motors. Fig. 8 is a detail view of the clutch mechanism for controlling the starting motors.

The speed motor *a* is mounted upon one of the axles *a* of the car-truck, while the starting-motor *b* is connected with the other axle *b′* through intermediate gearing. As illustrated, the armature of the motor *b* is mounted upon shaft b^2, upon which shaft is loosely mounted a gear-wheel b^3, meshing with a gear-wheel b^4 provided upon the axle *b′*. A clutch is provided for connecting the gear-wheel b^3 with the axle b^2 or disengaging the same therefrom. The clutches are operated by means of a rotating rod *l*, carrying an eccentric *l′*, Fig. 8, opposite each clutch, the strap l^2 of the eccentric being mounted upon the end of a lever l^3, pivoted at l^4, and engaging by its end the sliding collar c^3, that controls the clutch. Two speed motors *a* A are also provided. As illustrated in Fig. 7, the starting motors *b* B are connected in circuit with a reversing-switch *i*, whereby the direction of the current may be reversed, and with a series-multiple switch *m*, whereby the motors may be first connected in series and subsequently in multiple. The circuit from one side of the reversing switch *i* passes to the terminal m^3 and thence to the motor *b* circuit, then extending to the terminals m^4 and m^5 One side of the motor B is connected with the arm *m′* and the other with the terminal m^6, carried upon the end thereof, but insulated therefrom. When the terminal m^6 rests upon the terminal m^4, the motors are connected in series, and when terminal m^6 rests upon the terminal m^3 the motors are connected in multiple. The rheostat-terminals m^2 are preferably arranged so that as the arm is moved resistance is first cut out, step by step, after which the circuit arrangement of the motors is changed from series to multiple, and as the arm continues its movement, further resistance is cut out step by step. The speed motors *a* A are likewise connected in circuit with a reversing-switch *k* and a series-multiple switch *o*. In starting the car from rest the reversing-switch *i* is operated to direct the current through the motors in the proper direction, after which the arm of the series-multiple switch is moved to connect the motors *b* B in series, after which the motors are connected in multiple. The reversing-switch *k* is then operated to direct the current through the speed motors in the proper direction, after which the arm of the series-multiple switch *o* is operated, first to connect the speed motors in series and then in multiple, the starting motors *b* B being cut from the circuit after the speed motors have reached a predetermined speed.



TELEPHONE AND TELEGRAPH.

Telephones on Brooklyn Bridge.

Experiments have been made having in view the connection by telephone of the moving trains on the Brooklyn bridge with the train despatcher's office. The despatcher will sit in his office wearing a head telephone such as is used by the "Central" girl, and a long-distance transmitter will be at his desk. At the front and end of each train in service a telephone will be placed. In foggy weather the gripmen will wear a telephone receiver as a headpiece, so that they can respond instantly if called up by the despatcher.

The Underground Movement in St. Louis.

The agitation of the underground wire question goes on apace at St. Louis. The Association of Fire Underwriters of Missouri has condemned overhead wires of all kinds, and the members have agreed individually and as an association to do all in their power to secure municipal and State legislation looking to the burying of the wires.

Breach of Contract Claimed.

The Chicago "Inter-Ocean" states that a suit for $250,000 has been instituted in the Superior Court against the Cushman United Telephone Company. The plaintiffs are Sylvanus D. Cushman, inventor of the telephone of that name, and his wife, Idelia M. Cushman. The Cushman United Telephone Company was organized about a year ago with a capital stock of $20-000,000, which was entirely on paper. The company progressed so far as to rent an office, but the plaintiffs allege that the corporation never carried out any part of the contract which had been made with it. Under this contract Cushman gave up his patent rights and the company was to construct telephone lines and establish exchanges. The suit is for damages for the alleged breach of contract and to recover the property which Cushman surrendered.

A bill has been introduced in the House of Representatives authorizing the District Commissioners to permit the Home Telephone Company of Washington City to maintain and operate a telephone and telegraph plant in that city. The rates to be charged are not to exceed $30 for residences nor $42 per year for business houses, and the various Government departments of the District of Columbia and of the United States shall not be charged more then $18 per telephone per year.

The Citizens' Telephone Company has been organized at Florence, Ala. W. P. Campbell is president, M. B. Shelton, vice-president; James Burtwell, treasurer; H. B. Lee, secretary. The directors are: D. C. O'Steen, James K. Powers, Harry Smith and the officers above mentioned. J. W. Walker was elected superintendent of construction.

The York Telephone Company, York, Pa., has contracted with the American Electric Telephone Company, Kokomo, Ind., for an exchange equipment of 300 'phones.

The new branch telephone exchange in the "Hill" district of St. Paul, Minn, will not be opened until March, the postponement being caused by delay in completion of the switchboard.

The Municipal Signal Company of Boston has secured the contract for the police signal system to be installed at Albany, N. Y.

A project to connect Tifton and Sparks, Ga., by telephone by way of Staunton and Lenox is being considered.

At the sheriff's sale of the telephone plant at Independence, Kan., on the 18th ult., no bids were offered.

The new copper metallic circuit connecting Utica and Watertown, N. Y., has been completed.

The Postal Telegraph Company is making arrangements to extend its lines to Kingston, N. Y.

The directors of the Lansing Telephone Exchange, which is so successfully combating the Bell Company at Lansing, Mich., has elected officers as follows: President, Frank B. Johnson; vice-president, L. C. Blood; treasurer, Jacob Stahl. The selection of a secretary and manager will be made later.

An ordinance has been adopted by the city council of Newton, Kan., requiring A. R. Champlin to have his telephone plant in that place in operation by June 1 next.

The steamer "Faraday" is soon to sail from London with equipment and material for laying the cable up the Amazon river.

George W. Beers, W. J. Vesey, Charles S. Bash, Louis Fox and Charles McCulloch are interested in tho organization of an independent telephone company at Fort Wayne, Ind.

A company has been organized in Beeville, Tex., to construct a telephone system from Victoria to Tilden by way of Goliad, Beeville, Normanna, Pettus and Mineral City.

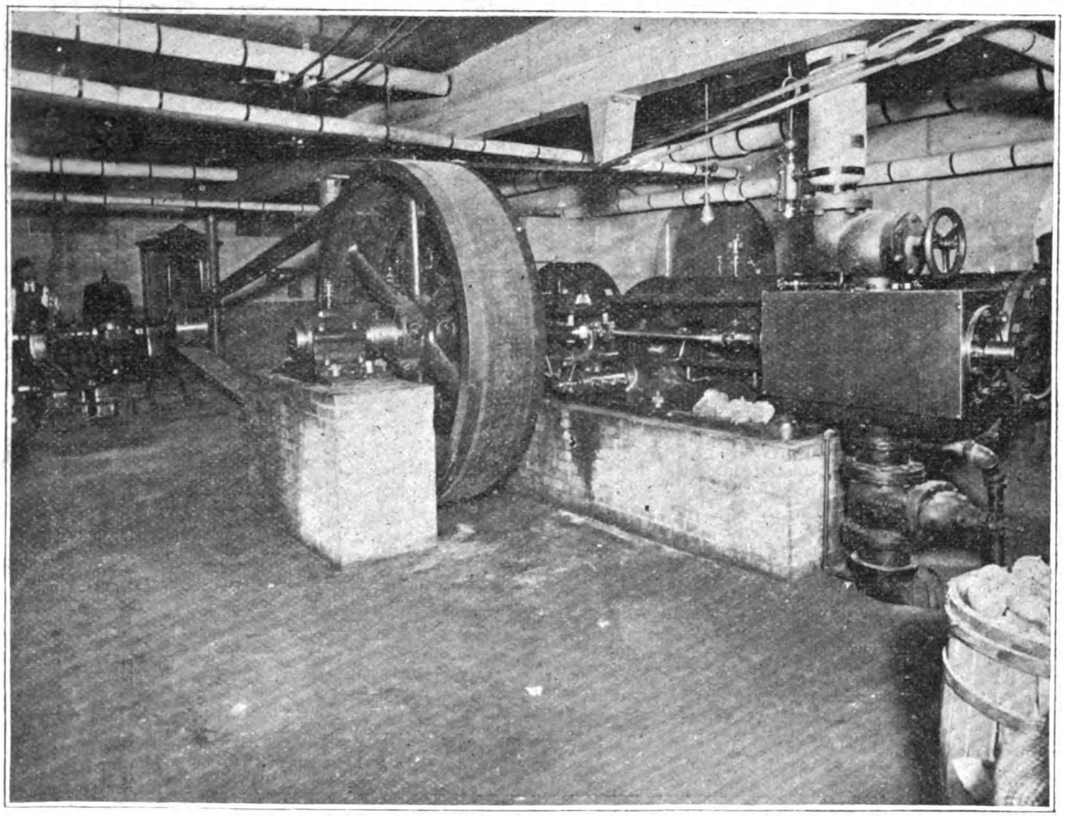
W. H. Harris, B. S. Harris and W. P. Harwell have incorporated the Fort Valley Telephone Company, Fort Valley, Ga., to construct a telephone system under franchise lately granted; capital stock, $5,000.

THE HOFFMAN HOUSE PLANT.

The accompanying illustration shows the arrangement of apparatus in the lately added engine room of the New Hoffman House, the electrical equipment of which was described in ELECTRICITY last week.

Prominently in the foreground is shown the High Speed Buckeye Engine connected by belting to the Fort Wayne Alternator. The switchboard is to the right of the generator, hidden from view by the band wheel of the engine.

The performance of both engine and dynamo has been entirely satisfactory. It is the intention of the management to practically duplicate this part of the equipment by the installation of another generator and engine of the same type.



WOOD ALTERNATOR-BUCKEYE ENGINE—HOFFMAN HOUSE PLANT.

COMMERCIAL PARAGRAPHS.

The Siemens & Halske Electric Company of America have opened new offices in the American Surety Building, 100 Broadway, New York. This will be the general Eastern office, and will be in charge of C. E. Yerkes, vice-president. F. N. Armour, recently of the Chicago office, will be the general sales agent. Chas. D. Shain still retains the agency for New York City and the immediate vicinity.

The Sunbeam Incandescent Lamp Company, Chicago, have recently commenced the manufacture of 2 C. P., 10 watt, and 4 C. P., 20 watt, incandescent lamps. These lamps have a small round bulb and are fitted with regular standard sockets. It is stated that the Sunbeam is the first lamp company to make lamps of such low candle power and wattage that they can be connected in multiple. The principal use for these lamps will be in sign and decorative work. In sign work especially a lamp of low candle power is preferable, even without considering the saving in energy, as with the glow of the small incandescent lamp the sign is clearer than with the glare of the larger lamp.

INCORPORATIONS.

The Weston General Company, Newark, N. J.—to develop electrical inventions and devices and manufacture and sell electrical machinery and appliances connected therewith. Capital stock, $200,000. Promoters: Edw. Weston, Newark, N. J.; Franz O. Matthiessen, New York City; Henry E. Niese, Jersey City, N. J.

The United Electric Light Company, Kansas City, Kan.—to operate works for the manufacture and supply of electricity for light, heat, mechanical and other purposes. Capital stock, $100,000. Promoters: C. F. Hutchings, Benj. Friedberg, Benj. Schnierle, Marcus Harris, Kansas City, Kan.

The Boston Electric Insulated Pole Company, Portland, Me.—to manufacture, deal in, and erect insulated poles. Capital stock, 100,000. Promoters: Edw. E. Drew, Boston, Mass.; Edwin L. Dyer, Geo. E. Macgowan, Portland.

The Oregon Electric Light & Power Company, Oregon, Ill.—to furnish light, heat and power. Capital stock, $50,000. Promoters: Albert H. Knodle, Wm. L. Taylor, H. Lee Allen.

The Ridley Park Light, Heat & Power Company, Ridley, Pa.—to supply light, heat and power or any of them by means of electricity. Capital stock, $1,000. Promoters: Richard S. Pomeroy, Chas. G. Darrach, Harry H. Sawyer, Ridley Park, Pa.

The J. E. Putnam Company, Rochester, N. Y.—to manufacture, construct and sell electrical appliances, apparatus, fixtures, specialties and machinery. Capital stock, $15,000. Promoters: Sylvanus E. Ellis, Jos. E. Putnam, Wm. B. Hale, Rochester, N. Y.

The Excelsior Electric Company, Port Huron, Mich.—to manufacture and operate arc and incandescent appliances. Capital stock, $120,000. Promoters: Henry McMarrao, W. F. Davidson, C. F. Harrington, Charles D. Thompson, F. G. McNutt, Port Huron.

The Lord Electric Company, Boston, Mass.—to manufacture, purchase and sell electric appliances and do all kinds of electric construction work. Capital stock, $15,000. Promoters: Fred W. Lord, Thos. B. Curtis, Nils Olson.

The Cleveland and Chagrin Falls Electric Railroad Company, Cleveland, O.—to construct, operate, etc., an electric railroad between Cleveland and Chagrin Falls, O., furnishing electric light, heat and power, etc. Capital stock, $300,000. Promoters: Vincent A. Taylor, F. W. Gehring, Jay E. Latimer, Jos. Black, Ferdinand H. Eggers, C. C. Barkwill, Albert V. Taylor.

The Bath & Lake Keuka Railway, Bath, N. Y.—to operate a surface electric railway ten miles long, from the Soldiers' Home, Bath, to the village of Hammondsport. Capital stock, $100,000. Directors: Israel A. Kelsey of West Haven, Conn.; John T. Prince of Boston, Mass.; John T. Prince, Jr., C. L. B. Tyler, F. H. Vielo, George E. Tyler, Chas. M. Hyde, E. J. Carpenter, and John L. Miller of Corning, N. Y.

Maguire & Backus, Ltd., New York City—to purchase and sell or otherwise dispose of patents, licenses, contract rights, powers, privileges, etc., relating to inventions, machines and processes, electrical or otherwise. Capital stock, $250,000. Directors: Wm. H. Paxton, Jr., Walter B. Howe, M. C. Fleming, Dr. H. Clark and A. E. Miller of New York.

The Rapid Transit Construction Company, Baltimore. Capital stock, $25,000. Incorporators: Wm. F. Rogers, Chas. H. Hopkins, Wm. O. Nelson, Harry C. Primrose and George N. Holloway.

The Wheeless Electric Lamp Company, Washington, D. C.—to buy and sell patents covering electric lamps, etc. Capital stock, $500,000. P. B. Thompson, of New York, is president of the company.

The Latrobe & Ligonier Electric Street Railway Company of Westmoreland County, Pa.—to build an electric railway twelve miles in length. President, Edward E. Robbins, of Greensburg, Pa.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JANUARY, 1896.

DATE.	LIGHT.	DATE.	EXTING.
1	No light.	1	No light.
2	5.20 P. M.	2	8.00 P. M.
3	5.20 "	3	9.10 "
4	5.20 "	4	10.30 "
5	5.20 "	5	11.40 "
6	5.20 "	7	12.50 A. M.
7	5.20 "	8	2.00 "
8	5.20 "	9	3.00 "
9	5.20 "	10	4.20 "
10	5.30 "	11	5.30 "
11	5.30 "	12	6.20 "
12	5.30 "	13	6.20 "
13	5.30 "	14	6.20 "
14	5.30 "	15	6.20 "
15	5.30 "	16	6.20 "
16	5.30 "	17	6.20 "
17	5.30 "	18	6.20 "
18	7.50 "	19	6.20 "
19	8.50 "	20	6.20 "
20	9.50 "	21	6.20 "
21	10.50 "	22	6.20 "
22	11.50 "	23	6.20 "
23	...... "	..	....
24	12.50 A. M.	24	6.20 "
25	1.50 "	25	6.20 "
26	3.00 "	26	6.20 "
27	4.00 "	27	6.20 "
28	5.00 "	28	6.20 "
29	No light.	29	No light.
30	"	30	"
31	5.50 P. M.	31	8.00 P. M.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DECEMBER 24, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

552,001. Underground-Current Supply for Electric Railways. August Rast, Nuremberg, Germany. Filed March 29, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

551,799. Electric-Arc Lamp. Elihu Thomson and Charles E. Harthan, Swampscott, Mass., assignors to the General Electric Company, of New York. Filed May 9, 1895.

552,036. Material for Incandescent Conductors. Ludwig K. Bohm, New York, N. Y. Filed Nov. 5, 1891.

DYNAMO ELECTRIC MACHINERY, ETC.

551,757. Electrically-Operated Elevator. Fred B. Corey, Boston, Mass. Filed May 13, 1895.

551,781. System of Electrical Distribution. Thomas F. Mullaney, Worcester, Mass., assignor to the General Electric Company, of New York. Filed Sept. 24, 1895.

551,809. Converting Simple into Polyphase Alternating Currents. Charles S. Bradley, Avon, N. Y. Filed June 11, 1892.

551,810. Alternating-Current Motor. Charles S. Bradley, Avon, N. Y. Filed Sept. 12, 1893.

551,820. Mechanism for Operating Elevator-Controlling Mechanism. Frank E. Herdman, Winnetka, Ill. Filed July 10, 1895.

551,856. Commutator-Brush. Caleb C. Dusenbury, Lake Mahopac, N. Y. Filed June 10, 1895.

551,868. Alternating-Current Machine. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Societe Anonyme pour la Transmission de la Force par Electricite, same place. Filed May 1, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

551,947. Electric Telegraph. William H. Cooley, Brockport, N. Y. Filed March 23, 1889.

551,948. Electric Telegraph. William H. Cooley, Brockport, N. Y. Filed April 18, 1893.

MISCELLANEOUS.

551,785. Electric Brake. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed March 30, 1895.

551,786. Lightning-Arrester. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Aug. 31, 1895.

551,790. Machine for Connecting Electric Conductors. Harlie J. Savory, Somerville, Mass. Filed April 17, 1893.

551,795. Electrogalvanic Belt. Samuel J. Spalding, Canton, Ohio. Filed May 9, 1895.

551,880. Electrical Eye-Cup. Theodore B. Wilcox, Newark, N. J., assignor to Eli Baldwin, New York, N. Y. Filed Jan. 10, 1895.

551,920. Electric Stop-Motion for Machines for Preparing Silver. William P. Canning, Lowell, Mass., assignor to the Lowell Machine Shop, same place. Filed June 19, 1895.

551,930. Electric Railway-Train Signaling. Walter S. Greene, Covington, Ky. Filed Sept. 3, 1895.

551,942. Electric Latch Apparatus for Semi-Automatic Operation of Railroad-Signals. Harry C. Barnes and William W. Slater, Oakland, Cal. Filed March 21, 1895.

551,982. Station Potential-Indicator. Ralph D. Mershon, Pittsburg, Pa. Filed April 29, 1895.

551,996. Pedo-Electric Trolley. Robert T. Oney, Charleston, W. Va. Filed March 27, 1895.

551,998. Electric Signal. Eugene M. Phelps and Archibald T. Sampson, Lynn, Mass., assignors, by mesne assignments, to the Farmer Electric Company, St. Louis, Mo. Filed Oct. 8, 1891.

552,053. Electrical Switch-Operating and Signal Apparatus. Justin Dutrey, New Orleans, La. Filed May 25, 1895.

552,057. Circuit Closer and Breaker. John R. Farmer, St. Louis, Mo., assignor to the Farmer Electric Company, same place. Filed Jan. 25, 1895.

ELECTRICITY.

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THE TRADE SUPPLIED BY

THE AMERICAN NEWS COMPANY.

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EDITORIAL NOTES.

Facts vs. Fancies. Extravagant claims of progress made, which cannot be supported or justified upon an impartial review of the actual facts, instead of being real helps to any science or industry, are calculated to check progress, hinder advancement and throw obstacles in the way of all earnest and honest workers. It is necessary to obtain and hold the support and confidence of those who can command the financial resources required to develop and perfect new departures, and anything that is calculated to alienate that support, or weaken its confidence in the justifiable claims and professions put forth in behalf of the new methods, is a check and hindrance to its legitimate progress.

No science or industry has suffered more from this cause than electricity. Wonderful and phenomenal as have been its progress and development in the last two decades, still more wonderful is the fact that it has been able to command the necessary financial support to make that progress possible, when we take into consideration the millions of dollars that have been contributed to foster impossible and chimerical schemes and lost. So many have lost money by trusting to the judgment of those in whom they thought they were justified in placing full confidence, only to find that confidence misplaced and their money gone, that there is now a wide and general feeling of distrust abroad, and it is of imperative importance that those who are looked upon as reputable authorities and guides should be particularly careful in not committing themselves to statements that cannot be thoroughly supported or substantiated. It is their place and duty to correct and do all in their power to check the wild and absurd claims, that are being made on all sides, of what is being done and is going to be done by means of electricity.

An article entitled "Progress of Electricity in 1895" and signed "Thomas Commerford Martin, Editor *Electrical Engineer*," that recently appeared in a newspaper of large circulation, contained some statements that it seems incredible should emanate from such a source.

While it cannot be disputed that great progress was made during the year just closed in various directions toward further utilization of electricity in the arts, sciences and industries, and a great deal was accomplished towards the perfection of apparatus, economy of operation, and also in the widening of its field of employment and usefulness, it has not reached any such stage of applicability to universal uses for power traction, heating, etc., that a perusal of Mr. Martin's paper would lead the public to believe, and in many departments never will until electrical energy can be generated in large quantities without the dynamo, and has not to be confined as at present to the transformation of power generated by other means.

It is not yet by any means certain that the Niagara power transmission scheme will justify the expectations and claims of its projectors and promoters on the lines now laid out and so far followed and proposed to be followed in the future. Indeed we are of the firm opinion that, with the immense outlay already made, and with the further immense outlay necessary to transmit the power to far distant points and there distribute it for general use as a substitute for steam power, there is little prospect of any return on the capital already invested and to be invested in the scheme.

We wish our readers distinctly to understand that we do not doubt, nor do we deny, the possibility of the transmission of electrical energy from the Niagara plant to even very great distances, but we do doubt, and do deny, that it can be done so as to be commercially profitable at points far distant from the place of generation as a complete and perfect substitute for steam power where coal is cheap.

It is the duty of a trade paper to do all it can for the best interests of the industry it claims to represent, and to foster its honest, stable and sound development; and it is equally the duty of every writer on the subject connected with the technical press of this industry to do likewise. Statements in the columns of the electrical journals of this country, tending to "boom" the industry on unsound lines, are sure to eventually injure the industry; and flowery and fanciful articles in the daily papers, written by persons connected with such journals, and tending to mislead the public concerning the possibilities of utilizing electrical energy, without reference to the commercial or practical results, are to be deprecated and looked upon as a direct and positive injury to the industry.

Power is only one of the items of cost in any industry, and in deciding upon a location for any factory all of them must be taken into consideration. In calculating the different items of cost in manufacturing industries, power is about 10 per cent. of the whole, taking an average. Raw material, labor and facilities for distribution are the guiding factors in the location of factories. It is generally cheaper to bring your source of power to your raw material than to transport your raw material to your power, other conditions being equal; and leaving out the important considerations of facility of distribution, etc., it follows that if the reverse had been the case we should find all the most important manufactories that utilize power situated in close proximity to the coal fields or water powers.

This matter of the feasibility of the profitable transmission and distribution of power to a distance by means of electricity has been much discussed during the past twenty years, and that by some writers who may fairly lay claim to being greater or less authorities on the matter. But notwithstanding the fact that Mr. Martin is one of the editors of the *Electrical Engineer*, it can scarcely be justly claimed that his training or experience has been such as to warrant anything that he may write or say upon this complex subject being accepted as authoritative or more than the product of the thought of a facile and rather versatile writer for the press, or as being anything more than a more or less complete reflection of the views of others.

The bane of electrical journalism in this country to-day is that the trade journals are mainly run or their policy is mainly directed by persons who are not trained electrical engineers, and whose main motive is to please their advertisers and thus secure advertising patronage ; and this is done without reference to whether such policy is for the best interests of the industry as a whole or not.

Much of the effusive writing on electrical subjects in other journals, which is now so prevalent, is due to the same spirit, and much of it emanates from the same class of writers as run or control the policy of the electrical trade journals.

We cannot in a short editorial discuss this matter of power transmission in the way it should be done ; but we caution all prospective or present investors in electrical power transmission schemes against accepting as authoritative on the subject the frequently much too flowery statements of writers identified with the regular trade journals, and also against overlooking the fact that their statements not only lack the weight of authority but may be more or less influenced by prospective profit.

It is quite common for such writers as are referred to to point to some particular instance of the successful transmission of power, under certain conditions most favorable to the use of this method, and then to reason that because in that particular case it is profitably done it can be done in all cases.

They seem to think that the price of such a commodity as power is fixed the world over, and that because electricity is sometimes economically and profitably used in the transmission of power it follows of necessity that if a system of power transmission is "electrical" it is not affected by the operation of ordinary business laws. With coal from eight to twenty dollars per ton, it is manifest that the commercial elements in the transmission of power must, of necessity, be very different from those cases in which coal costs from $1.25 to $3 per ton ; and no two cases of the transmission of power electrically can be fairly compared unless the conditions of the problem are stated, or are known to be exactly alike.

Power can be electrically transmitted from Niagara to Europe as easily as it can be delivered 100 feet away; but the question of what *can* be done is not the only factor to be considered; it is, as before said, a matter of dollars and cents, and we believe power cannot be electrically delivered from Niagara to Buffalo as cheaply as it can be produced locally by steam power generated and used under proper conditions.

In electric traction for street railways and suburban or rapid transit work, where light trains and frequent service prevail, there is no room to doubt as to the economy of the electrical method of operation, for power can probably be more economically subdivided into small units by that system than by any other, but to maintain that electricity can be substituted for steam locomotion in all the conditions of service is both misleading and ridiculous, and anyone who understands sufficient about the subject to figure out the cost of electrically equipping and operating a main line of railway for, say, 300 miles, will soon abandon any idea of relegating the steam locomotive to the scrap heap.

Again, Mr. Martin says : "Prominent also in the annals of 1895 is the application of electricity to the Erie Canal in a *successful and scientific way.*"

That canal boats *can* be electrically propelled is without doubt true. The fact that one was so operated is doubtless also true, but to say that it was done in a "*successful and scientific way*" is putting our credulity to too great a strain, for anything more unscientific, unmechanical and uneconomical it is difficult to conceive; and to ask us to believe that they will shortly be running canal "greyhounds" by this system is little less than an insult to the understanding.

Now, coming to the problem of electric heating—in spite of Mr. Martin's assertion that it made a mighty stride forward in 1895, it made no stride whatever, and never will as long as the electrical energy is produced as now by the transformation from coal to heat in the furnace, water to steam in the boiler, steam to mechanical energy in the engine, mechanical to electrical energy in the dynamo and then transmitted a distance to the electric heater to be finally transformed into heat. Under the most perfect conditions not more than 10 per cent. of the heat generated by the combustion of coal is available for distribution by the electric heater, and in most instances it would not be more than half of that.

Electric heating is available now, as it has been heretofore, to everyone to whom cost is a matter of indifference, but it is about equal in economy to coal at $50 per ton. The fact that some of the trolley roads have been installing electric heaters (the same that have been on the market some years) is no justification for the statement that electric heating has "made a 'mighty stride' in 1895."

The Brooklyn road which Mr. Martin alludes to put heaters in their 500 cars. These heaters each absorbed the first cold day about 12 amperes per car to perceptibly warm them ; that at 500 volts pressure was about 8 H. P. per car, or 4,000 H. P. for the whole. It was almost a question which the company should do, warm the passengers or take them to their destination, for it seemed at one time impossible to do both with the power at their command.

It is feared that the "influential capital" that is being invested in the exploitation of such heaters will not yield a very heavy dividend for its subscribers.

The electrical industry has had a long and hard struggle, but it has so far survived the attacks of its most open and adverse opponents whose domain it has curtailed. In its future advance, as in the past, it has less to fear from its avowed enemies than from its supposed friends. Its principal danger is within its own ranks—fraudulent financiers, plausible but dishonest schemers, and last, but not least, injudicious and meretricious writers for the daily and technical press and the strictly trade journals.

Let all honestly engaged in the industry frown down the constant and apparently ever-increasing stream of articles tending to mislead the public concerning the possibilities of the application of electricity in the various arts and industries in which it is employed, no matter from what source the articles may emanate.

* * *

Why European Lamps Are Poor.

The somewhat acrimonious discussion of incandescent lamp tests, which recently appeared in the English electrical press, has done much to confirm the belief held by most American electricians that European lamp makers have sought more to produce a lamp of low first cost than one possessing the more important qualities of high efficiency and sustained candle power. Following the publication in Electricity of the tests of European lamps made by Mr. D. Paisley, a number of English manufacturers have rushed into print with declarations tending to substantiate rather than to controvert the correctness of the results established by these tests. These communications have in the main been confined to a discussion of the relative merits of the several lamps tested, and have merely been protests from the manufacturers whose lamps, on actual test, have failed to sustain the claims made for them. However vehement these critics may have been, and notwithstanding the original tests were published in journals which our abstruse and extra dry contemporary, the London *Electrical Review*, pleases to regard as "not strictly technical," the fact remains that the conclusions reached by Mr. Paisley have not been proven to be incorrect. The exceptions taken are such as would be expected from interested manufacturers, and even if the ratings given the lamps in the test are different from those claimed by the manufacturers, no data has yet been published which will show a higher efficiency or greater sustained candle power of European lamps than was given in the original tests.

This controversy has brought into prominent notice a number of interesting facts in connection with the manufacture of lamps in Europe. It is plainly evident that, among English makers at least, there is not that refinement in factory practice, or the care in the selection and preparation of materials, or the careful testing of finished products, such as may be found in any well-regulated American factory. But little attention appears to be paid to the candle power rating of lamps, and even less to standardizing. The aim of most manufacturers seems to be to produce lamps that can be sold at the lowest prices—"not merely," says *Electrical Plant* "because they avoid payment of heavy royalties for patents, but because they lessen the cost of production by devoting insufficient attention to standardizing."

That the product of the Continental lamp makers has been quite as defective as that of their English competitors is shown by the report of a commission appointed by the Union Representatives of Electricity Works to investigate the incandescent lamp question in Germany. The report, published last week in Electricity, states that "the complaints of consumers that the lamps are bad—good for nothing—are justified."

The committee found these complaints to be based upon the following causes : "Imperfect sorting, false marking, little economy and too short life of the lamps." In 70 lamps supplied by eight makers, which were given as 16 standard candle-power, and whose rate of consumption should have been 3.25-3.50 watts per candle-power, the illuminating power fluctuated between 7.82 C. P. and 22.85 C. P. and the rate of consumption between 2.8 and 6.3 watts per candle-power.

It is a source of some congratulation to know that, with few exceptions, American lamp manufacturers have profited by the experience which followed a sacrifice of quality to price. Their European brethren seem slow to learn in the same school, but until they do there will be no improvement in either the quality or price of their product.

* * *

Our London namesake has an honest correspondent who admits that "we Britishers are sadly behind even some of our colonies in electric lighting and telephony—especially the latter. One has only to travel abroad a bit to realize the many ways in which Great Britain is behind the world."

* * *

In France the price of Welsbach burners has been reduced to $3.20, in Germany to $1.25. *The Progressive Age* explains that the ground for this action is said to be in that the incandescent gas light companies of those countries have enjoyed a phenomenal business and have practically secured all the business that could be had at fancy figures, and the reduction in price has been made in the nature of a bid for trade among the poorer classes who have been deterred from introducing Welsbachs because of the prohibitive first cost.

* * *

It is stated that the Chilian Government has decided to establish an electrical section mainly with the object of familiarizing naval engineers with the principles of electrical engineering

Under the Searchlight.

Views and Opinions on Timely Topics.

To Offset the Bell Lobby.

To the Editor of ELECTRICITY.

SIR: Referring to the item in your issue of some weeks ago regarding the action of the Attorney General in asking the advice of Congress in regard to the prosecution of the Berliner case—while occasion for this action on part of the Attorney-General may exist, it strikes me that it offers an opportunity for the Bell people to get in some dangerous lobbying, which might defeat a necessary appropriation, and in other ways discourage the proper conduct of the case.

From "straws" which I have observed, I believe that the Bell people are afraid to have the case come to trial, and our company at least will bring every possible pressure to bear with our Congressmen to favor a large appropriation and have the case handled to the best possible advantage. Being aware of your friendly feeling toward *legitimate* independent telephone interests, I make bold to ask if you will not call attention to this matter in your next issue (providing, of course, that you consider it good policy), requesting every man who is in any way interested in the success of the independent telephone movement to have all possible pressure brought to bear with the Representative from his district to favor the prosecution of the case.

I fully agree with the opinion which you expressed in an issue several weeks ago, to the effect that it is better for the independent people to assist the Government in this case than to ignore it, for several reasons. Yours truly,

Boone, Ia. W. E.

* * *

Where is Burton?

A few weeks ago, it will be remembered, the *Electrical Engineer* gave a page or more to a description by George D. Burton of a process, of his invention, for the electrical smelting of ores. ELECTRICITY at once pronounced the invention, the system and the company to be nothing less than gross frauds, and chided our contemporary for allowing such matter to appear in its columns. A few days later Mr. Burton called at this office and offered to make a practical demonstration of his discovery. We offered him every facility, including current and power. He never came back. Later we were advised by one of his agents that there was to be a public exhibition at the works of the Eddy Company at Windsor, Conn., and that a quantity of ore had been shipped there. The exhibition has not been held, and Mr. Burton has been advised that the generator built for him awaits shipment upon receipt of check for same in advance. When in Chicago recently, a representative of ELECTRICITY met some of the California gentlemen to whom Burton had sold "rights" for that territory. They were gunning for Mr. Burton, who had fled the city or changed his hotel.

We trust our contemporary is properly proud of the assistance it gave to this fraudulent scheme.

* * *

These are the times which try men's souls, especially the souls of G. E. managers. When stocks once quoted at 120 are oscillating between 20 and 25 things look blue. But still worse is in store for our friends the enemy.

* * *

IF Diogenes lived in this progressive age he might even yet be unable to accomplish the object of his historic search, but he would certainly be better equipped with apparatus to aid his failing powers of vision. An inventor has recently secured a patent for a contrivance to be used either as a cane or electric lamp, to carry which, in Athens, or even in New York, would attract less attention than would the early form of searchlight employed by the discerning philosopher. This article is described as follows:

It is hollow, and the interior is filled nearly to the top with the necessary chemical solution. The knob is really an incandescent bulb, with an ornamental and protective covering of nickel or silver, which either unscrews or flies open at a touch upon a spring. The poles of the battery extend into the hollow of the cane, but not far enough to reach to the acid. But when a light is desired the cane is held knob downward, the acid attacks the zincs, and the electricity generated lights the bulb. They give out a really surprising amount of light and last nearly two hours. There is no waste of material when the light is not in use, as no electricity is generated except when the cane is turned upside down and the acid so brought in contact with the zincs. So a single filling may last for weeks or months. When the bulb is burned out, or the zincs are eaten away, or the acid loses its strength, the owner can easily reload the cane, as the supplies can be bought for a trifle.

* * *

The Reason For It.

(With apologies to Frank L. Stanton.)

The world is always sunny
To the man who spends his money,
But you've got to hunt the honey
Like the bees.
If they stayed inside the hive—
Didn't show that they're alive—
Would their honey-making thrive
By their ease?

Though little trade is goin'
There is still some money flowin'
To your rival who's been sowin'
Left and right.
So you've got to ope your eyes,
You must learn to advertise,
Or you'll never win the prize
In the fight.

THE NEW TESLA RAILWAY MOTOR.

A gentleman, described by the St. Louis *Globe-Democrat* as "one of the shrewdest electrical engineers in the employ of the Westinghouse Electric and Manufacturing Company," was recently interviewed by a reporter of that paper, to whom the following statements were made in reference to the Westinghouse-Baldwin combination, and the new railway motor now being perfected by Nikola Tesla:

The Westinghouse and Baldwin companies have become convinced that the demand for electric locomotives will grow rapidly in the near future. The steam locomotive which the Baldwin company has been making for sixty years is not to be laid on the shelf right away, but that company has come to believe, I think, that it will gradually, but surely, be displaced by its electric successor, and has grasped the opportunity to take advantage of the coming change by joining forces with one of the two great electric manufacturing companies which control the supply of such motors in the United States.

The allied companies propose to perfect and to offer to the steam railroads electric locomotives which they will buy and use. The resources of both concerns; the electric inventions, devices and experts of the one; the methods, the expert locomotive and running gear machinists of the other, are being taxed in the effort to produce a motor which the steam companies can use to advantage for any kind of service, but especially for the rapid and safe transportation of passenger trains running more frequently than the steam trains at the present time.

The demand first to be satisfied is for electric locomotives to draw passenger trains on the suburban roads of the trunk lines. The demand already exists—in fact, all the Eastern steam companies have placed large orders.

Tesla is working on an idea in the shape of a motor that I believe will about successfully equip a locomotive with the power desired. This motor is entirely original and truly marvelous. The secret lies in turning the inert and seemingly lifeless force of magnetism into an active force more powerful than steam or a current from a dynamo.

The principles of the motor, concisely put, are these: An electric current is passed through a circular magnet, in appearance resembling a life-preserver. It consists simply of a ring of iron with copper wire bound around it. The electric current generates a strong magnetic current which flashes around and around the circular magnet at terrific speed. Now, if one holds a nail close to an ordinary electric magnet it will be passive in the hand until it is brought close enough for the magnetic force to seize it, when it will fly out of the hand straight to the magnet. But if one holds a nail close to the circular magnet of Tesla it will begin to revolve in the hand; that is, if the nail is held by the head and the point allowed to hang over the hollow center of the magnet, the point will move around in a circle, slowly at first, then faster and faster, until, if it is dropped upon the table in the center of the hollow it will spin around so rapidly that the eye can not follow its motions.

Several explanations are given of the phenomenon one that there are several magnetic currents in the iron ring and they are chasing one another around in a furious race, but the mystery is as profound as ever.

Another interesting experiment is the balancing of an iron wheel on a nail, or let the wheel revolve upon the finger, using the finger as the axle, and holding it close to the magnet. It will fly around at a rate that will take one's breath away. It is not necessary to touch the magnet at all. All one needs to do is to hold a piece of iron or steel in the hand and bring it within a foot of the magnet, and then he will feel a queer sensation, as of some invisible force trying to draw the piece of metal out of his hand, and, failing in this, trying to twist it around in a circle.

Such is the principle of the coming Tesla motor. In its application as a motive power on the railroad, the construction, of course, differs from that of the experimental magnet, but the idea is the same.

In equipping the new locomotives the circular magnet is attached to the bottom of the engine, and the axle upon which the wheels revolve passes through the center of the magnet without touching it. When the current is turned on, the magnetic force whirling around in the hollow of the magnet catches the axle and turns it. The power for generating this magnetic current can be transmitted by underground wires for almost any distance, and there is practically no waste of power or energy.

We think the time has arrived when we may, with perfect justice and propriety, clearly indicate the policy of this paper in relation to press notices of a character similar to that printed above.

We should like to know—

1st. Is the Westinghouse Company responsible for the statements in that article, or does it encourage its press agent to give public currency to such statements?

2d. If it does, what is the object of such statements?

3d. Who is the person referred to as "one of the shrewdest electrical engineers in the employ of the Westinghouse Company?"

We ask these questions because we should like to definitely fix the responsibility for the many obviously untruthful statements made in the article.

Can it be truthfully stated that either or both of the two great electrical manufacturing companies in this country control the supply of electric locomotives employing either direct or alternating currents? We think not. Indeed we know that this field of work is fully open to any one who wishes to enter it, or any who are already engaged in it.

We know that Mr. Tesla is not engaged on electric locomotive work, and the description of the motor given in the article and its principles of operation differ in no way from the well-known rotary field motor used for years past in this country and Europe.

Is it not about time that the large electrical manufacturing companies of this country stopped this kind of puffery and misstatement of facts? Such notices certainly do not materially strengthen the position of the company responsible for them in the eyes of the general public, nor increase the confidence of capitalists in electrical enterprises.

Any sensible business man knows if any company engaged in any line of business has a startlingly novel and useful invention, of such a revolutionary character as is supposed to be described in the above article, that it is most unwise to publicly announce the fact before the invention is ready for the market, such a course of action being invariably followed by its competitors exerting unusual diligence to find out what the new thing is, and stimulating them to make the utmost exertions not to be left behind in the race. An article of the kind referred to may indeed be looked upon as public notice to its competitors of the direction in which the company making the announcement is working—a thing which everyone possessing a modicum of common sense desires to avoid and carefully endeavors to conceal.

The public have already had enough of promises of what is going to be done and too little fulfilment of such promises.

PROFESSOR FORBES ON "HARNESSING NIAGARA."*

BY ERNEST A. LE SUEUR, SC. B.

The past few months have seen the successful completion of a gigantic work, of epoch-making extent and significance—the Niagara Falls electrical power transmission plant. An article appeared in these pages in September, 1894, describing something of the difficulties which had been met and overcome by the engineers in charge of the water power and generator installation of the Cataract Construction Company, as the corporation which had the contracts for erecting the plant was named.

Prof. George Forbes, who held the position of consulting electrical engineer to that company, is to be heartily congratulated upon the success that has crowned his efforts. It becomes pertinent at present to insist, however, that Prof. Forbes should be content to limit his claims to glory to the considerable work that he has undoubtedly accomplished, for, unfortunately, he appears not overanxious to define that limit when discoursing to the public about his achievements.

There has been some bickering between Prof. Forbes and Prof. Rowland, of Johns Hopkins, as to which of the two was the originator of certain of the novel points in the Niagara Falls Power Company's generators. The atmosphere is very murky in consequence, but some facts would seem to have filtered through, and we shall take occasion to refer to them later. What seems to call for notice at this moment is a paper by Prof. Forbes, which appeared in the September "Blackwood's," entitled "Harnessing Niagara."

It is doubtful if any American magazine would have published that article, even had it contained fewer references to the shortcomings of the United States. It seems to us, however, that it would have been much better for it to have appeared in this country than in Great Britain, because of the freer criticism it would here have had, and because America's faults would then have been told where it might be hoped that, coming from so authoritative a source, certain valuable reforms would result.

A large portion of the article is devoted to a description of Forbes's own unusual endowments and capabilities, natural and acquired, which, it would appear, fitted him for the position of consulting electrical engineer to the Cataract Construction Company, not less than for the suppression of the American railway conductor. A perusal of the article brings to one's mind the couplet by a famous English librettist:

> "He was the bravest man in France;
> He said so and he ought to know."

Turning to such portions of the paper as do actually bear upon the Niagara work, we have, as above mentioned, the professor's remarkable claim to originality in the matter of the revolving fields. Again, in describing the steps leading to his choice of apparatus, he says: "I soon realized the fact that not only could the latter (alternating) current be more easily obtained at high pressures, but that it could more easily, and without moving machinery, be transformed to any required pressure at any spot when it was wanted." This statement, it is to be regretted, is nothing short of dishonest. Forbes is here speaking of the year 1890, at which date the fact that he refers to as having worked out for himself was literally the A B C of electrical work and part of the common knowledge of thousands of "line" laborers throughout the world.

With regard to the two points so far mentioned the distinguished engineer has not sought to belittle the work of others, but only to magnify his own; he has not, however, confined himself to this more moderate course, and we find him stating that "the highest scientific authority in America had taken up the same position as Lord Kelvin," referring to the latter's alleged strenuous opposition to the use of the alternating current. The eminent authority referred to would seem to be Prof. Rowland, of Baltimore. This gentleman, who ought to know what it was he advised, states positively that he did not strenuously oppose the use of the alternating current; that he did not oppose it at all; and that, moreover, his opinion was given in 1889, not 1890; that what he did advise at that early date, in view of the untried state of either direct or alternating current transmission, was merely caution in adopting plans; which advice, we may add, was most carefully followed, as will be seen from the fact that the main plans, not to speak of the details, were not decided upon until three years later, during which interval some most remarkable developments had taken place both in the design of machinery for use with alternating current and in the practical transmission of the latter over an immense distance in Europe.

Our writer says: "Until I went to America the manufacturers of electrical machinery never had a consulting engineer to reckon with, but dealt directly with the financiers, who knew nothing about cost or efficiency of machinery," and reference is later made to his being the first to get guarantees of performance from manufacturers of such machinery. The present writer speaks from personal experience in declaring this to be incorrect. The way in which a company, larger and even more representative than the chief one with which Prof. Forbes did business, filled an 1,100 horse-power contract under guarantee, and later supplied an auxiliary generator to make the guarantee good, would perhaps have impressed that gentleman. The particular occurrence referred to is immediately within the writer's knowledge, and the extremely exacting specifications for the said machinery were written and insisted upon by consulting engineers and not by the financiers. It should, however, be unnecessary to say that, of course, the method of requiring guarantees and of employing engineers to write specifications was common in the electrical business, as well as in all others, long before the advent of Forbes.

There are other points in the professor's paper besides those already referred to which require contradiction, and still others, covered by the matter in controversy between himself and Prof. Rowland, which there is every reason to believe might be improved in the matter of accuracy, but which, since directly opposite statements are put forth by the two men, we must be content to let stand in default of other sources of information regarding them.

An opinion of Prof. Forbes that surprises us is set forth in the sentence, "I had always wished to put the dynamos at the bottom of the pit close to the turbines, and I still believe that this arrangement would have served us better." It is the opinion of the writer that it is an unusually good thing for the Niagara Falls Power Company that the above was not done. In his experience it is a practical impossibility to keep penstocks under great head from leaking, and the moisture thereby communicated to the atmosphere, as well as that due to the location of the dynamo room at the bottom of a narrow pit 150 feet deep, with a torrent carrying a hundred million gallons per hour raging immediately beneath, could not well fail to impair the machines' insulation. Since the latter must carry a vast electrical pressure of alternating current, any impairment would be fatal to the maintenance of the plant. An instance occurs to mind in which a generator plant was located on a level with the wheel cases, and this not at the bottom of the pit by any means, but at the top of a draught tube some feet above the level of the surrounding ground, and in which, owing to the moisture unavoidably present, the generators had subsequently to be removed.

In an opening paragraph Prof. Forbes speaks of the production of the paper under discussion as the result of an attempt to curb a natural tendency to reticence, and, later, in describing the Falls of Niagara, he says "the most impressive points of view are those that make you feel the smallest." It is not apparent whether the professor himself experienced the sensation, but if he did the depression must have been evanescent, for near the end he says that, while his company ascribes his "splendid results" mainly to engineering skill, "I am inclined to believe that they were fully as much the result of an exercise of tact, judgment and forbearance, combined with firmness—qualities which I do not hesitate to say that both the officers of the company and myself recognized in each other." All of which, while possibly true, is scarcely the utterance of a man hampered by a temperament in which reticence and a feeling of insignificance are struggling with each other for supremacy.

Americans have faults and are not more sensitive to having them pointed out than other people, but the tendency among descendants of Anglo-Saxon stock to resent the imputation of the possession of visual motes by ill-tempered owners of larger ocular imperfections is deeply rooted. We have not for many a long day seen an article in a prominent English journal so well designed, by its gratuitous disparagements of America, to keep alive the fast-expiring dislike to the mother country that it is to the interest of all of us to see buried.

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* From the "Popular Science Monthly" for December.

AN INVESTIGATION OF THE ALTERNATING-CURRENT ARC.*

BY J. A. FLEMING, D.SC., F.R.S., AND J. E. PETAVEL.

During the last six months investigations have been carried on by us in the electrical laboratory of University College, London, with the assistance of some of the senior students, which form part of an analytical study of the alternating current arc as yet not quite complete. Two arc lamps were selected of well-known types—one of them suitable for working with continuous current and the other with alternating current, the lamps being chosen with a view to good regulation and steady working over wide limits of power consumption.

The first portion of the experimental work consisted in the construction of an inspectional reflecting wattmeter, intended to enable the observers to measure and to regulate with great accuracy the power taken up in the arc itself, neglecting altogether the power absorbed in the mechanism of the arc lamp. The wattmeter consisted of a fixed coil, which was the current coil of the instrument, and through which the current of the arc passed, and a movable coil hung by a bifilar suspension, the two suspending wires being exceedingly fine silver wires. In series with the suspended coil was a non-inductive resistance, capable of being varied in magnitude within certain limits. The suspended coil had affixed to it a plane mirror, and an image of a wire illuminated by an auxiliary arc lamp was thrown by it on to a fixed scale. The suspended coil consisted of 33 turns of wire, and the fixed coil of 10 turns of thicker wire. The non-inductive resistance, in series with the suspended coil, had a resistance of 1,200 ohms, the resistance of the shunt coil of the wattmeter being 3.67 ohms and that of the fixed coil 0.01 ohm. The wattmeter was fixed firmly to a wall, and the scale carried at a fixed distance opposite to it. The wattmeter was calibrated by means of continuous currents, and by means of an interpellation curve the power, reckoned in watts, passing through the wattmeter could be read off from the position of the image of the wire thrown upon the fixed scale. The terminals of the fine wire coil were connected to the arc carbons. In all the experiments the wattmeter readings were subsequently reduced so as to give the true power taken up in the arc, neglecting the power required to actuate the arc lamp mechanism and the power taken up in the voltmeter and wattmeter itself.

In addition to the wattmeter measurements, the current through the arc, as well as the potential difference between the carbons, was taken by properly corrected instruments, and the length of the arc was also measured at the same time by projecting its image upon a screen. The photometric measurements were made with Sugg's star disk photometer, the *light* from the arc lamp being compared by this means with that of an incandescent lamp, which was worked at a sufficient voltage to bring it up to about 2½ watts per candle, the incandescent lamp being compared at frequent intervals with a primary standard incandescent lamp.

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*Abstracted from *The Electrician* (London).

It was found that by focussing the eye for a point rather nearer to the eye than the images of the photometric disk the color difference between the two images became less distracting, and in this manner the observations that were made are all taken in terms of a white-light standard, no measurements made in terms of red or green light having any practical value. The experiments consisted in taking a series of observations of the photometric intensity of the arc in different angular directions to the horizontal plane through the arc in the usual manner, the power supplied to the arc being kept perfectly constant by a regulating carbon resistance in series with the arc. A complete series of observations was taken with the continuous current arc when supplied with power of from 200 to 600 watts. For each complete set of observations the wattage in the arc was kept perfectly constant, and from the photometric observations the ordinary illumination curve of the arc could be plotted out, and the mean spherical candle-power calculated in the usual way by means of Rousseau's diagram. In the case of the alternating-current arc, owing to the circumstance that there is a slow periodic rotation or change of place of the arc, quite independent of the fact that the current or the wattage in the arc is maintained perfectly constant, the photometric measurements become particularly troublesome. In this case it was necessary to take a series of photometric observations rapidly in different azimuths for each particular inclination angle, and to take the mean of these observations. Carrying out this process, a series of illumination curves was obtained for the continuous and the alternating-current arc, which had the usual characteristic form. In both cases these experiments and measurements of the mean spherical candle-power were repeated for different expenditures of power in the arc varying from 200 to 600 watts. The alternating current experiments were made at two frequencies—viz., 50 ∼ and 83.3 ∼. The carbons used in the case of the alternating-current experiments were both 15 mm. cored carbons of the best quality, and in the case of the continuous-current arc experiments two sets of observations were made, one with both carbons cored and 15 mm. in diameter, the other set with the positive or upper carbon cored and 15 mm. in diameter, and the lower or negative carbon solid and 9 mm. in diameter. When all the necessary reductions of the hundreds of observations were made by the integration of the illumination curves to give the mean spherical candle power, and the reduction of the wattmeter scale readings to give the true power in watts expended in the arc itself, apart from anything taken up in the mechanism or instruments, the results were embodied in a series of curves as shown in Fig. 1, in which the horizontal distances represent the power in watts taken up in the arc, and the vertical ordinates the mean spherical candle-power. The four curves there shown show the variation of mean spherical candle-power for the particular carbons used for the various powers employed in the case of both arcs, the details of the observations being given in the table above.

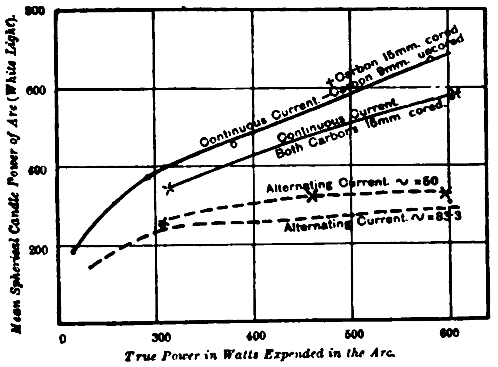

FIG. 1.

The general result of the above-described experiments therefore confirms the conclusions reached by one of us in 1894, and which indicated that for a given amount of power expended in the arc under the conditions under which these experiments were carried out, the mean spherical candle-power for continuous current was nearly double that for the alternating current.

—	Continuous-current arc.					
	+ Carbon 15mm. cored. — Carbon 9mm. solid.				Both carbons 15mm. cored.	
Power expended in the arc in watts	582	380	292	215	607	313
Mean spherical candle-power	675	455	372	181	582	344
Potential difference of carbons in volts	56	44	36	26	60	40
Current through arc in amperes	10.6	8.7	8.1	8.2	10 2	8
Length of arc in centimeters	0.715	0.25	0.07	0	0.807	0.061
Power factor	1.0	1.0	1.0	1.0	1.0	1.0

—	Alternating-current arc. Both carbons 15mm. cored.							
	Frequency 83.3 ∼					Frequency 50 ∼		
Power expended in the arc in watts	601	501	404	305	233	596	459	308
Mean spherical candle-power	307	274	256	250	144	326	322	254
Potential difference of carbons in volts	37.5	34	28	21	15.8	39	31	22
Current through arc in amperes	16.2	15.1	15.1	15.5	15.4	16	15.1	14.6
Length of arc in centimeters	0.628	.....	0.125	0.016	0.01	0.7	.	.....
Power factor	.....	.....	0.96	0.96	0.99	0.97	0.99	9.97

In reading the above tables it must be noted that it was the power, measured in watts, taken up in the arc which was kept constant. The current and difference of potential of the carbons were allowed to take care of themselves. The current and volts were approximately constant, and had the mean values given in the tables, but the product of these mean values does not quite agree with the true mean power measured in watts taken up in the arc.

The above-described experiments do not, of course, by any means exhaust the subject. The question whether continuous-current arcs *per se* are more efficient than alternating-current arcs in regard to mean spherical candle-power produced per watt is a large question to consider, and perhaps cannot be answered in a general sense, but it is capable of being settled for any particular instances which occur in practice. It is for this reason that we selected the two typical cases of an alternating-current arc worked with 15 mm. cored carbons worked at frequencies 83.3 ∼ and 50 ∼, and compared it with a continuous-current arc worked with 15 mm. and 9 mm. carbons as commonly employed. The experiments, of course, do not settle whether any particular form of alternating-current arc can be produced which shall give the same mean spherical candle-power for a given expenditure of power as a continuous current arc with the same carbons, and such a question has, perhaps, too purely an academic interest to make it worth while to spend time upon it.

These experiments amply justify generally the opinion which has been held as to the relative inefficiency of alternating-current arcs in mean spherical candle-power, apart from any question as to differences in the distribution of the light, and show the correctness of the opinion which dictates the employment of continuous current or rectified alternating current for public arc lighting purposes.

The second part of the investigation was concerned with an analytical examination of the periodic variation of light coming from various parts of an alternating-current arc. For this purpose an alternating-current arc was formed with currents of frequencies of about 83 ∼, 50 ∼, and 25 ∼.

Fig. 2 shows a complete set of observations giving the current through the arc, the potential difference between the carbons, the power expended in the arc, and the variation of the light in the center of the true a c, excluding any light coming from the incandescent carbons. The firm line curve in Fig. 2 therefore represents, by its ordinates, the periodic variation of the light coming from the purple arc discharge lying in between the carbons, but does not include any light coming from the carbons themselves.

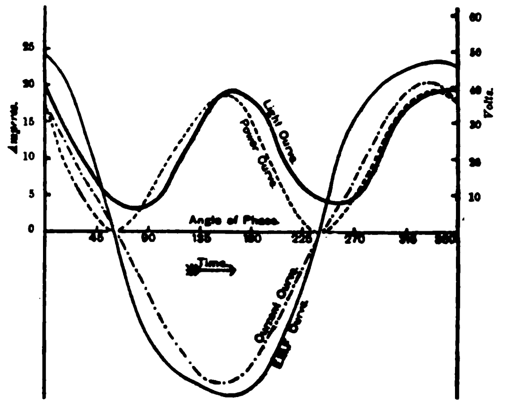

FIG. 2.

The ordinates of the firm line marked "Light" represent the periodic variation of illuminating power of the center of the *true arc* of an alternating-current arc. The other curves marked E. M. F., current and power represent the variation of potential difference of the carbons, current and power in the arc. Carbons, 15mm. cored; ∼ = 83.3; amperes = 14; volts = 39; length of arc, 0.55cm.; volts at alternator terminals = 104.

It was found that the blue or purple light forming the true arc in between the carbons undergoes a periodic variation in intensity, completely vanishing at a certain instant during the phase, but at the same time there is outside this true arc a dim halo of golden light which is persistent, and it is on account of this persistent aureole of faint light that the ordinates of the firm line curve in Fig. 2, which represent the variation of light in the true arc, never becomes zero, but there is always an outstanding constant amount of light. In order to select as far as possible merely the blue or purple colored light from the true arc, irrespective of any admixture of white light coming from the aureole, a blue gelatine transparent screen was employed to select a certain group of rays. By shifting the position of the mirrors slightly it was possible to measure the periodic variation of light coming from any part of the incandescent carbons. The diagram in Fig. 3 represents the periodic variation of light coming from the center of the crater of the lower carbon, the other curves of the same diagram representing the variation of current through the arc, potential difference between the

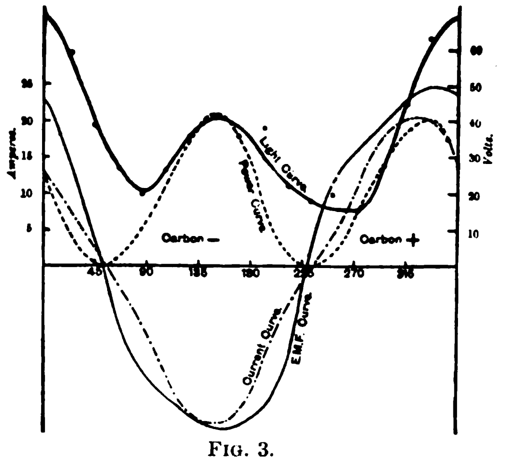

FIG. 3.

The firm line curve in the above diagram represents the variation in illuminating power of the *crater* of the lower carbon during one complete phase of an alternating-current arc. Carbons, 15mm. cored; ∼ = 83.3; amperes = 14; volts = 36; length of arc, 0.42cm.; volts at alternator terminals = 98.

carbons, and power expended in the arc. It must be noted that the scale to which the light curve in Fig. 3 is drawn is very different from that of the light curve in Fig. 2, as the crater is, of course, far more brilliant than the true arc. The interesting point to notice is that during the time when the lower carbon is negative the maximum light emitted from the center of the crater of the lower carbon does not reach such a maximum value as it does when the same carbon is positive. For a frequency of 83 it is not much more than one-half as great—that is to say, the brilliancy of the crater on the carbon undergoes a periodic variation, but at the instant when the carbon is negative and when the maximum power is being expended in the arc the brilliancy of that part of the carbon is not much more than one-half that which it is when the same carbon is positive and receiving its maximum power expenditure. The lower the frequency, the greater this difference. It is easy to distinguish the part of the period during which the lower carbon is negative from that in which it is positive by holding a magnet at the back of the arc and noting which way it causes the image of the arc to be deflected.

It is evident from the curves in Fig. 3 that there is a certain lag in the curve representing the variation of light from the carbons behind the curve representing the power; in other words, the light lingers on a little after the power has fallen to zero. It will also be noticed there is a very slight difference of phase between the current and the electromotive force, which is also found in all the other curves taken with the alternating current arc.

Gas Engines and American Incapacity.

(From the Scientific Machinist.)

There is not perhaps a larger market for any mechanical device of which a need is felt than for a small gas and gasoline engine. The mechanic who will build a one H. P. fairly efficient gas engine and sell it at about the cost of a one H. P. steam engine will secure a trade of very large proportions. If he should be able to realize a fair profit on each sale—and otherwise it would be dangerous to engage in that or any business—a large fortune could undoubtedly be built up in a few years.

The question is often asked, why are Americans, who in most matters of enterprise generally have no superiors, so backward in the use of gas and gasoline engines. And it is a pertinent question which no one can answer. The English lead us in this line of work, and perhaps this only. They adopt our steam engine and boiler designs, machine tool designs and have modified much of their engineering work in various branches along the line of American ideas, but they are our masters in the design of gas engines. Not only this, but our manufacturers are either so egotistical or fossilized that they see nothing of the kind, admit no part of the truth, and apparently care nothing about doing their plain duty by their customers and to maintain America's reputation. They are even lacking in Yankee adroitness or they would at least copy some of the good English designs.

Will not some of the live, enterprising, inventive men found in all branches of mechanical engineering but this one, take hold of the gas engine question? There is a splendid field for the exercise of true business capacity. They need not fear patents. In fact there is scarcely an American patent on a gas or gasoline engine which would be found useful in placing the manufacture of those machines on a proper commercial basis. The modern gas engine is principally valve gear, and apparently the manufacturers have competed with each other for the most complicated and costly contrivances with which to accomplish a simple mechanical act. These wonderful mechanisms must be relegated to the relic chamber before much progress can be made in cheapening the cost of the gas engine and in adapting it to the multifarious uses for power in this country.

ELECTRICITY IN BITUMINOUS COAL MINING.*

The subject of mining coal by the aid of machinery has received renewed consideration each year, as its importance has become more apparent to the industry. This is especially true since the recent industrial depression has fallen upon the commercial world. Coal has been mined in the State in this way to a greater or less extent during the past seventeen or eighteen years, but not until within the past two years has it become plainly manifest that upon the present basis governing the relations of pick to machine mining the latter has such a decided advantage. It is believed that within this period the subject has received more attention than during any other period since its inception. While this is true, the subject of mining coal by the aid of machinery is by no means of recent birth. The records in the U. S. Patent Office show that as early as 1858 it had materialized to such a point as to be considered patentable.

These patents exhibit the range of thought over which inventors have gone in their endeavors to produce coal by the aid of mechanics, and with what eagerness they have tried to solve a problem that even to-day retains many mysteries. To those who are familiar with the progress made in this branch of industry, the small percentage of the claims which have been found to possess merit will appear quite startling. It is possible that the machines of many of the early inventors fell short of success for want of suitable power with which to operate them, the science of electricity being in a primitive condition and the air compressors being very imperfectly understood. For this and reasons hereinafter considered, it is doubtful if the number of economic mining machines on the market at the present time will exceed a half dozen, and it is certain the number can be represented by a single digit.

There are many reasons why the energy of so many inventors has not been crowned with greater success. One is, that mining machines are operated in caverns of Egyptian darkness in which even inventors who have this problem under consideration rarely enter, hence the machines escape the gaze of the inquisitive mechanic who is constantly prying into ingenious devices which are exposed to the light of day. This results in the skilled mechanic and the inventor having little or no knowledge as to the requirements of a successful mining machine or to the amount of labor that it must perform. They are equally ignorant as to the rough usage that it must withstand in order to reclaim a ton of coal with economy to the mine operator. Although the most intelligent and skilled miners, thoroughly versed in their vocation, are usually selected to operate the mining machines, as miners they are entirely wanting in the knowledge of mechanics, and therefore unable to calculate as to the amount of additional strength required, or of the form or place to apply it in order that the machine may withstand the resistance offered by the coal. It will be readily seen that the mining machine is thus deprived of suggestions, alterations and improvements that would be offered by both mechanics and inventors were it operated where it would be exposed to the public eye, as are other labor-saving devices. Even since the introduction of the first economic machine, which was about 1876 or 1877, there have been scores of machines patented and placed on the market, many of them possessing features that would have been of great value to the mining industry had they been fully developed, but upon trial they were found to be too frail, and after a number of vexatious delays, caused by breakage, they were consigned to the scrap pile, and the disheartened inventor found himself forced to abandon his hope of reward and return to his former vocation. Had he been possessed of a knowledge as to the units of work that are required to undercut the coal he would have increased the factor of safety in his calculations and the result might have been more satisfactory.

But few coal veins are adapted to machine mining at all, and in a still smaller number can the present type of standard machine be used with economy. For profitable mining the roof must be strong and free from slips or bell-shaped balls. Especially is this true of the rotary bar or of the end-cutting chain machine, either of which cannot be well operated if the props are set less than twelve feet from the coal face. The floor of the coal vein must be nearly, if not quite, level to admit of the successful working of machines. There is no instance within the writer's knowledge where the mining machines have given satisfaction when operated on an uneven floor. The thickness of the vein has been considered as the index by which its adaptability for the introduction of mining machines is to be determined, and, with but few exceptions, no attempt at an installation has been made except in the very thickest of the veins; and so machine builders have designed only for the mining of high coal. For this reason the practicability of using machines in reclaiming the coal in thin veins still remains undecided. This is largely owing to the fact that the fiber of the coal is as firm in the thin veins as in the thick, so that the power required to undermine the coal remains the same, hence the weight of the machine must be as great for one as for the other. The diminished space in which to use the bars by which the machine is moved, also the necessity of using a shorter bar, thus diminishing the leverage, makes the moving of the machine very laborious and slow, and thus diminishes the opportunity of profit that might be derived from their installation. With a view of widening the field of machine mining, some manufacturers have turned their attention to the designing of a machine that would be of such a height as to not come in contact with the roof while being moved, but the weight of the machine was so great that it offered no encouragement to the operators in thin veins. The mere fact that a machine is of a height that will permit of its being readily moved is no guarantee that it can be profitably used in that vein. It is an old rule in mining to make the undercutting the same depth as the coal vein is thick. If a proper amount of powder is then judiciously used the coal will be liberated in its best possible form.

The present type of bar or chain machine is designed to undercut from six to seven feet, and where the vein is from eight to twelve feet in thickness this is, of course, much less than the rule would require. In such an instance great difficulty has been experienced in producing merchantable coal, owing to its flaking off in thin slabs so shattered as to not stand handling.

It has been found that a seven-foot machine must be much heavier than one that is designed to undercut but six feet, hence it is the writer's belief that if in these veins the machines were designed to undercut from three and one-half to four and one-half feet, as the thickness of the vein would demand, it could be so reduced in weight as to be readily moved into position. Such a machine would be designed to undercut the full thickness of the vein, and the coal thus produced will enter the markets in as good form as if it were the product of pick mining.

The early installations of mining machines, beginning about 1877, were confined to the use of compressed air as a motive power. This continued until early in the year of 1889, when electricity was first successfully applied to a rotary bar machine by the Jeffrey Manufacturing Company of Columbus, Ohio. This machine is still in use in the mine in which it was first installed. The ease and economy with which this new power could be conducted about the mine commanded for it at once the attention of the inventor and operator. It placed the employment of the mining machine within the reach of a greater number of operators, and the development of machine mining has gone forward rapidly since that date.

The question of operating mines by electricity has received more discussion during the past six years than any other subject before the mining public. The few years elapsing since the first introduction of electricity have witnessed its successful application to every labor-saving device in the industry in which compressed air had formerly been utilized. Furthermore, it has been known that the amount of power required to operate the mining machines has been reduced; also that the construction of the mining machine has been improved, and that new and improved machinery has been designed to attack the coal in a more advantageous manner. Still there has been no careful investigation of this progress or no published information for which the public has been the wiser. It would seem that the efficiency of the power, its adaptability to the uses of the mine, the amount of it required to do a given amount of work, the loss in transmission, etc., were questions which should have received ere this the most careful investigation and the results placed before the mining public. The absence of this information can only be accounted for on the assumption that the persons who desire it dislike to undergo the necessary hardships and inconveniences, much less to perform the labor, whereby it can be acquired.

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*Abstract from Annual Report of R. M. Haseltine, Inspector of Mines of State of Ohio.

Pressure Limits in England.

The committee, consisting of Lord Kelvin, Mr. W. H. Preece and Major Cardew, to whom the London Board of Trade referred the many points involved in the discussion of pressure limits, has proposed that where the conditions of the supply are such that the pressure may at any time exceed 500 volts if continuous, or 250 volts if alternating, but cannot exceed 3,000 volts whether continuous or alternating, the supply shall be deemed a high pressure supply. The committee advise that the regulatnioy be amended as follows: "The pressure of a suppls delivered to any consumer shall not exceed 250 volts at any pair of terminals;" "no such conductor shall be at a higher pressure than 300 volts from earth." In Regulation No. 6, the words "or less than 45 volts if continuous, or the equivalents thereof respectively if alternating," are to be omitted.

With reference to the suggested alteration to the regulation for safety, the committee are of opinion that to enable the use of 500 volts continuous pressure between the outer conductors of a three or five wire system with bare conductors laid in conduits, the Board of Trade may give a provisional sanction to an earth connection being applied to one point of the middle conductor in any case in which they are satisfied that a high insulation is maintained on all other points of the system, and that suitable and sufficient means are provided for the immediate detection, localization and correction of any fault of insulation.

The committee consider that in making the above suggestions they have indicated clearly how, in their opinion, the question of limitation of pressure should be treated to adequately secure the safety of the public and to meet the requirements of electric lighting undertakers and the convenience of their customers.

Commenting editorially upon the conclusions reached by the committee, the London *Electrical Review* says:

> "Pressure" now means simply "the difference of electrical potential between any two conductors through which a supply of energy is given, or between any part of either conductor and the earth." By inference, a low-pressure supply becomes one in which the pressure can never exceed 500 volts if continuous, or 250 volts if alternating; a high-pressure supply is one between 500 and 3,000 volts for continuous currents, and 250 volts and 3,000 volts for alternating currents, and an extra high pressure, anything over 3,000 volts, on either system. The pressure may not be changed at any consumer's terminals without his consent. In our issue of a fortnight ago we pleaded for three things that have not been granted, but which we considered vital to the best interests of the industry; these were, that practical and experienced station engineers should be included on the committee, that the meeting should be open to the public, and that no difference should be made between continuous and alternating currents. By the failure to grant these points, we think that the conclusions of the committee are unsatisfactory, and will not be accepted without demur by a large proportion of the electrical engineering profession.

The Storage Battery.[*]

A DISCUSSION OF ITS APPLICATIONS BY THE MEMBERS OF THE A. I. E. E.

ACCUMULATOR ECONOMICS.

BY ARTHUR V. ABBOTT AND FRANZ J. DOMMERQUE.

[The above-named paper, read at the Chicago meeting of the Institute held simultaneously with the New York meeting, dealt with the advisability of storage battery installation by comparing the cost of an electric lighting plant capable of supplying the entire city of London with a steam plant alone or with a steam plant with accumulator regulation. The capacity of this station is based upon load diagrams taken over a year ago.]

The load curve shows a maximum load of 11,600 kilowatts, or 15,700 H. P., and a minimum load of 800 kilowatts, or 1,080 H. P., the load factor being 33 per cent. The items required to determine the expenses would be: cost of fuel per year, cost of labor; cost of supplies and repairs; interest and depreciation on plant. It has been ascertained by Mr. Fritsche that the average load throughout the year is 16.375 per cent. of the maximum load, which in this instance would be 2,571 H. P. per hour, or 22,521,960 H. P. per year; the amount of coal used per H. P. hour being about 1½ lbs. The total H. P. hours would equal 25,587,960 H. P. per year, and the amount of coal used would equal 38,351,940 lbs., or 19,176 tons. The price of coal per ton may be taken at $2.25, then the cost of fuel per year equals $43,146.

The cost of labor is determined as follows: One attendant is required per unit, or five in all, at 25 cents per hour, equals an expense per hour of $1.25. Ten firemen and two helpers at the same rate, or an outlay of $3.00 per hour. This fixes the cost of labor at $4.25 per hour. Add for superintendence $1.50 per hour, obtaining a total of $5.75 per hour, or $50,000 per year. Cost of supplies and repairs is found to be $18,000 in round numbers.

Money is obtainable at five per cent., and the amount necessary to provide for depreciation should not be any more; therefore 10 per cent. is assumed. The cost of steam plant, taken at $64 per H. P. (Emery's value) + ⅛ surplus power, a plant of 17,700 H. P., as required, will cost $1,132,800, 10 per cent. of which is $113,280. The cost of dynamo, switchboard and accessories may be taken at $35 per K. W., or $25.90 per H. P. The cost of 15,700 H. P. will be $395,000, the interest and depreciation of which, on the basis of 10 per cent., will amount to $39,500. The total expense, therefore, per year will be $264,300 for regulation by shutting down part of the plant.

For a plant with accumulator regulation it is calculated that the engine power required under the assumption of 90 per cent. efficiency of the dynamos would be, in round numbers, 6,850 H. P. The accumulator capacity required would be 240,000 ampere hours. From the price list of the Electric Storage Battery Company, a cell of 5,000 ampere hours' capacity costs $375. Forty-eight cells in parallel, or a total of 3,120, would be required, costing $1,092,000. Then interest and depreciation on accumulators equal $109,200.

For switchboards and meters a first cost of 10 per cent. on the accumulators would not be too low, the interest and depreciation on which may be taken at 10 per cent., then the annual expense for switchboard and meters equals $10,920. The steam plant required was found as 6,850 H. P. Taking again the cost per H. P. at $64 + ⅛ surplus power would give $467,840; interest and depreciation at 10 per cent. would give $46,784. The dynamo plant, figured at $25.90 per H. P., would amount to $177,420; 10 per cent. interest and depreciation gives annual expense for dynamos and switchboard as $17,742. The amount of coal used would be 6,141 tons. Then taking the cost per ton again at $2.25, the expense for fuel would be $13,820.

Cost of labor will be found as follows: Three attendants at 25 cents per hour, expense per hour $.75; four firemen and one helper, at same rate per hour, $1.25; plus $1.50 for superintendence, which makes a total of $3.50 per hour, or $30,660 per year. Cost of supplies and repairs equals $5,550 per year; adding all determined expenses, the total per year would be $234,676, as against $246,300 found for regulation by shutting down part of the plant.

DISCUSSION.—(Chicago Meeting.)

Mr. Carl K. MacFadden—We have installed an electric light station of over 400 H. P. in gas engines, and have found in a number of cases that although the battery plant has a capacity of not over 600 ampere-hours it has helped us in a wonderful way when we have had trouble with an engine, and we have found it especially valuable in very light loads, when it would not pay us to run the smallest engine, which is of 80 H. P. In small gas-engine stations there has been considerable attention paid to storage battery auxiliaries. In large gas-engine stations, storage batteries will be used in conjunction with improved types of gas engines, so as to keep the engine up to its best load, for the gas engine ought to be loaded up to its rated load to get its best results, the same as the ordinary steam engine.

Mr. Ludwig Gutmann—The reason that the storage battery business is so well developed in Europe and almost neglected in America can, no doubt, be traced to the fact that in Europe until within the last year or two, with few exceptions, all installations were of the low tension continuous current type. In many places, especially in theaters, it was compulsory to provide means such as storage batteries, to prevent a sudden giving out of light due to defects in machines. On the other hand we find in America the majority of installations of the high tension alternating current order. Here in America there was not such a great need for storage batteries, or, if it existed, it was not satisfied because capital was afraid of master patents.

Mr. M. H. Gerry, Jr.—If a storage battery can be obtained, costing not more than the same kilowatt capacity of a first-class prime mover, having a commercial efficiency of 75 per cent., and a cost of maintenance not greater than six per cent. of the investment, then such a battery can be used in a great many power stations with advantage in point of economy. It is only a question now whether such a battery can be obtained, and a great many practical engineers are looking with considerable interest in the direction of storage battery manufacturers.

The present method of stating the capacity in kilowatt-hours or ampere-hours is not altogether satisfactory. More important than the total capacity in the application to fluctuating loads is the maximum rate at which a battery can be repeatedly discharged without seriously damaging it. A kilowatt rating representing this maximum discharge would be of more value in cases of this kind than the kilowatt-hour or ampere-hour.

Mr. B. J. Arnold—Mr. Perry states that under no circumstances would he recommend the use of batteries, for the simple reason that the gas engine will be found more economical. I think this is rather a broad statement and one which the advocates of this system will have some difficulty in substantiating, for the reason that gas engines working on variable loads are extremely uneconomical, and not only are they uneconomical, but they are very sensitive to changes of load. If the load on a gas engine changes suddenly, it is liable to require immediate attention on the part of the operator to keep it in operation. There is no question in my judgment but that a gas engine plant, installed properly and run on producer gas, will deliver a K. W. hour on the switchboard for less money than a steam engine plant can do it, but in order to do so, the engines must be run at practically a constant load.

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[*] Abstract of Communications and Discussion at the Chicago Meeting of the American Institute of Electrical Engineers.

Such a plant, working in conjunction with a battery auxiliary, I believe to be the most feasible solution of the power station question, and one which we will probably come to in this country in the near future.

The most important application of batteries to lighting work which I have had to do with is the plant now being installed in the Chicago Board of Trade. In this plant the operating expenses average now about $25,000 per year, using simple engines at 75 lbs. of steam, hydraulic elevators with compound pumps working steam full stroke, and old style belted electric plant with shafting. By increasing the steam pressure to 125 lbs., installing new boilers, new compound engines, and with direct connected generators, electric elevators and a battery auxiliary, we expect to reduce the operating expenses to $15,000 a year.

Between the hours of 9 A. M. and 2 P. M. the batteries act in conjunction with the generator, as the demand is in excess of the capacity of the generator, while from 11 o'clock P. M. until 7 A. M. the entire load of the plant is carried by the batteries without the aid of the generators, thus leaving all of the plant, except the batteries, idle for this period of the twenty-four hours, and necessitating but one attendant during this time, who fires the boilers in the winter for steam heating, and also acts as watchman. With this arrangement, the 75 kilowatt unit operates for a period of sixteen hours at its maximum economical load, and is then shut down and stands idle until the next operating period. From this plant will be operated 1,000 16-C. P. incandescent lamps, four 10 H. P. electric motors, four 30 H. P. electric elevators, and it is expected that one 75 K. W. generator will handle this load economically when the plant is completed.

A battery plant properly built, with sufficient lead to do the work required of it, and properly handled, will prove an economical investment where the conditions are favorable ; but it should be borne in mind that a battery, like every other power-saving device, cannot effect a saving unless the load is such as to warrant its use, which is especially the case on variable electric loads.

Prof. Carhart—Three years ago I had the pleasure of visiting, in company with several other gentlemen, the central stations of London, through the kindness of Professor Silvanus Thompson. One thing that impressed me very much, in comparison with what I have been accustomed to see in connection with storage batteries in America, was the fact that they construct their storage batteries there for durability. The cells were of enormous size and capacity. They were extremely heavy, and intended for actual use. They were not made, apparently, by the manufacturers to make money out of, by selling cheap metal at a high price, but they were made for service and durability. The people in charge of those stations in London which use storage batteries watch them very carefully, and when anything is the matter with them they put them in the hospital. Storage cells remind me of an invalid, requiring great care and watchfulness. They must be taken care of and watched when they are not giving their highest efficiency. They require considerable labor, and this item ought to be added to the account.

I have come across one or two points of scientific interest. It is certain that the internal resistance of a storage battery changes considerably with the length of time that it is discharged. As it is discharged, we have a sulphate formed which has a higher resistance than the active material. This internal resistance will change in the course of charging for half an hour. Then there is another point. You all know that the internal resistance of any primary battery decreases as the current increases. We have been able to get very nice smooth curves. With a storage cell the change is small and is quite difficult to measure, but measurement shows that the internal resistance is lower when the current which we are taking from the battery is larger.

Prof. W. M. Stine—There is good reason for the lack of data for the life and usefulness of storage batteries. Through all the years they have been with us, they have existed in tentative form, and their history is a failure of one form, leading to fresh experiments on others. That they have recently been the subject of large speculation by some of our leading financiers is by no means a convincing argument in their favor. This is neither the first nor the greatest financial combination of its kind, and should it not prove successful it is only adding one more to a long list of disastrous failures. The engineering view of our subject has been frequently and pretty exhaustively presented, but too often by those who have had no practical experience with batteries, and whose estimates of first cost, maintenance and depreciation are far below the actual figures.

A commercially practical storage battery would be one of the greatest boons to electrical engineers. This is undeniable. It does not require any especial foresight to realize the great advantages accruing from their use. The problem of when and how far to employ them is not more difficult of solution than the most advantageous amounts and distribution of copper in distributing circuits. It requires that a sufficient number of load curves be taken to get a reliable average curve. It then remains to determine the size of generating plant to handle the average load, and the addition to this to handle the peaks in the load, allowing sufficient reserve to handle the maximum peak likely to occur. The equivalent in batteries of this reserve portion of the plant can then be calculated. The total operating expense in each case would present no especial difficulty were data at hand which would reliably state the depreciation, maintenance and labor involved by the use of storage batteries. Additional elements would be the enhanced efficiency of the generating plant when run with a nearly constant load of the service and battery combined and the power factor of the batteries, or their efficiency from the generator to the consumer. With such data as outlined, the question of the commercial applicability of the storage battery would be a very simple one. All that would be necessary would be to balance accounts between the two classes of reserve plants. On the one side would be the first cost of generators, engines, boilers and accessories, labor, maintenance, operating expenses and depreciation. On the other, the first cost of the reserve equivalent in batteries, their maintenance, depreciation, operating expenses, labor, and the large number of accessories. Here conscientious calculation would leave but little room for discussion, except on methods and details of installation. If the problem has been fairly stated, then why does the present hesitation to install batteries exist? There is no doubt that storage batteries would prove desirable adjuncts to many power and lighting stations, and would be generally introduced, could any reliance be placed upon such low depreciation as 7½ per cent., as has been recently stated. But American engineers are justly conservative on this latter point. In too many cases the depreciation has reached 100 per cent., or the batteries have been abandoned in a short time.

It is undeniable that a strong sentiment exists in this country against the storage battery. Most of the data obtainable is against it. Under such circumstances it would be wise to make haste slowly, and let the burden of the introduction of batteries rest on the company manufacturing them. The argument that the engineering world wants is not engineering calculations showing a paper economy, but it wants to be granted the demonstration of plates that have stood at least from 1,500 to 2,000 daily reversals on continuous service. A battery of which at least 90 per cent. of its plates could make such a showing would be not a mere curiosity but a most convincing argument.

The general trend of practice is to employ a greater weight of lead per ampere-hour capacity. The heavier plates suffer the same actual loss in pound weight of active material as lighter ones, but can support the loss for a greater length of time. But the proportionate life of a heavy plate, owing to physical disintegration, may in reality be less than the lighter one. The interest on the first cost of the extra lead which is used to ward off the day of final destruction is a direct loss unless the proportionate life of the heavy plate greatly exceeds that of the lighter one.

It has been so often proven that the use of reliable storage batteries is excellent engineering practice that the arguments have become mere platitudes. But where shall we obtain the reliable battery? Certainly it is yet to be proven that it is made in America. Can we point to any make of battery that has stood up under at least five years of ordinary commercial service? Litigation is claimed to be responsible for the non-use of storage batteries in this country. Yet we all know better than this. If a perfectly reliable battery had existed, it would have come to the surface in spite of all lawsuits. The very fact that manufacturers are constantly changing the form of plates, etc., is sufficient argument to show that plates will not stand up under service. Great stress is laid on the extensive use of the storage battery in England, Germany and Switzerland. But here the plants are too modern to prove their ultimate economy.

European practice offers a counter argument. The fact that batteries are used there so extensively shows that they must prove at least a partial success. Let American engineers, then, profit by European experience. Let us go to them for our information.

Another question remains to be decided. Can batteries be profitably sold outright? In many cases the manufacturer has maintained a fostering care over plates installed, and the life shown has in a measure been due to frequent patching up of plates. Among points not sufficiently emphasized by many writers are the great outlay for the numerous expensive accessories demanded by a first-class installation, the constant attention and treating which they demand, and the disagreeable nature of repairs due to handling sulphuric acid.

Determining Center of Light from Photometric Burner.

At the New York meeting of the American Society of Mechanical Engineers, D. S. Jacobus, of Hoboken, N. J., read a paper entitled "Experimental Method of Determining the Effective Center of the Light Emitted from a Standard Photometric Burner," based upon data obtained in testing car lamps in the Department of Tests of the Stevens Institute, Hoboken. In these tests a burner of about six candle power was used as a standard of light. The burner selected was a Sugg Argand gas burner fitted with an opaque screen of the Edgerton pattern which passed over a glass chimney. The opening for the emission of light was arranged so that the top and the lower part of the flame were obscured from view, whereas the horizontal width of the slot was made greater than the diameter of the flame. The horizontal width of the slot was one and one-half inches, and its height was thirteen-thirty-seconds of an inch. The diameter of the opaque screen was one and seven-eighths inches. The back of the screen opposite the slot was cut away so as to prevent reflected light from being thrown back and through the slot.

In this class of a screen and burner, the distances employed in calculating candle power measurements are often measured to the geometrical center of the frame. Any error so involved will be a small one if the illuminated disk of the photometer is used at a considerable distance from the burner and in about the same position which it occupied when the burner was calibrated by means of candles. In these tests, however, the burner had to be used in positions near to as well as far away from the disk, so that it was necessary to determine the effective center of the light which it emitted.

The method of determining the effective center was as follows: The photometer disk was set at a given distance from the candles, and the standard burner was brought to a position at which there was an equal illumination on the two sides of the photometer disk. The distance from the disk to the geometrical center of the burner was then recorded. The disk was then moved to another position, and the corresponding distance from the disk to the burner was recorded. The disk was then set back to its first position and a second reading obtained. It was then moved to the second position, then back to the first, and so on, until a number of readings were obtained. After a sufficient number of readings were taken to eliminate any irregularity due to variations of light emitted from the candles, the results were averaged and the distance of the effective light center from the geometrical center of the flame was found by means of a formula.

The results of the experiments showed that the effective light center of the burner was about nine-tenths of an inch from the geometrical center of the flame and entirely outside the flame as indicated. The candles do not have to be corrected for variations in the rate at which the paraffin is burned. All that is necessary to insure accuracy is to make a number of observations, changing the distance of the photometer disk from the candles each time a reading is taken, as has already been explained, and employing the average figures.

The error involved, if all the measurements were made from the axis of the burner instead of the effective center, both in calibrating and in using the standard burner, would have been as a maximum about ten per cent. in the lamp tests which we made. In these the effective center of the burner was placed at a distance of sixty inches from two standard candles in calibrating the burner, and the minimum distance at which the burner, when used as a standard, was placed from the photometer disk was about twelve inches.

ndro Ainary way of using the burner is to place it sixty inches from two standard candles to calibrate it, and then set it sixty inches from the flame of which the candle power is to be determined, all distances being measured from the axis of the burner. If calibrated and used in this way, there is an error of about three and three-quarters per cent. for a flame of twenty candle power, and of about six per cent. for a flame of forty candle power.

Another way in which the burner is calibrated is to measure the candle power of a uniform gas flame, first with candles and then with the burner, and repeat the two operations until an average figure is obtained. When this is done there is but a small error involved in measuring from the axis of the burner, provided the gas flame which is measured is of about the same candle power as the flame which was employed for calibrating the burner, so that the distance from the standard burner to the photometer disk is about the same in both cases. If the burner is calibrated at sixty inches from a gas flame of twenty-four candles, and is used at the same distance to measure the intensity of a flame of sixteen candle power, there will be an error of about one per cent.

Magnets for Lifting Purposes.

An interesting use of magnetism is being made at the Sandycroft foundry in England. At these works electric cranes are operated from the electric power and lighting circuits, together with electro-magnets, which permit the ready lifting of pieces of iron or steel weighing up to two tons. The magnets constructed for lifting purposes are attached to a crane. One magnet takes 5½ amperes at 110 volts to excite it, at which energy it will support a weight of two tons of iron or steel. A switch controls the supply of current delivered to the magnet. By the use of this magnet, or crane, three men do the work in one quarter of an hour which previously took six men one hour and a half to perform.

TELEPHONE COMPANIES DECLARED TO BE COMMON CARRIERS.

The temporary injunction secured some months ago by Simon Sterne, a New York lawyer, restraining the Metropolitan Telephone & Telegraph Company from removing a telephone from his office because he refused to pay $240 a year for the use of it, has been continued by a decision of Judge Ingraham of the Supreme Court of New York. The action of Attorney Sterne was in the nature of a test suit, brought for the purpose of determining the power of the courts to regulate the compensation that should be paid to the telephone company for the service given.

Mr. Sterne insisted that the rates fixed were extortionate and excessive. The company, on the other hand, insisted that the advance in the rates from $125 to $240 was due to the increased cost occasioned by the improvements in the service. As Mr. Sterne declined to pay the higher rate, the company threatened to remove the instrument from his office. He then instituted proceedings and secured a temporary injunction protecting him in the continued use of his telephone. In his decision Judge Ingraham holds that the injunction must be continued. He says in his opinion:

> There can be no doubt whatever but that the Legislature would have power to regulate the business of this defendant. It is a corporation created by law, and the business it is conducting is of a quasi public character. In this case the Legislature has not attempted to regulate the price that this defendant should charge for the use of its telephones, and the question is presented as to whether or not the courts in the absence of legislative enactment can so control the business of the defendant corporation as to prevent its charging for the use of its telephones a sum that is greater than that proved to be a reasonable compensation for the services rendered.
>
> I think it is clear that at common law in the absence of legislative enactment a common carrier is bound to furnish transportation to the public for a reasonable charge, and the courts, upon a proper application made, may determine in each case what is the proper and reasonable compensation to be paid to the corporation and compel the corporation to furnish such transportation on the payment of such reasonable compensation.
>
> I am inclined to think that this duty of the courts extends to a business carried on under the authority of law which is in its nature a public business affected with a public interest, and that the transmission of intelligence by electricity is a business of such public character that it is to be exercised under public control.

The question of rates, Judge Ingraham thinks, can best be determined by the examination of witnesses upon a trial of the issues.

The Government Given More Time in the Berliner Case.

Judge Colt, of the United States Circuit Court of the Massachusetts District, has granted the United States until May 31, 1896, in which to take evidence in rebuttal in the case of the United States against the American Bell Telephone Company and Alexander Graham Bell, in which the question of fraud in procuring the Berliner patent is raised.

Judge Colt refused to limit the Government to the question of fraud raised. The Government has taken a vast amount of evidence in support of the claim of Daniel Drawbaugh, and the defendants have taken countervailing evidence on the same issues. The Government now wishes to take evidence to rebut the defendants' evidence, and the Court has given time for that purpose. It did not restrict the Government from taking evidence on the question of alleged priority of invention, which it could have done had it granted the request of the defendants.

In the suit of the city of Tacoma, Wash., against the Tacoma Light & Water Company, the jury awarded $787,000 damages to the city. Three years ago the president of the Light & Water Company secured, by what has been declared by the Chamber of Commerce of Tacoma to be the most corrupt election ever held in the city, the sale to the city of the water plant, including an electric light plant, for $2,080,000. Fraud, bribery, misrepresentation and ailure to deliver what was promised to sell resulted n a suit for $1,000,000 damages.

Multiplex Telephony.

To the current number of the *Sibley Journal of Engineering*, Mr. Kempster B. Miller contributes an article on the above subject, being mainly a description of the systems patented in the United States by William W. Jacques of Massachusetts and Maurice Hutin and Maurice Leblanc of France. The first of these systems is founded upon the principle that the human ear can readily detect a sound lasting but a very minute part of a second, while it will fail to notice an interruption of much longer duration in a sound continuous except for such interruption. In this system the line terminates in a group of reeds adjusted to vibrate rapidly and synchronously between contact plates attached to multiple telephone receivers. The rate of vibration is so rapid that the switch arms are not removed from either of their contacts for a period greater than one-hundredth of a second at a time. Since a sound occupying but one-hundred-and-five-thousandth part of a second can be heard, while an interruption lasting as long as one-hundredth of a second in a sound continuous except for such interruption cannot be detected, it follows that a conversation can take place between any pair of telephones attached to the reed vibrating apparatus.

The second system depends for its operation upon an analysis and synthesis of sound, to accomplish which the inventors make use of the fact that an alternating current of one particular frequency only will be efficiently transmitted over a circuit having a given coefficient of self-induction, resistance and static capacity, while currents of all other frequencies will be so greatly reduced as to be relatively insignificant.

A combination of a condenser and a self-induction coil, called by the inventors an "electric resonator," is used, it being understood that a circuit containing such a combination will select one particular frequency of alternating current, to the exclusion of all others, just as a Helmholtz resonator will select a particular frequency of sound vibration.

To each end of a line wire are connected selectors, each composed of a number of parallel circuits containing condensers and self-induction coils, or in other words, a number of resonators. To the other side of each selector is connected respectively a telephone set consisting of a receiver, an induction coil and a local circuit containing a microphone and a local battery. The various resonators of the selectors are tuned to frequencies of 100, 105, etc., to 1,100 alternations per second, each selector therefore having a range corresponding to a fundamental tone and nine of its harmonics.

If a sound be uttered in front of the microphone connected to one of the selectors, an alternating current will be generated in the usual manner in the secondary of the induction coil attached to it. Of all the components of this complex wave only ten will be transmitted through the selector to the line wire. At the other end of the line these components will only find passage through the resonators of the corresponding selector, and will be barred from passage through the other selectors, these latter having no resonators tuned to any of these particular frequencies. After passing through the particular selector, the components are reunited and produce in the corresponding receiver at the receiving station a sound closely approximating that uttered against the microphone at the sending station.

The current selector corresponding to any telephone nstrument therefore transmits to the line ten of the components of the complex current generated in its induction coil, and the corresponding selector at the opposite end of the line picks out this particular ten from all others which may be coming over the line from this and other instruments, and recombines them into a complex resultant alternating current which is capable of producing in the receiver at the receiving station a sound almost but not quite a correct reproduction of the original.

Electrical Reduction of Colorado Ores.

W. S. Stratton the millionnaire mine owner of Colorado, has contracted for the equipment of a complete electrical reduction plant to be installed at one of his extensive ore mines either at Cripple Creek or Colorado City. The equipment will consist of a direct connected generator having a capacity of 2,000 amperes at 25 volts. The ore will first be crushed, then placed in vats to be acted upon electrolytically the process being similar to that employed at the Anaconada mine. In this plant there are seven generators. Four give a current of 1,200 amperes at a pressure of sixty volts and three give 750 amperes at 140 volts. The tanks each contain 100 plates placed in series. The tanks are connected up in sets of five, and these sets are connected with the feed wires in multiple. The original plates are cast in the shape of a very broad T, the two flanges at the top being the supporting points and the bottom going into the tank. The solution in this tank is made up of copper, gold and silver, mainly copper. While running, the solution is kept up to almost saturation. The action of the plates is for the solution to dissolve copper off the first plate and deposit the same amount on the bottom of the second, and at the same time dissolve off a portion of the face of the second and deposit this on the rear of the third, and so on. The first plate, instead of being copper, is lead and does not contribute to the solution. The backs of all the other plates are blackleaded, so that the copper may strip when wanted. By keeping the copper solution up to its highest point in value, as is readily determined by the use of a hydrometer with frequent assays as a check, the copper dissolves off the face of the plates only in very small proportions, while the amount deposited on the rear is extremely great.

When the solutions are first made up, all the metals present are dissolved, and, if they were all deposited on the plate there would be no advantage. As nearly all metals require a slightly different current for plating or depositing, the current is so regulated that the copper only is deposited and the gold and silver are dropped to the bottom of the vat as slime, which is cleaned out frequently and refined. At the same time the solutions themselves grow saturated with these metals, and they are also at long intervals taken out and the contents precipitated and recovered. By the electrolytic process copper of more than 99 per cent. fine can be produced.

Chicago Electrical Association.

The Chicago Electrical Association held its third meeting this season on the 3d inst. The paper of the evening was by W.Clyde Jones, on the "Protection of an Invention," and was a very concise and complete statement of facts regarding American patent laws and customs. The paper was discussed by W. R. Garton, Thomas G. Grier, S. B. Jamieson and others. Following the paper the election of officers for the ensuing year was held and resulted in the election of W. Clyde Jones president, S. G. McMeen vice-president, J. R. Cravath secretary, F. S. Hickok treasurer.

There has recently been a great increase in interest and membership of this association, which promises to take a prominent place among the local societies in the largest cities in the country.

International Congress of Applied Chemistry.

The second annual meeting of the International Congress of Applied Chemistry has been arranged to take place in Paris next year under the patronage of the French Government, and will be accompanied by an exhibition of chemical and agricultural industries. The congress will be divided into 10 sections, of which Section X is devoted to electro-chemistry, and will be presided over by M. Moissan. The secretary is M. Gosselin, and among the vice-presidents are MM. d'Arsonval, Hospitalier, Javaux, Mascart, etc. The following is the programme of subjects to be discussed : 1. The laws of electrolysis, with the determination of the constants involved (the resistance of electrolytes in solution and in a state of fusion, the effect of temperature, the E. M. F. of polarization, etc.). 2. The use of electrolysis in analysis. 3. (*a*) The preparation and use of insulating materials, including indiarubber, guttapercha, and their substitutes ; (*b*) the resistance, temperature coefficient and electric properties of alloys. 4. Electrolysis in the alkali trade (chlorate of potash, soda, bleaching powder, etc.). 5. The use of electrolysis in organic chemistry (rectification of alcohols, sugar manufacture, sterilization of impure water, synthesis of organic compounds, etc.). 6. Electrolysis of metals in the wet way. 7. Electrolysis of fused salts (sodium, magnesium, silicon, lithium). 8. The electric furnace (carborundum, calcium carbide, silicon boride, titanium, etc. 9. Thermo-electric work (welding, electric heating, etc.).

OBITUARY.

Alfred E. Beach, who died of pneumonia Sunday morning, was the son of Moses Y. Beach, who established the *N. Y. Sun* and conducted it for many years. Mr. Beach was born in 1826 in Springfield, Mass. In 1846 he and his former schoolmate, Orson D. Munn, founded the firm of Munn & Co., and became the proprietors of the *Scientific American*, which at that time was the only weekly journal of its kind published in this country. For nearly fifty years Mr. Beach was active in the editorship of the *Scientific American* and in the direction of the extensive patent business of the firm. He leaves a widow, one son and a daughter.

GENERAL NEWS.

What is Going On in the Electrical World.

Sullivan, Ill.—J. H. Baker's electric light plant was completely destroyed by fire on the 23d ult.

Manlius, N. Y.—The electric lights were turned on in this village for the first time a few nights ago.

Milwaukee.—Negotiations are pending at South Milwaukee for the establishment of an electric light plant.

Winchester, Ky.—An advertiser whose address is "Electricity," Winchester, wants a 300 light 110 volt dynamo.

Columbus, Ga.—The Columbus Railroad Company intends to expend $50,000 in the enlargement of its electric plant.

Coloma, Mich.—Leading business men are agitating the introduction of electric lights and electric cars in this town.

St. Louis.—Mayor Walbridge has signed the bill granting the Manchester Road Electric Railway Company a franchise.

Northfield, Minn.—The Northfield Heat, Light & Power Company have their new electric light plant ready for operation.

Watkins, N. Y.—Surveyors have been at work recently on the proposed electric road here, reviving interest in the project.

Ellwood City, Pa.—Council has passed the electric light ordinance over the veto of the burgess and a plant will be put in as soon as possible.

Lancaster, Wis.—Hobart S. Bird, of Madison, has been here making an investigation as to the advisability of starting an electric light plant.

Boulder, Col.—The Western Electric Transit & Power Company will locate its plant near the mouth of Boulder canon and will run it by water power.

New York.—The net earnings of the Edison Electric Illuminating Company of New York for 1895 will show about 8 per cent. earned on the capital stock.

Dublin, Ga.—An election will be held here on the 12th inst. to decide the question of bonding the city in $25,000 for waterworks and an electric light plant.

Gainesville, Fla.—The Gainesville Electric Company wants a new or second-hand plant for forty 2,000 C. P. arc and one thousand 16 C. P. incandescent lights.

Lowell, Mich.—The vote at the recent election in favor of expending $23,000 for the construction of an electric lighting plant by the city was 363 ; against, 68.

Warren, O.—The recently-incorporated Cleveland & Chagrin Falls Electric Railway Company has announced its intention of extending its proposed line to this place.

Guthrie, Okl.—The local electric light plant has been largely extended by the recent addition of a complete new lot of machinery, including dynamos and switchboard.

Kansas City, Mo.—It is stated positively on good authority that as soon as the entanglements of the Union cable line are straightened out the road will be equipped with electricity and added to the street railway system of the city. M. M. Broadwell, of New York City, who is now in the city, says that he came here to see the line put in operation under the new system.

Middletown, Conn.—It is stated that the Middletown Electric Railway Company will shortly erect a new power house equipped with all the latest improvements.

Freeport, L. I., N. Y.—The people of this place are anxious to have electric lights and are urging the trustees to have an election held to get a vote of the public on the question.

Alexandria, La.—Bids will be advertised for by this city shortly for a 50 K. W. alternating dynamo, engine, boiler, etc. Address A. C. Jones, superintendent electric light plant.

Staunton, Va.—Arrangements have been made to change the motive power of the City Railway Company from mules to electricity, and work on the new system will begin at once.

Carlisle, Pa.—Chief Burgess J. M. Bretz, of Camp Hill, has vetoed the ordinance providing for electric lights for that borough. The ordinance was passed some time ago by council.

Rush City, Minn.—The Minneapolis Electrical & Engineering Supply Company have completed the erection of an electric light plant here which is pronounced one of the best in the State.

Bangor, Me.—At a meeting of businesss men in this city, it was unanimously voted to aid as far as possible the construction of the proposed electric road to Charleston and East Corinth.

Niagara Falls.—Petitions are being signed by the property owners throughout the city in favor of having another electric street railway line. Gen. Benj. Flagler is interested in the new company.

Charlevoix, Mich.—The village council has granted to Charles Gabriel, manager of the electric light company, a franchise for an electric railway to connect this place with neighboring resorts.

Chatham, Can.—Thos. W. Horn and H. A. Beatty, of Toronto, have been conferring with our representative citizens on the question of establishing an electric street railway in this city with extensions north and south.

Flint, Mich.—From recent manifestations it is almost certain that the proposed electric railway from Flint to Fenton, via Long Lake, the franchise for which is held by T. Nolan, of Saginaw, will be constructed at an early day.

Toronto, Can.—The Toronto, Hamilton & Niagara Falls Electric Railway Company has given notice of application for a charter at the next session of Parliament. A number of villages would be connected by the proposed route.

Youngstown, O.—The Orient Electric Company has received an order through a New York exporter for incandescent electric lamps for a big Russian order, and will, it is said, be kept working overtime on this order for three months.

Montague, Mass.—The Montague Street Railway Company has applied to the selectmen for permission to build an electric railway from Montague Center to connect with the present system at Lake Pleasant. There is little doubt that the franchise will be granted.

San Bernardino, Cal.—If an investigation now in progress shall result satisfactorily, the citizens of San Bernardino will be given an opportunity to express their individual opinion on the subject of establishing a municipal electric lighting plant by voting for or against the issuing of bonds.

Newark, N. J.—A good many business men are advocating the building of an electric belt line railroad here for the transportation of freight as well as passengers, and an effort will be made to have an act passed permitting the carrying of freight within certain limits for the convenience of manufacturers.

Baltimore, Md.—It is probable that the City Passenger Railway Company will shortly decide to change the motive power on the Blue Line from cable to electric. Some time ago President Franklin stated that such a change was desirable in order to reduce operating expenses and provide for future suburban extension.

Montclair, N. J.—The following changes have been made in the officials of the Montclair Light & Power Company : William Winslow Ames has been elected president, vice Whiting G. Snow, resigned, and Philip N. Jackson, vice A. C. Fisher, resigned. C. D. Backus and George R. Baker have resigned from the board of directors.

Rochester, N. Y.—The board of supervisors have awarded the contract for the gas and electric light fixtures for the new court house to Archer & Pancoast, of New York. A member of that firm says that the fixtures which his house will furnish will be reproductions of the finest work in buildings of a like order of architecture in Europe.

White Plains, N. Y.—A franchise has been granted to the Port Chester, Rye & White Plains Electric Railroad to construct a line through Westchester avenue from the monument to the town line. Franchises will also be asked of the towns of Port Chester, Harrison and Rye. The company agrees to begin work in sixty days and have the road completed in six months.

Reading, Pa.—The deal in which the newly organized United Traction Company secures control of the various lines of electric railways formerly operated by the Reading Traction Company was concluded last week at a meeting of the shareholders at which the leases were ratified. The new company controls all the electric lines in Reading with the exception of the Reading and Southwestern.

Cripple Creek, Col.—An enterprise of great importance to Cripple Creek has been inaugurated by Omaha capitalists, who have organized the Cripple Creek Power & Mining Company, for the purpose of generating electric power at Florence and transmitting it to this camp. It is proposed to furnish light as well as power to mines or manufacturing enterprises at a rate which will enable them to be operated much cheaper than at present.

Brooklyn, N.Y.—Mayor Schieren's veto of three solution granting a franchise to the State Electric Light & Power Company was not sustained in the board of aldermen.—The application of the Brooklyn City Railroad Company to annul the city ordinance regulating the speed of cars has been denied by Judge Cullen, of the Supreme Court, who holds that the common council had not surpassed its vested powers in passing the ordinance.

Harrison, N. J.—The bids for lighting the streets were as follows: Fort Wayne Electric Light & Power Company, 75 arc lights of 2,000 C. P. each, 33 cents per night, under a five years' contract; Kearny Electric Light & Power Company, same number of lights under a five years' contract, 27½ cents per night; People's Electric Light & Power Company of Newark, 28 cents per lamp a night. Each proposal was accompanied by a certified check for $3,500.

Cleveland, O.—The "Press" says: "A trip that cannot be duplicated anywhere in the world will be possible, next summer, as the result of the development of electric railway systems by capitalists in Cleveland and Buffalo. Informal plans have been discussed by representatives of the Akron, Bedford & Cleveland Electric road and some Buffalo people, by which trips may be made next summer from Akron to Niagara Falls entirely by electric road and boat."

Washington, D. C.—The "Times" states that there "are unmistakable surface indications to the effect that preparations are being made for the consolidation of the Columbia and Metropolitan street railways, the reorganized company to be known as the Metropolitan Electric Traction Company. This proposed street railway deal is equal in importance to the transverse arrangement by which the Chevy Chase line swallowed the Washington and Georgetown."

Provo City, Wash.—It now seems certain that before another summer passes there will be a mammoth power plant erected near the mouth of the Provo Canon. The location of the plant has already been determined on and the surveys and plottings accepted by the Provo River Power Company, of which L. L. Nunn, of Telluride, Col., is the chief manager. It is thought that sufficient water power can be developed at the selected point to generate electricity enough to supply power and light to all the mining settlements of Utah.

Portland, Conn.—George C. Raymond, secretary of the Connecticut Engineering Company of Norwich, Charles Potter, a well-known capitalist of the same city, and George Hunt have completed arrangements for the purchase of the entire stock, also the plant and fixtures of the practically defunct Portland Electric Light Company, established two years ago. The company will be reorganized under entirely new management, and the plant will be enlarged and put in operation as soon as the necessary work can be completed.

St. Louis.—Another electric railway line has been projected to extend westward through St. Louis county from the city limits to St. Charles, over the St. Charles rock road. Surveyors have been engaged surveying the route, and their reports as to the feasibility of the line and the cost of construction have been most favorable to the enterprise. The promoters are Messrs. Frank Thompson, F. C. Fisher, Robert Lucas, T. M. Kilby, H. Damon, J. C. Miller, George Wise, George Brown, E. T. Thomas, James Dawson, John Shackelford and J. C. Ghio.

Lewiston, Me.—The Lewiston & Auburn Electric Light Company has leased the valuable water power on the Little Androscoggin river known as the Gay power, situated near Littlefield's Corner, formerly occupied by the American Light & Power Company. This water privilege has a fall of 24 feet and is estimated to furnish at least 400 H. P. The steadily growing demand for electric lights and electric power has made it necessary for this company to obtain increased power in some direction, and the location of this privilege is so favorable in connection with their present plant that it is considered an especially valuable acquisition.

New Orleans.—The Gulf Coast Electric Company, organized about a year ago, have recently held consultations with capitalists in regard to their plans and shown much earnestness in promoting the scheme they have in view, which is the building of an electric railway, following the Gulf Coast line, between the towns of Pass Christian and Biloxi, with spurs to the Louisville & Nashville at Pass Christian, Long Beach, Mississippi City and Biloxi. The officers of the company are: President, A. M. Dahlgren; first vice-president and manager, James B. Cable; second vice-president and general auditor, G. W. Bennett; secretary and pro tem. treasurer, J. V. Ross. The capital stock to be subscribed is $250,000.

New Haven, Conn.—At the annual meeting of the Connecticut Electric Lighting Association, held here on the 27th ult., the following officers were elected: President, James English, of New Haven; first vice-president, C. H. Merritt, of Danbury; second vice-president, L. F. Curtiss, of New Milford; treasurer, A. M. Young, of Norwich; directors for two years, J. E. Sewell, of Waterbury, and A. S. Hurlburt, of Norwich. E. S. Breed, of New Britain, and Charles D. Sherman, of Meriden, were appointed a committee to draft suitable resolutions on the death of the late James A. Hadley, superintendent of the Meriden Electric Light Company and first vice-president of the association. A. J. Purington, superintendent of the Stamford Gas and Electric Company; Charles D. Sherman, superintendent of the Meriden Electric Light Company, and John E. Sewell, general manager of the Waterbury Traction Company, were appointed a committee to prepare a joint paper on various matters of interest pertaining to electric lighting, to be read at the June meeting.

TELEPHONE AND TELEGRAPH.

Climbed the Wrong Pole.

Judge Baker of the Federal Court at Indianapolis, Ind., has handed down an opinion in the case of Thomas Dickson versus the Western Union Telegraph Company, involving a somewhat novel point. Dickson was a line inspector for the defendant, and while in pursuance of his regular work climbed a pole belonging to the Central Telephone Company. While astride of a cross-arm the arm broke, precipitating Dickson to the ground and injuring him. He sued the Western Union Company for $5,000 damages.

In deciding the case the court held that the plaintiff, as an employee of the Western Union Company, and not of the Central Telephone Company, was not responsible to his employer for the condition of a pole belonging to the latter company, and that his act in climbing the pole was entirely voluntary on his part; that his employer was not responsible to him for damages for injuries, which were manifestly occasioned through his voluntary action and which were received while he was on a pole which the Western Union Company did not own and over which it could not have had control.

To Reduce Rates in New York State.

The Kings County Pharmaceutical Association of New York City, in co-operation with other commercial organizations throughout New York State, has completed the draft of a bill, to be shortly introduced in the Legislature, providing for the reduction and regulation of telephone rates. The bill provides that in cities of 1,000,000 and more inhabitants the rate shall not exceed $125; in cities of 500,000, not to exceed $85; in cities of 100,000, not to exceed $48; in cities of 20,000, not to exceed $36; in cities and places of 8,000, not to exceed $30, and in all cities of less than 8,000, not to exceed $27 per annum.

The charge at pay stations for local messages is fixed at ten cents for the first five minutes and five cents for every succeeding five minutes or fraction thereof. It is also proposed that no yearly patron or subscriber having and paying for a telephone at his own place, office or residence on the unlimited service rate shall be charged for the use of a telephone at any public or pay station when used by him or his employees in his business exclusively. All such patrons, subscribers and customers shall be furnished with cards or certificates showing their telephone number or numbers and entitling them to such free use of public or pay stations.

Telephones in Iceland.

The telephone has apparently got a footing in Iceland. It is said that an American is laying a line between Reykyavik and Akureyri. It is also reported that an Englishman has submitted to the Althing a proposal for a telegraph cable between Iceland and the Shetland Islands. The funds necessary for this undertaking have already been secured, and Great Britain, Denmark and Iceland will jointly guarantee those who advance the money an interest of 6 per cent. for a number of years.

The New French Cable.

The Budget Committee of the French Chamber of Deputies has approved the draft convention concluded between the Government and a French cable company for the laying of a new cable between Brest and New York, with an extension to the West Indies, and thence to Para in Brazil.

Telephony in Austria.

The official statistics just published show that the telephones in Austria now number 17,404. Of these the State controls 9,295 and a private company 8,109. There are 121 town systems with 8,723 subscribers under State control. In private hands there was only the Vienna exchange with 7,924 subscribers.

The Marseilles Telephone Company, Marseilles, Ill., has certified to an increase in its capital stock from $2,000 to $4,000.

The finance committee of the city council of Alexandria, Va., has accepted the bond of the Home Telephone Company. The company will begin the construction of its plant at once.

An ordinance has been introduced in the council of East St. Louis, Ill., providing for the granting of the franchise to M. M. Stephens, H. D. Sexton, Paul W. Abt, Thomas L. Fekete and W. J. Kurtz to operate a new telephone system. The provisions of the ordinance state that a bond of $10,000 must be given by the company receiving the franchise; telephones must be furnished free for the Mayor's residence and all public offices. The ordinance fixes the rates of rental at 50 cents per week for each telephone in places of business and 25 cents per week in residences.

The Southern Bell Telephone Company has been granted permission and will at once begin the work of laying an underground system in Savannah, Ga.

The New York & New Jersey Telephone Company has declared a quarterly dividend of 1¼ per cent. and an extra dividend of 1 per cent., payable January 15 to stockholders of record of January 4.

The telephone line at Seneca Falls, N. Y., is to be largely extended through Seneca county south, touching six different towns and connecting with Ithaca.

A new telephone company is being organized at Syracuse, N. Y. The Mason-Maxwell instrument will be used.

The Bell Telephone Company of Buffalo, N. Y., has established a rate of $30 for 336 messages, conditioned upon prompt payment of bills.

The Postal Telegraph Company is rapidly adding new offices all over the United States. The following have recently been opened: Evansville, Ind.; Paris, Ky.; Vincennes, Ind.; Lexington, Ky.; Cynthiana, Ky.; Falmouth, Ky., and Albany, Ga.

The People's Telephone Company of Knoxville, Tenn., will erect a line to Chattanooga, Sevierville and Maryville as soon as winter breaks.

The Valley Telephone Company, which has assumed the franchises recently granted the Saginaw Valley Telephone Company in Bay City, West Bay City and Saginaw, Mich., is selling stock and making preparations to construct the exchanges under its franchises.

The York Telephone Company, of York, Pa., elected Dr. C. A. Eisenhart president and Charles Frick secretary and treasurer. The company will establish telephone connection with Baltimore, Harrisburg and intervening places of importance.

The Circuit Court at Dayton, O., has declared that the Central Union Telephone Company has no right to use the streets or alleys in that city. The company had a franchise for ten years and neglected to have it renewed about two years ago. No one molested or disputed its right to the streets until a rival company was organized and applied for a franchise. The Central Union Company objected and in turn was itself ousted by the court.

The North American Telegraph Company and the city of St. Paul, Minn., disagree regarding the possession of the conduit used by the telegraph company in the streets of that city. The company has been under the impression that it owned this conduit, having purchased the franchise from the National Conduit Company, which constructed it. But St. Paul claims that the National Company did not have a perfect title to the franchise because the stipulated number of miles had not been built within the time specified by the contract with the city.

New Companies Incorporated.

The Southwestern Telephone & Construction Company, Dodgeville, Wis. Capital $2,000. Incorporators: Henry Halverson, John M. Reese and George E. McAfee.

The Henderson County Telephone Company, Stronghurst, Ill.—to operate a telephone exchange. Capital stock, $2,500. Incorporators: J. O. Anderson, J. F. Mains, Orin L. Dunsworth, T. J. Hunter, E. H. Allison, E. B. Campbell and L. M. Loomis.

The Carolina Mutual Telephone & Telegraph Company has been incorporated at Charleston, S. C., with a capital stock of $30,000. E. M. Bailey is president, Moultrie Mordecai vice-president, and R. B. Lebby secretary and treasurer.

The Orange Telephone Company has filed articles of incorporation at Newark, N. J. The company proposes to establish a telephone service for the cities, towns, boroughs and villages in Essex county, N. J. The capital stock is placed at $250,000, and business is to be begun at once with $100,000. The incorporators are Edward P. Chamberlain, of Brooklyn; Merrit S. Middleton, of Point Pleasant, N. J., and Charles H. Johnson, of Jersey City.

COMMERCIAL PARAGRAPHS.

The Westinghouse Machine Company has declared a quarterly dividend of 1½ per cent. on the preferred and common stock.

The general office of the Indiana Rubber and Insulated Wire Company has been removed from Marion, Ind., to the factory at Jonesboro, Ind.

Mr. Charles D. Shain's New Year's greeting comes to hand as usual, wishing good luck to every one for 1896.

N. L. Norris, of Warren, O., has been elected secretary, treasurer and general manager of the Orient Electric Company of Youngstown, O., vice C. O. Shatto, secretary, and Dallas Dennison, treasurer and general manager, who recently resigned. The company recently made a large shipment of incandescent lamps to Russia.

The Standard Underground Cable Company has declared a quarterly dividend of 2 per cent. payable January 10.

The Falkenau Engineering Company, Ltd., of Philadelphia, has removed its offices to 711 Reading Terminal Building in that city.

A Factory Outfit Wanted.

C. A. Merritt, of Birmingham, Ala., inventor of the "Merritt" incandescent lamp, is organizing a company to manufacture lamps and other electrical appliances. He would be pleased to have manufacturers send him catalogues and prices on an outfit for a factory, also supplies for manufacturing.

The Victor Motors.

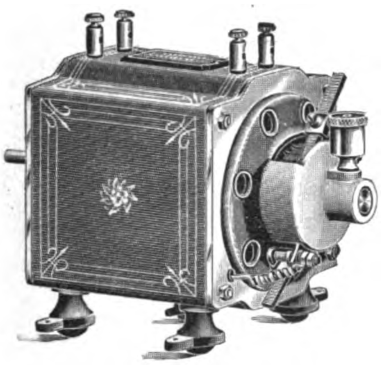

FIG. 1.

The Victor Electric Company, 87 Washington street, Chicago, has placed on the market a line of small electric motors adapted to a multiplicity of uses. These motors are compactly and neatly built and possess a number of valuable features. In Fig. 1 is shown a one-sixth shunt wound motor of stationary type. In Fig. 2 the motor is shown to be mounted upon a fan stand and having other accessories of the fan motor. The general plan of construction is the same in both types.

For this fan motor it is claimed that it is so constructed as to be proof against accidental damage; it is easily repaired, all parts being interchangeable; the motor has no external magnetism whatever; it makes no noise; it will outwear any other; uses only one ampere of current at 110 volts, and may be readily attached to any lamp socket without extra wiring.

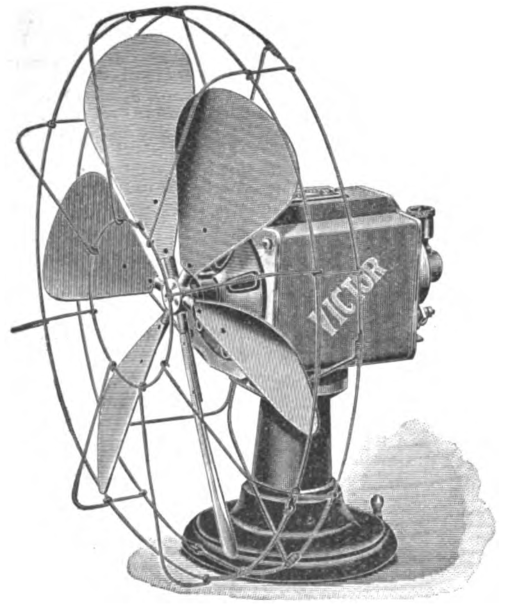

FIG. 2.

In addition to the above-named types of motors the Victor Company has perfected a complete electrical dental engine consisting of a motor with foot-controlling switch, extension bracket, pneumatic plugger, etc., the use of which enables a dentist to entirely discard the foot engine.

Designs and patterns are now being prepared for motors and dynamos of all sizes. By May 1st the company will be prepared to ship all sizes up to 5 H. P.

Industrial Providence.

In a recent souvenir edition of the Providence *Telegram*, comprising 42 pages, a full page is given up to a description with illustrations of the institution known as the American Electrical Works, one of the leading industries of the city.

One of the illustrations shows the barn in which Mr. Eugene Phillips, twenty-five years ago, was turning out wire chiefly by his own handiwork, using 30 pounds of copper per day. Now, we are told, the factories at Phillipsdale cover three acres, consume 75,000 lbs. of copper daily, and give employment to 700 people. There is also a factory at Montreal where 100 hands are at work.

MOONLIGHT SCHEDULE FOR THE UNITED STATES.

(Issued by the Washington Carbon Company.)

JANUARY, 1896.

DATE	LIGHT.	DATE.	EXTING.
1	No light.	1	No light.
2	5.20 P. M.	2	8.00 P. M.
3	5.20 "	3	9.10 "
4	5.20 "	4	10.30 "
5	5.20 "	5	11.40 "
6	5.20 "	7	12.50 A. M.
7	5.20 "	8	2.00 "
8	5.20 "	9	3.00 "
9	5.20 "	10	4.20 "
10	5.30 "	11	5.30 "
11	5.30 "	12	6.20 "
12	5.30 "	13	6.20 "
13	5.30 "	14	6.20 "
14	5.30 "	15	6.20 "
15	5.30 "	16	6.20 "
16	5.30 "	17	6.20 "
17	5.30 "	18	6.20 "
18	7.50 "	19	6.20 "
19	8.50 "	20	6.20 "
20	9.50 "	21	6.20 "
21	10.50 "	22	6.20 "
22	11.50 "	23	6.20 "
23	...... "	..	....
24	12.50 A. M.	24	6.20 "
25	1.50 "	25	6.20 "
26	3.00 "	26	6.20 "
27	4.00 "	27	6.20 "
28	5.00 "	28	6.20 "
29	No light.	29	No light.
30	"	30	"
31	5.50 P. M.	31	8.00 P. M.

INCORPORATIONS.

The Sullivan Estate Company, San Francisco, Cal.—to deal in stocks, bonds and construct water works; generate electricity and electric and water power. Capital stock, $1,000,000. Promoters: Francis J. Sullivan, Chas. A. Sullivan, Ada E. Sullivan, Frances V. Sullivan, Geo. B. Sullivan, Henriette Sullivan, Emmet V. Sullivan, Belle S. Turner, Mary Piggott, San Francisco.

The Meadville and Saegertown Street Railway Company, Pittsburg, Pa.—to build an electric street railway in Meadville. Capital stock, $31,000. Promoters: Geo. D. Trawin, H. H. Thompson, F. R. Shryock, Meadville, Pa.

The Latrobe and Ligonier Electric Street Railway Company, Latrobe, Pa.—to build an electric street railway in Westmoreland County, Pa., from Latrobe to Ligonier, a distance of 12 miles. Capital stock, $72,000. Promoters: Ed. E. Robbins, John E. Kunkle, Harry N. Yout, Greensburg, Pa.

The Electric Railway Switch and Supply Company, Saco, Maine—to manufacture and deal in electric railway motor and station switches. Capital stock, $100,000. Promoters: Leonard L. Davis, Edgar Tanner, Springfield, Mass.; Ambrose Eastman, Boston, Mass.

The O'Brien Electrical Construction Company, Bloomfield, N. J.—to construct, maintain and operate electric light, power and signal and electric elevator apparatus. Capital stock, $100,000. Promoters: Jas. P. O'Brien, Philip J. O'Brien, New York City; Daniel J. O'Keeffe, Bloomfield, N. J.

The Saegertown and Venango Street Railway Company, Pittsburg, Pa.—to build an electric street railway in Saegertown, Crawford County, Pa. Capital stock, $72,000. Promoters: Geo. D. Trawin, H. H. Thompson, F. R. Shryock, Meadville, Pa.

The Keystone Boiler Works, San Francisco, Cal.—to deal in patents, patent rights, stocks, bonds; manufacture machinery, ships and water crafts of all kinds: construct foundries, machine and boiler shops, all kinds of railways, cable roads, electric roads and bridges. Capital stock, $200,000. Promoters: Jas. Hamilton, John J. More, John V. Hunter, San Francisco, Cal.; Wm. Leach and Jas. M. Robinson, Oakland, Cal.

The Empire City Traction Company—to operate a street railway in the upper part of New York City. Capital stock, $100,000. Directors: H. L. Scheuerman, F. H. Knight, E. M. Johnson, B. F. Defreee, F. W. Elder, M. J. Katz, H. W. Mayer and Homer Scoville, of New York, and Samuel Slater, of Arlington, N. J.

The Fredericktown Electric and Manufacturing Company, of Fredericktown, Mo., has increased its capital stock from $6,000 to $25,000.

The Electric and Steam Appliance Company, Jersey City, N. J.—to conduct a general mechanical engineering business and manufacture and deal in machinery of all kinds, including valves and electrical and mechanical controlling devices. Capital stock, $500,000. Incorporators: Alfred Luthnan, New York; Edward J. Maturin, Jersey City, and Herbert Hatch, East Orange, N. J.

The Millbrook Electric Light Company, Ltd., Millbrook, Can.—to carry on the business of the present Millbrook Electric Light Company. Capital, $6,500. Incorporators: J. C. Kells, J. A. Vance, R. J. Doak, W. T. Wood, Dr. H. A. Turner, A. A. Smith and A. Leach of Millbrook, and S. G. Parkin, of Lindsay, Can.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DECEMBER 31, 1895.

ELECTRIC RAILWAYS AND APPLIANCES.

552,338. Electrical Rail-Fish. Victor Thelin, Geneva, Switzerland, assignor to the Compagnie de l'Industrie Electrique, same place. Filed Aug. 1, 1895.

552,347. Motor-Suspension for Street-Cars. George F. Card, Mansfield, O. Filed Aug. 21, 1895.

552,369. Means for Operating Electric Railway-Vehicles. Ernst G. W. C. Hoffmann, Charlottenburg, Germany assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Sept. 8, 1895.

552,451. Electric Railway. Michael H. Smith, Halifax, England. Filed Oct. 26, 1887.

552,477. Rail-Bond for Electric Railways. Budd J. Jones, Chicago, Ill. Filed March 29, 1895.

552,479. Electrical Rail-Bond. Minott K. Kendall, Melrose, assignor of two-thirds to Gilbert Hodges, Medford, and Ephraim Harrington, Boston, Mass. Filed Aug. 12, 1895.

552,486. Car-Brake. Alexander B. Roney, Chicago, Ill., assignor to Philip Opper, same place. Filed Dec. 8, 1894.

ELECTRIC LIGHTS AND APPLIANCES.

552,190. Electric-Arc Light. Louis B. Marks, New York, N. Y., assignor to the Electric Arc Light Company, same place. Filed Oct. 9, 1894.

552,371. Method of and Apparatus for Measuring Illumination. Edwin J Houston and Arthur E. Kennelly, Philadelphia, Pa. Filed Feb. 13, 1895.

552,384. Electric Gas-Lighter. Philip Meyer, Alameda, Cal. Filed Sept. 20, 1895.

552,495. Regulator for Electrical Circuits. Joseph C. Mayrhofer, New York, N. Y., assignor to Denman Thompson, West Swanzey, N. H. Filed July 5, 1895.

552,496 Electric-Lighting System. Joseph C. Mayrhofer, New York, N. Y., assignor to Denman Thompson, West Swanzey, N. H. Filed July 5, 1895.

552,498. Electric-Arc Incandescent Lamp. John A. Mosher, Chicago, Ill. Filed Sept. 23, 1895.

DYNAMO ELECTRIC MACHINERY, ETC.

552,103. Multipolar Electromagnet. William P. Daniels, Cologne, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Sept. 7, 1895.

552,105. Apparatus for Automatically Maintaining Current Upon Moving Vehicles. Harry E. Dey, Brooklyn, assignor to Edward N. Dickerson and Ernest R. Esmond, New York, N. Y. Filed May 20, 1895.

552,172. Electro-magnetic Mechanism. Stephen D. Field, Stockbridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Aug. 5, 1895.

552,260. Apparatus for Transforming Alternating Currents into Unidirectional Currents. Carl Pollak, Frankfort-on-the-Main, Germany. Filed May 22, 1893.

552,313. Synchronous Single-Phase Motor. Charles E. L. Brown, Baden, Switzerland. Filed Feb. 6, 1893.

552,337. Electric Motor. Albert W. Smith, Washington, D. C. Filed July 23, 1895.

552,397. Regulator for Dynamos. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 1, 1889.

TELEPHONE AND TELEGRAPH APPARATUS.

552,173. Electric Telephone. Stephen D. Field, Stockbridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Aug. 5, 1895.

552,420. Signaling and Lock-Out Apparatus for Telephone-Stations. John D. Clarke, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed April 5, 1895.

552,469. Double-Diaphragm Telephone-Transmitter. Dan'l Drawbaugh, Eberly's Mill, assignor to G. Milton Bair, Hanover, and Calvin W. Ream, Reading, Pa. Filed Feb. 23, 1895.

BATTERIES.

552,211. Depolarizer for Primary Batteries and Method of Making Same. Gustav W. Thurnauer, Aurora, and Milton M. Kohn, Chicago, assignors to themselves and Siegfried M. Fischer, Chicago, Ill. Filed Feb. 20, 1895.

552,219. Electrical Battery. David S. Williams, Philadelphia, Pa. Filed Aug. 23, 1895.

552,218. Electric Battery. David S. Williams, Philadelphia, Pa. Filed July 19, 1895.

552,220. Electric Battery. David S. Williams, Philadelphia, Pa. Filed Aug. 23, 1895.

552,322. Secondary Battery. Alvaro S. Krotz and Wilbur W. Spencer, Springfield, O. Filed Jan. 31, 1895.

552,425. Secondary Battery. Camille A. Faure, Paris, France, and Frank King, London, England Filed March 6, 1895.

SIGNALS AND SIGNALING APPARATUS.

552,181. Electrical Railway Signaling Apparatus. Henry J. Hovey, Evanston, Ill. Filed Aug. 5, 1895.

552,279. Electric Signal for Railways. Elisha B. Cutten, New York, assignor to Arthur C. Fraser and George H. Fraser, Brooklyn, N. Y. Filed April 1, 1891.

552,316. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed July 10, 1894.

MISCELLANEOUS.

552,094. Automatic Electric Switch. Harry H. Blades, Detroit, Mich. Filed Sept. 14, 1895.

552,153. Keyless Fire-Alarm-Telegraph Box. Nathan H. Suren, New York, N. Y., assignor to The Gamewell Fire-Alarm Telegraph Company, same place. Filed March 8, 1895.

552,'66. Electric Thermostat and Push-Button. Orator F. Woodward, Le Roy, N. Y. Filed Dec. 29, 1893.

552,239. Safety Device for Electric Circuits. Paul H. D'Unger, Chicago, Ill., assignor of one-half to William Porter Verity, same place. Filed Sept. 16, 1895.

552,271. Electrical Bicycle. Ogden Bolton, Jr., Canton, O. Filed Sept. 19, 1895.

552,309. Electric Meter. John R. Tucker and Charles C. Hinckley, Aurora, Ill. Filed March 25, 1895.

552,341. Electric Smelting-Furnace. Joseph A. Vincent and James E. Hewes, Philadelphia, Pa. Filed July 18, 1895.

552,363. Insulating-Joint. Elliott P. Gleason, Brooklyn, assignor to the E. P. Gleason Manufacturing Company, New York, N. Y. Filed Dec. 27, 1894.

552,414. Galvanic Feed-Water Purifier. Samuel G. Cabell, Washington, D. C. Filed Oct. 16, 1895.

552,501. Insulator. Charles H. Snivley, Mount Carmel, Pa. Filed March 20, 1895.

DESIGNS.

25,028. Box for Electric Motors. Arthur W. Browne, Prince's Bay, N. Y., assignor to the S. S. White Dental Manufacturing Company, Philadelphia, Pa. Filed Oct. 12, 1895. Term of patent 14 years.

25,032. Frame for Dynamo-Machines. Clinton E. Woods, Chicago, Ill. Filed June 11, 1894. Term of patent 14 years.

25,033. Frame for Electric Motors, etc. Dugald C. Jackson and Conrad M. Conradson, Madison, Wis. Filed July 26, 1895. Term of patent 7 years.

ELECTRICITY.

Vol. IX. NEW YORK, JANUARY 8, 1896. No. 26

Insulating Conduit

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AT THE MEETING OF THE

American Institute of Electrical Engineers,

HELD ON THE 20TH OF NOVEMBER, 1895,

MR. C. L. EDGAR,

General Manager of the Edison Electrical Illuminating Company of Boston,

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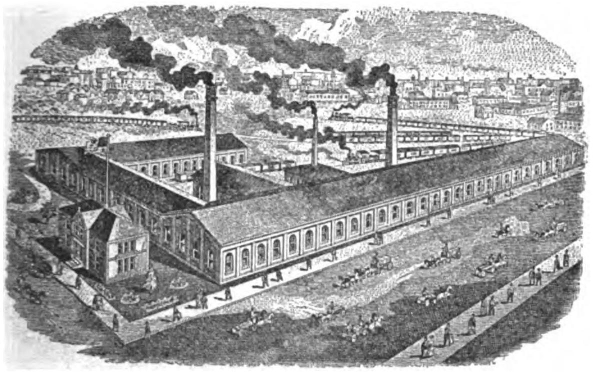

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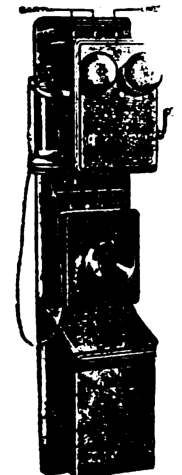

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Claim No 1 of the "Hunnings" Patent "is in a tension-regulator or means for varying the resistance in a telephone transmitter, finely divided conducting material in a loose and free state."

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Does not depend upon variable pressure between electrodes in constant contact. **Incorporated as a portion of the Electric Circuit** is a quantity of finely divided conducting material or dust, the movement of which varies the current.

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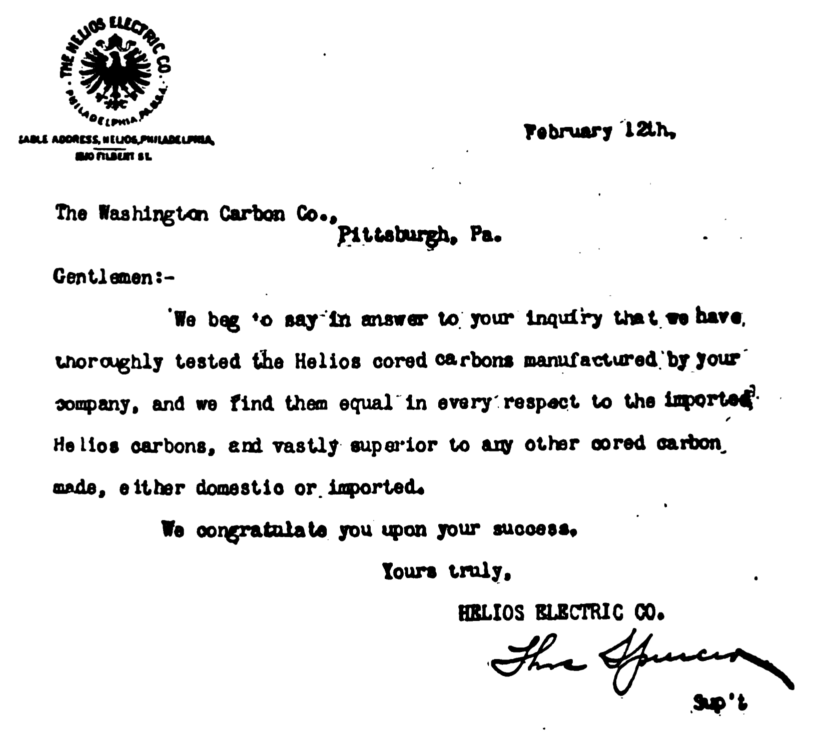

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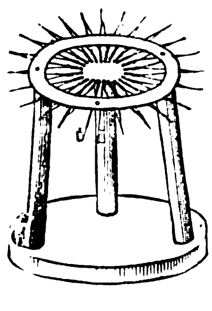

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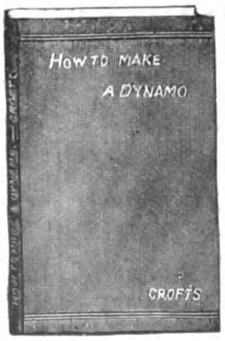

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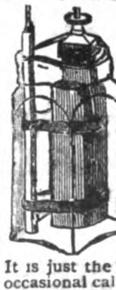

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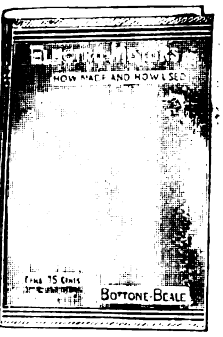

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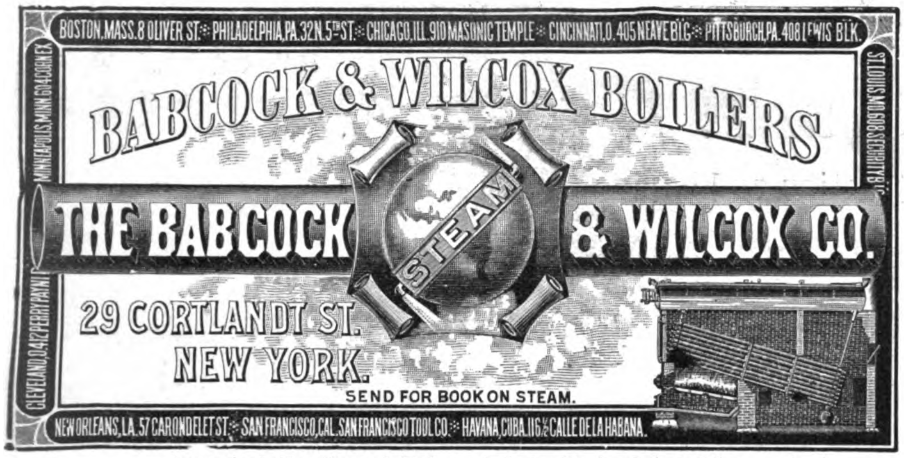

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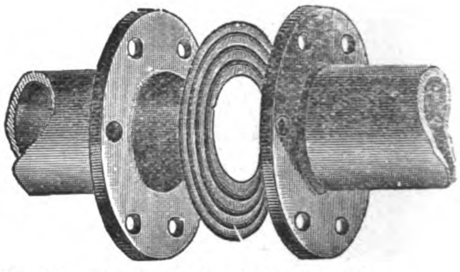

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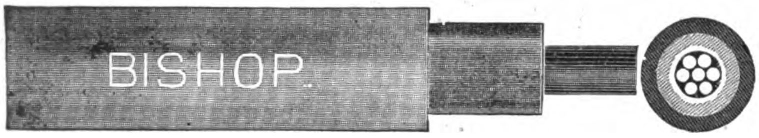

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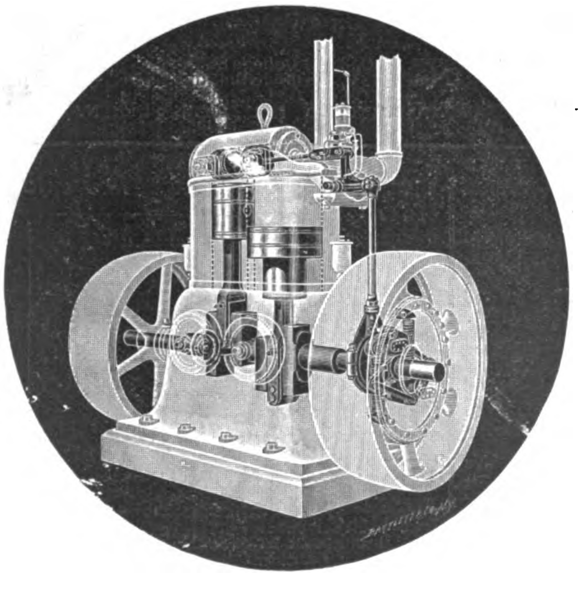

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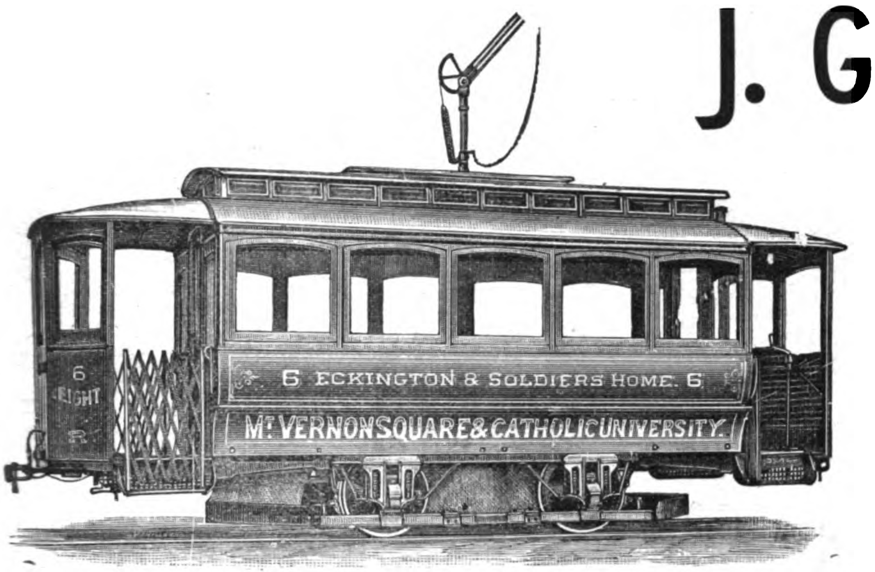
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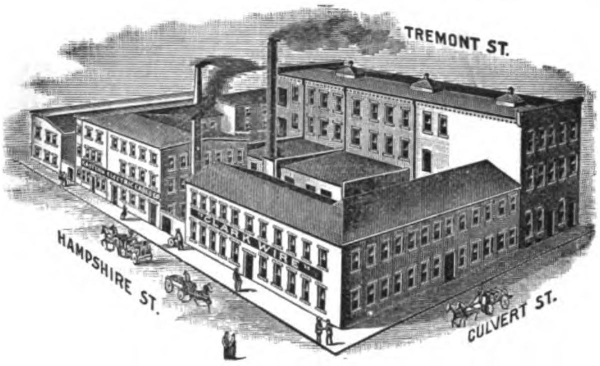
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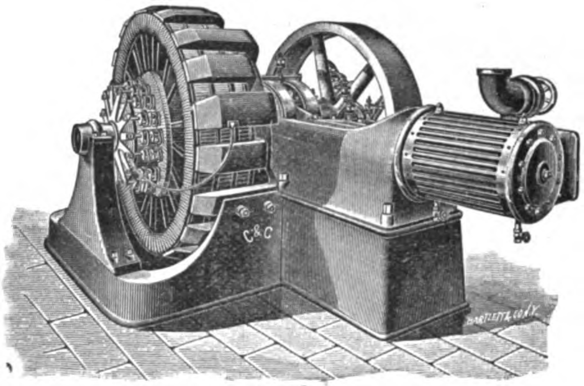

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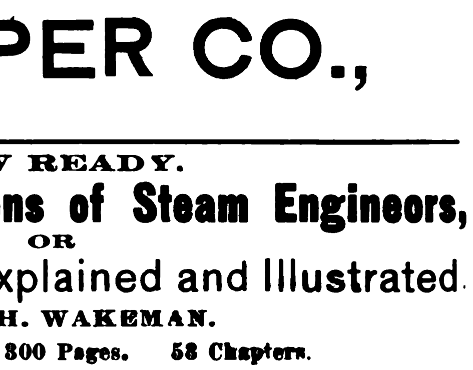

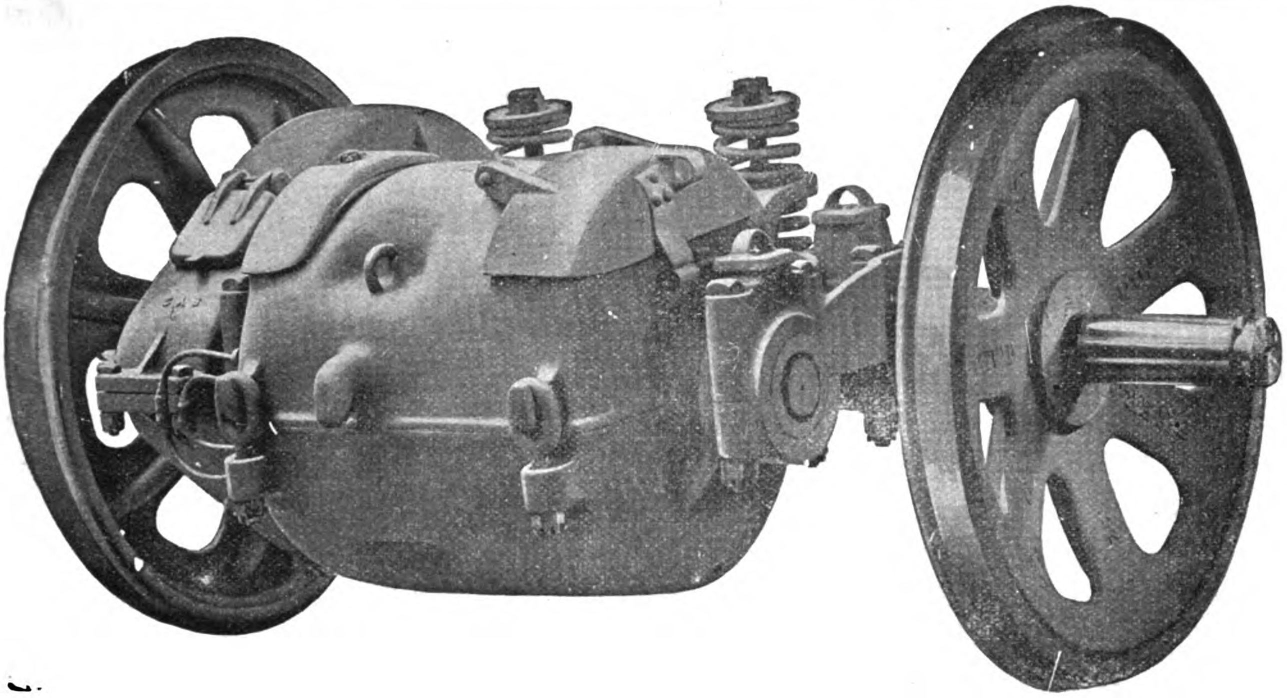

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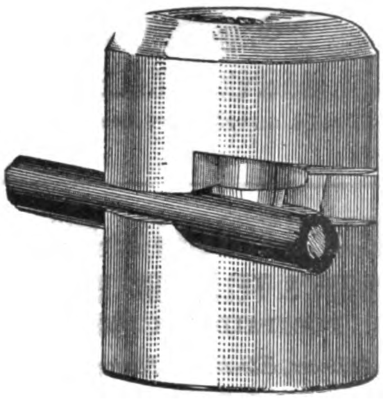

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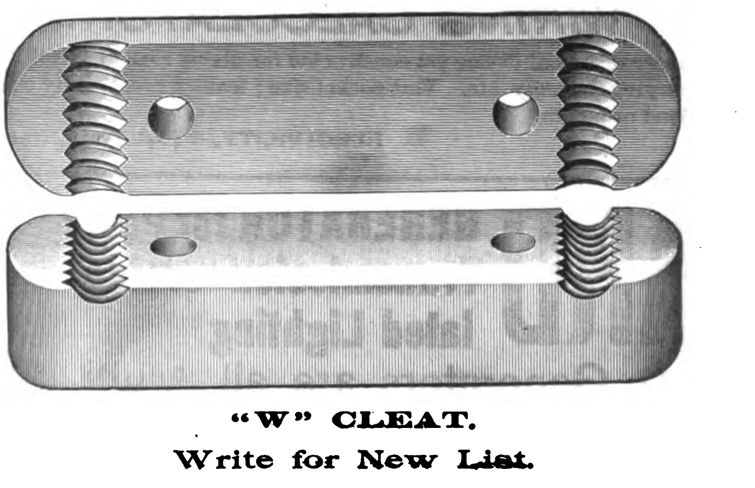

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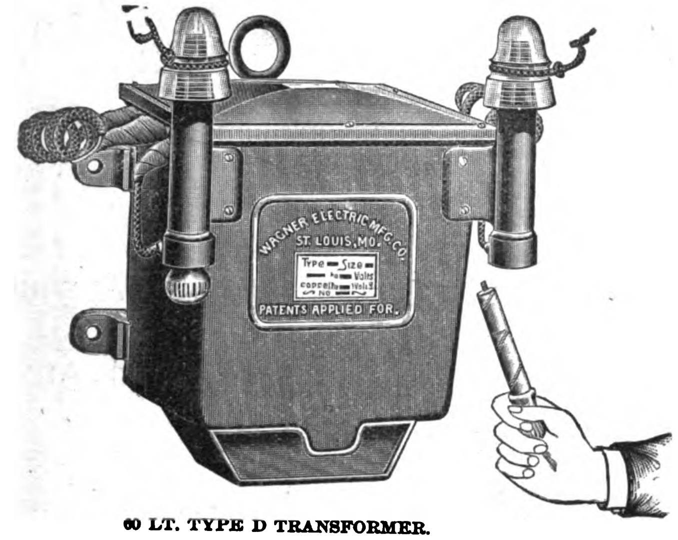
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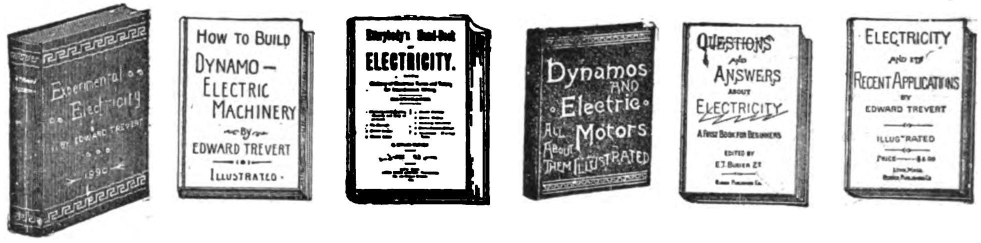
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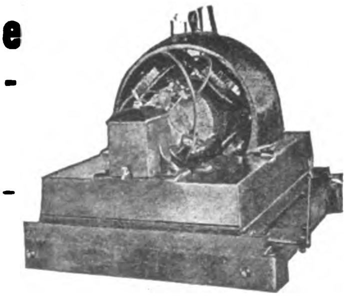

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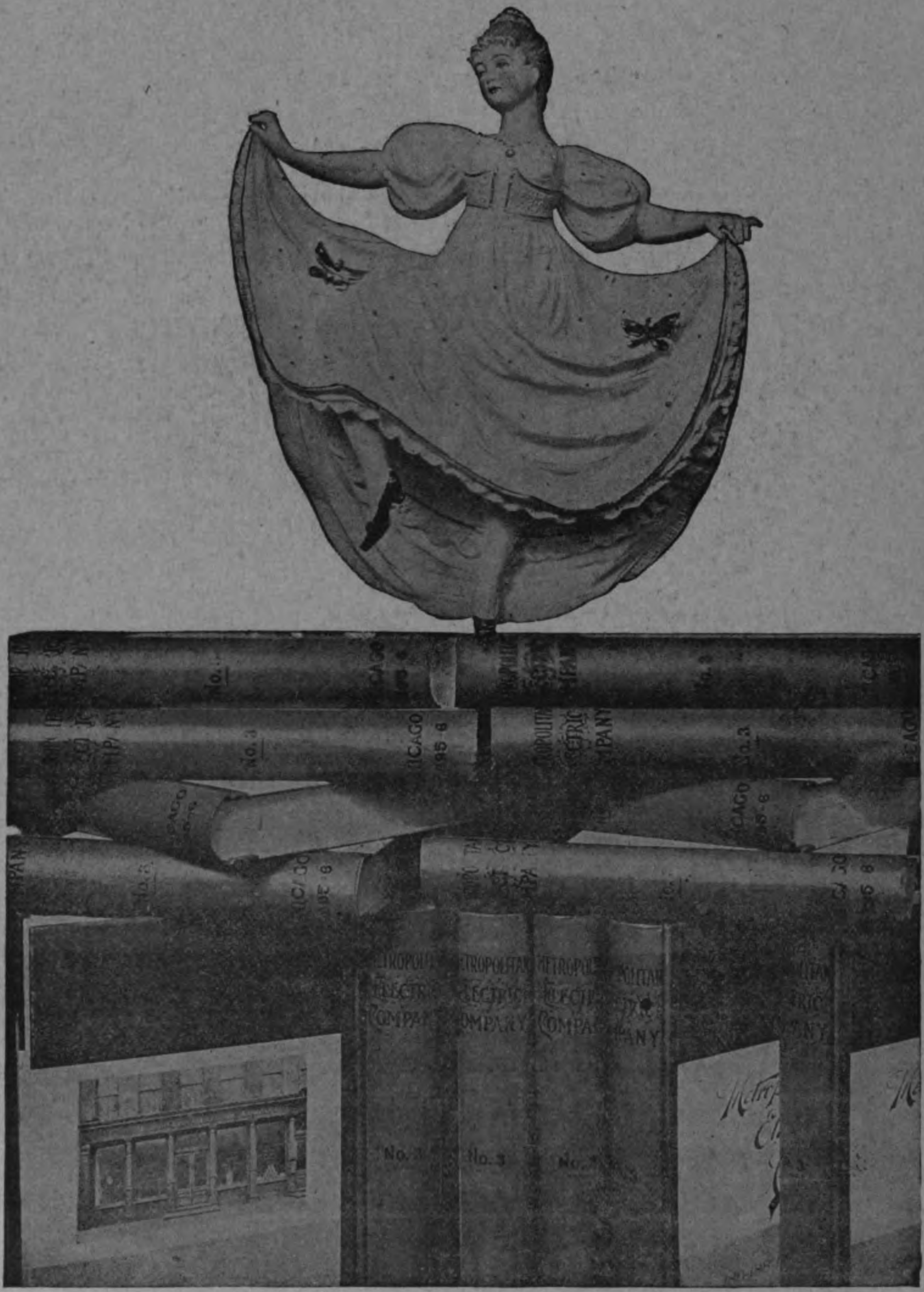

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